DRAFT REVISION 1

SITE CHARACTERIZATION AND REMEDIATION

WORK PLAN

FORT WAINWRIGHT, ALASKA

Contract No. W911KB-04-P-0136

Prepared for:

Department of the Army
U.S. Army Corps of Engineers, Alaska District
P.O. Box 6898
Elmendorf AFB, AK 99506-6898

Prepared by:

235 East 8th Avenue, Suite 210
Anchorage, AK 99501

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ACRONYMS AND ABREVIATIONS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ASTM	American Society of Testing and Materials
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CDQR	Chemical Data Quality Review
CFR	Code of Federal Regulations
cy	cubic yard
DFW	Definable Features of Work
DPW	Directorate of Public Works
DRO	diesel range organic compounds
DQO	Data Quality Objective
FSP	Field Sampling Plan
ft^2	square feet
GRO	gasoline range organic compounds
HTRW	Hazardous, Toxic, and Radioactive Waste
IDW	investigative-derived waste
msl	mean sea level
MS/MSD	matrix spike/matrix spike duplicate
North Wind	North Wind, Inc.
OIT	OIT thermal treatment facility in Fairbanks, Alaska
OSHA	Occupational Safety and Health Administration
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyls
PID	photoionization detector
PPE	personal protective equipment
PM	Project Manager
QAPjP	Quality Assurance Project Plan

ACRONYMS AND ABREVIATIONS (CONTINUED)

RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
SGS	SGS Environmental Services, Inc.
SIM	selective ion monitoring
SOPs	Standard Operating Procedures
SSHP	Site-Specific Safety and Health Plan
TCLP	Toxicity Characteristics Leaching Procedure
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	volatile organic compounds

1.0 INTRODUCTION

The U.S. Army Corps of Engineers, Alaska District (USACE) has contracted North Wind, Inc. (North Wind), to delineate extent and nature of contamination at various locations on Fort Wainwright, Alaska. This task includes excavation and stockpiling of contaminated soil, transfer of soil to a thermal treatment facility, sampling and installation of groundwater wells to identify potential impact to and monitoring of groundwater. This project is being performed under Contract No. W911KB-04-P-0136.

This work plan describes the known definable features of work (DFW), implementation strategy, and objectives for this project that will meet quality and safety standards as established by the work plan and the appendices. A site specific sample strategy plan will be developed for each individual task.

1.1 Project Purpose and Scope

The purpose of this project is to support activities at Fort Wainwright that require delineation of soil contamination, excavation and stockpiling of contaminated soil and installation of groundwater wells for sample collection or monitoring. Soil contamination shall be evaluated by review of soil samples data collected during the drilling of soil borings. Analytical data collected from the soil borings will be compared to the Alaska Department of Environmental Conservation (ADEC) 18 Alaska Administrative Code (AAC) 75 Under 40 Inch Zone, criteria. Contaminated soil with results exceeding most stringent cleanup criteria will be excavated and temporarily stockpiled on-site. Non-hazardous soil will be transferred to the OIT thermal treatment facility in Fairbanks, Alaska (OIT). Analytical data will be collected from the bottom of the excavations to confirm adequacy of soil removal. Excavation(s) will be backfilled with clean material and the excavated site(s) will be restored to original grade.

Additionally, groundwater wells will be installed in select areas, sampled and submitted for laboratory analysis. Groundwater suite of analytical parameters will depend upon the results of soil samples collected in the associated area. Temporary or permanent wells may be installed depending on the requirements of the site. Both types of wells will be developed and purged

before they are sampled as described in the Field Sampling Plan (FSP) (Section 1 of Appendix A). Temporary wells will be decommissioned and abandoned after completion of sampling activities.

Table 1 provides the DFW and summarizes the strategy and approach for managing the project objectives for each DFW. Analytical data quality objectives were developed to support the action limits defined in Table 1. The data quality indicators, reporting limits and additional quality assurance/quality control requirements for sample collection, testing and reporting are discussed in the Quality Assurance Project Plan (QAPjP) that is provided as Section 2 of Appendix A.

Table 1 Project Objectives

Definable Features of Work	Sample Collection Strategy	Sample Frequency [1]	Analytical Tests Required [2, 3,4]	Criteria for Evaluation
1) Delineate Extent of Soil Contamination				
Soil Borings – will be used to collect soil samples to delineate nature and extent of contamination	Soil borings will be advanced to a maximum of 15 feet bgs. Location of borings will be biased toward areas where highest contamination is suspected as the result of surface staining or historical use.	Two soil samples per soil boring: 1) Soil boring bottom; and 2) Interval to be determined by results of field screening (PID)	AK101 (GRO) AK102 (DRO) SW8260B (VOCs) SW6010/7471A (8 RCRA Metals) and PAH SIM and SW8082A as needed ***(Preliminary data due in 72 hours)***	18 AAC 75, Method 2, Under 40 inch Zone, most stringent pathway criteria will be used to evaluate potential human health risk.
Field Screening	The PID will be used as a screening tool for analytical sample collection.	One reading per every five foot of boring.	N/A	Higher PID results indicate greater contamination.
Cuttings	Cuttings from the 75 borings will be containerized.	No samples will be collected. Results from soil borings will be used to characterize the soil cuttings.	TCLP may be required if soil boring results exceed RCRA limits	40 CFR 261.24 Table 1
2) Excavate and Stockpile Contaminated Soil				
Excavate Contaminated Soil – soil removal strategy will be based on results provided by PID and soil boring analytical data	NA	NA	NA	Sample results from soil borings that exceed 18 AAC 75, Method 2, Under 40 inch Zone, most stringent pathway criteria will be excavated.
Bottom of Excavation – confirmation samples will be collected from the bottom of the excavation after all contaminated soil is removed to the depth defined by soil boring data	Samples will be collected from the bottom of the excavations to confirm that all contaminated soil exceeding human health risk based levels have been removed.	2 samples per first 250 square feet and 1 additional sample for each additional 250 square feet of excavation. PAH and PCB samples will be collected at a reduced frequency and may be biased toward areas of highest contamination.	AK101, AK102, SW8260B, SW6010/7471A, and PAH SIM and SW8082A as needed ***(Preliminary data due in 72 hours)***	18 AAC 75, Method 2, Under 40 inch Zone, most stringent pathway criteria will be used to evaluate potential human health risk, 18AAC78.090
Construct Stockpile – contaminated soil will be temporary stored in a covered stockpile constructed at each site until transported to the OIT facility	NA	NA	NA	18 AAC 78.274, Table B
Stockpiled Soil – contaminated soil will be sampled to characterize soil and determine disposal option	Collect grab sample from stockpiled soil that represent condition of the soil. If boring sample results indicate potential hazardous levels of metals exist, TCLP will be performed to evaluate RCRA criteria.	2 samples for the first 50 cy and 1 sample for each additional 50 cy will be collected. Waste characterization frequency will depend on waste stream.	AK101, AK102, SW8260B, SW6010/7471A, SW1311/6010/7470A ***(Preliminary data due in 72 hours)***	18 AAC 78.605c 40 CFR 261.24 Table 1
3) Treat Contaminated Soils				
Transportation of Soil - transport contaminated soils to OIT Treatment Facility	OIC will collect samples of the treated soil and report results directly to North Wind	Reference Table C for frequency	AK101, AK102, SW8260B BTEX, SW6010/7471A	18 AAC 78.605b, Table C

Table 1 Project Objectives (continued)

Definable Features of Work	Sample Collection Strategy	Sample Frequency [1]	Analytical Tests Required [2, 3,4]	Criteria for Evaluation
4) Drums				
Collect Empty Drums – remove drums from excavations and dispose as non-hazardous material	No sampling required.	NA	None	RCRA empty, less than one inch of material in bottom.
Drums containing materials	Notify DPW immediately, leave drum in place if leaking.	NA	None	None
6) Groundwater Monitoring Wells				
Install Temporary Wells – the temporary wells will be installed, sampled and removed before leaving each site	If groundwater is encountered while drilling the soil boring a well may be needed to evaluate impact to groundwater.	1 sample per well	AK101, AK102, SW8260B,	18 AAC 75, Table C
Permanent Wells – the permanent wells will be installed when groundwater monitoring is needed	Permanent wells will be installed near the final stages of the project if groundwater monitoring is required.	1 sample per well.	AK101, AK102, SW8260B	18 AAC 75, Table C

Notes:
1 Sample frequency may be modified to support actual site conditions.
2 The SW8260B analysis includes BTEX. Therefore, a separate test is not required when only these analytes are a concern.
3 Duplicates shall be collected at a 10% frequency per method and matrix.
4 MS/MSD will be collected at a frequency of 5% per method per matrix.
bgs –below ground surface
BTEX –benzene, toluene, ethylbenzene, and total xylenes
CFR –Code of Federal Regulations
cy – cubic yards
DPW–Directorate of Public Works
DRO–diesel range organic compounds
ft^2–square feet
GRO–gasoline range organic compounds
MS/MSD–matrix spike/matrix spike duplicate
NA – Not Applicable
PAH SIM – Polynuclear Aromatic Hydrocarbons Selective Ion Monitoring
PCB – polychlorinated biphenyls
PID – photoionization detector
RCRA – Resource Conservation and Recovery Act
SIM – selective ion monitoring
TCLP – Toxicity Characteristics Leaching Procedure
VOC –Volatile Organic Compounds

1.2 Project Organization and Responsibilities

PROJECT MANAGER North Wind's Project Manager (PM), Gloria Beckman acts as the single point of contact for the individual delivery order between North Wind and USACE's PM, Robert Brock. The PM is responsible for the overall management and execution of the task order in accordance with the statement of work, work plans, and all applicable laws and regulations.

SITE MANAGER As North Wind's on-site representative, Dan McGauhey has the responsibility of coordinating the field tasks for this project. The Site Manager is responsible for the management and execution of all site activities in accordance with the contract, work plans, and applicable federal, state, and local laws and regulations. This position is responsible for the following tasks:

- Coordinate clearance and necessary site access requirements with base authorities;
- Perform soil logging and field screening;
- Collect soil and groundwater samples and coordinate sample transportation to the laboratory;
- Provide field data to the laboratory;
- Inspect the quality of the subcontractors' fieldwork against contract and planning documents through regular quality control checks;
- Submit daily reports to North Wind PM,
- Conduct health and safety oversight of project activities; and
- Coordinate field activities with the North Wind PM.
- Manage subcontractors' performance against the subcontract. The subcontractor field personnel will work directly with the Site Manager to ensure the project's objectives are met.
- Conduct tail gate safety meetings.
- Develop punch list for site inspection at conclusion of all field activities.

ANALYTICAL LABORATORY COORDINATOR The Analytical Laboratory Coordinator, Susan Elkins, will coordinate sample receipt, storage, testing, and reporting with the laboratory PM. She will review analytical and field data against data quality objectives (DQOs) and quality indicators defined in the work plan and the Sampling and Analysis Plan (SAP). She will also perform the data review and provide a data quality assessment for each individual task. She will

coordinate the data quality assessment with the USACE Project Chemist, Julie Sharp-Dahl, and the North Wind PM.

DRILLING SUBCONTRACTOR This subcontractor is responsible for drilling soil borings to a depth no more than 15 feet bgs. The drilling subcontractor will collect drill cuttings and decontamination water in appropriate drums and transport them to the designated base investigative-derived waste (IDW) storage area(s).

SURVEYING SUBCONTRACTOR Design Alaska, Inc. is responsible for determining the location and elevations of the borings and monitoring wells. The surveying subcontractor will also be responsible for supplying the raw survey data to North Wind.

EXCAVATION SUBCONTRACTOR This subcontractor is responsible for the excavation and stockpiling of contaminated soil. The subcontractor will also be responsible for backfilling the excavations with clean material and returning the surface elevation to previous levels.

TREATMENT SUBCONTRACTOR The OIC Fairbanks, Alaska Facility is responsible for the thermal treatment of the contaminated soil. North Wind will be responsible for hauling the soil to the facility.

CHEMICAL ANALYTICAL LABORATORY SGS Environmental Services, Inc. (SGS) is responsible for testing the samples sent to the laboratory, reporting results, and maintaining quality to meet project DQOs. The laboratory will be required to hold current certification from the USACE and the ADEC.

2.0 SITE DESCRIPTION

This section provides a brief description of Fort Wainwright. The individual site descriptions will be provided as each individual scope of work is defined prior to each field task.

2.1 Background and Site History

Fort Wainwright occupies a 915,000-acre military reservation located west of Fairbanks, Alaska. Fort Wainwright was originally established in 1938 as a cold-weather testing station. The facility was renamed Ladd Army Air Field by the U.S. Army in December 1939. During World War II, it served as a crew-transfer point in the Army Air Corps' lend-lease program. In 1947, the newly established U.S. Air Force took over the facility and renamed it Ladd Air Force Base. It was used as a re-supply and maintenance base for the remote Distant Early Warning Sites and an experimental station in the Arctic Ocean. In 1961, all base operations were transferred back to the U.S. Army and the base was renamed Fort Wainwright. Currently, primary missions at Fort Wainwright include training infantry soldiers in the arctic environment, testing equipment in arctic conditions, preparation of troops for defense of the Pacific Rim, and rapidly deploying troops worldwide. Fort Wainwright includes the main post area, a range complex, and two maneuver areas. On-site industrial activities include use of fixed-wing aircraft, helicopters, and vehicle maintenance and support activities. Figure 1 presents a site location map of Fort Wainwright.

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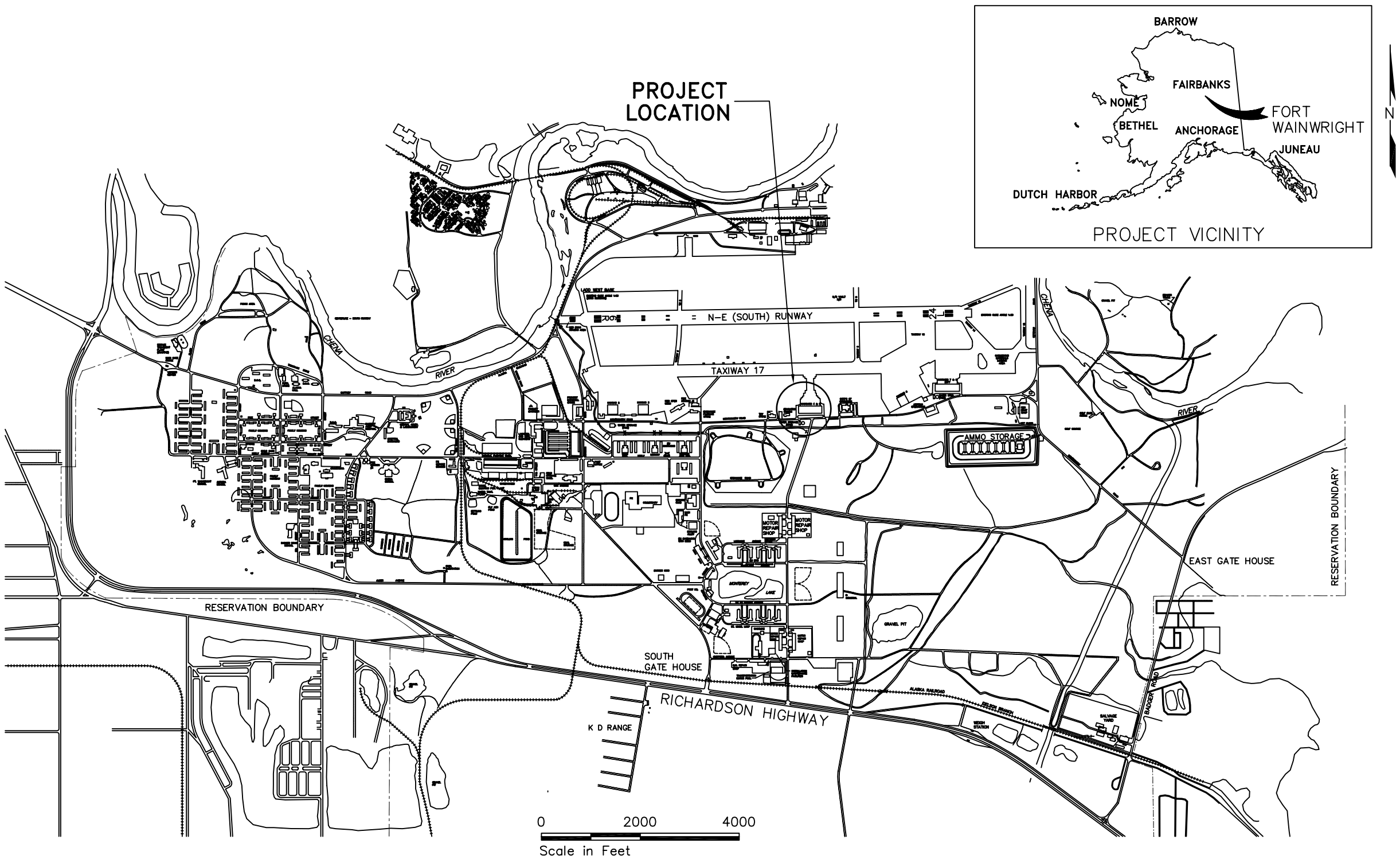
FORT WAINWRIGHT, ALASKA

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, ALASKA DISTRICT
CONTRACT NO. W911KB–04–P–0136



MAP SOURCE: USACE

Figure 1
Project Location Map

DRAFT WORK PLAN REV 1
SITE CHARACTERIZATION AND REMEDIATION
Fort Wainwright, Alaska
June 2005

North Wind
235 E. 8th Avenue, Suite 210
Anchorage, Alaska 99501
(907) 277-5488

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3.0 TECHNICAL APPROACH

The objective of this work is to delineate, excavate, and treat potential contamination at various locations on Fort Wainwright. The project objectives are:

- Identify effective soil boring and monitoring well locations;
- Collect analytical samples from the soil borings and monitoring wells;
- Evaluate analytical data to define the nature and extent of contamination;
- Excavate and stockpile any contaminated soil;
- Collect confirmation samples from the excavated areas;
- Collect characterization samples from contaminated soil stockpiles;
- Backfill excavation(s) with clean material;
- Transport contaminated soil to treatment facility;
- Properly dispose of IDW; and
- Prepare project summary report.

3.1 Pre-mobilization Activities

The following sections discuss the activities that will be carried out prior to the commencement of fieldwork. The completion of these activities will ensure that the fieldwork is completed in a timely and efficient manner, while complying with all contract requirements.

3.1.1 Project Kick-Off Meeting

In advance of mobilization, the specific methods to be used and material quantities required shall be verified by North Wind's PM, Site Manager, and subcontractors, USACE's PM, and Fort Wainwright representatives in a project kick-off meeting. The meeting will include a review of the project schedule, resource (equipment, supplies, manpower) requirements, submittals, reporting requirements, health and safety procedures, and base-specific work guidelines.

3.1.2 Clearances, Licenses, and Certificates

North Wind in cooperation with the USACE PM, Fort Wainwright Environmental Coordinator and/or others will obtain base permits or specific clearances for work in the areas of the soil borings. A dig permit clearance request will be completed and approved by Fort Wainwright Excavation Clearance authorities before drilling activities begin.

Federal, state, and/or local licenses or certifications are required to perform this work to protect human health and the environment. All contract workers directly involved in the field activities shall have the following current licenses and certificates:

- Hazardous Waste Worker (40-hour) Certificate from a U.S. Environmental Protection Agency (USEPA)-approved training provider per 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response

Copies of all required documents will be provided to the North Wind PM or Site Manager one week in advance of field mobilization for all workers assigned to this project. Should any worker be substituted that was not originally scheduled for this work, the required certifications for this worker shall be provided in advance to the project manager for approval.

3.1.3 Subcontractor Preparation

The drilling subcontractor(s) will procure all necessary materials in the required quantities. Any necessary notifications will be completed in advance of the work by North Wind. Subcontractor(s) worker qualifications will be verified with North Wind's Site Manager. Any base security protocol will be followed for mobilization.

The contract laboratory will be notified of the project schedule and will provide all necessary sampling analysis supplies prior to the initiation of field activities.

3.2 Mobilization and Site Setup

Specific equipment and personnel needed to perform this work will be mobilized only after the necessary clearances, schedule coordination, and approved materials are confirmed by the North Wind PM.

Specific equipment and personnel needed to perform the site activities will be mobilized to the site one to two days prior to the start of drilling activities. The equipment and personnel will demobilize from the site immediately following the completion of the fieldwork.

3.3 Soil Borings

Soil borings will be advanced to a depth not to exceed 15 feet bgs using a standard hollow-stem auger. The drill rig will be equipped to collect samples of unconsolidated material in split-barrel samplers every 5 feet from ground surface. Drill cuttings will be logged by North Wind's Site Manager in coordination with the North Wind geologist during all drilling, in accordance with American Society of Testing and Materials (ASTM) D2488. The soil will also be characterized by PID readings every 5 feet in the soil boring. All soil properties (including visible staining, odor, free product, etc.) will be recorded on a soil boring completion log. All soil borings will be backfilled with bentonite chips or pellets (as appropriate) and hydrated.

Two soil samples will be collected from the split-spoon of each boring and submitted for laboratory analyses: one sample will be collected from the bottom of the soil boring, and one sample will be collected from the location within the soil column exhibiting the highest PID reading. The second soil sample will be taken from an interval in the column at the discretion of the Site Manager if all PID results are equal throughout the soil column. Duplicate samples will be collected from the borings at a rate of 10 percent of the total primary samples. MS/ MSD samples will be collected at a rate of 5 percent of the total primary samples.

The analytical samples will be collected at the location with the highest PID reading and analyzed for the following parameters: GRO, DRO, VOCs, and the eight RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). Trip blanks will be analyzed for GRO and VOC compounds. All sample results will be provided to the North Wind Analytical Data Coordinator within 72 hours of sample receipt at the laboratory.

3.3.1 Soil Boring Survey

The survey subcontractor will provide a Professional Land Surveyor to establish the location and elevation of each soil boring. The surveying of all soil borings will conform to Third-Order Class 1 requirements for establishing new primary control as specified in EM 111-1-1005 Topographic Surveying. Secondary control will also conform to EM 111-1-1005.

The horizontal location, easting and northing, of the center of the boring will be collected in both the Fort Wainwright grid system and Alaska State Plane coordinate systems. Horizontal accuracy will be within the nearest 0.1 foot. The vertical elevation of the boring will be collected at the ground surface above msl. The accuracy of the vertical elevations will be within the nearest 0.1 foot above msl. All locations will be traceable to a USGS monument.

The surveyor will prepare drawings showing survey control, elevations and features and store results on a compact disc in an Excel format. Original field notes, sketches, recordings, and computations made by North Wind and North Wind's subcontractors used to establish the survey points will become the part of the permanent project file.

3.3.2 Excavation of Soil

The areas of contamination delineated by the results of soil borings will be excavated and placed in temporary stockpiles on-site. Soil will be excavated based on the results of the soil boring samples. Some excavated soil maybe determined to be clean and will be available for use as backfill. North Wind will obtaining additional backfill material and coordinate approval from DPW and ADEC on acceptability of source.

3.3.3 Sampling Bottom of Excavation

Confirmation soil samples will be taken from the bottom of the excavation to ensure all contaminated soil has been removed. In the interest of worker safety, no person shall enter the excavation(s) at any time. Bottom confirmation samples will be collected from the soil located in the center of the equipment bucket.

The soil samples will be analyzed for GRO, DRO, VOCs, and RCRA Metals, as well as limited analyses of PAHs and PCBs. The analytical suite for excavation confirmation samples may be modified and limited to include only those methods that include analytes detected at concentrations that pose a potential health risk.

3.4 Contaminated Soil Stockpiles

North Wind will provide all equipment and labor to build temporary stockpiles and store contaminated soil. The stockpile(s) will be created and covered in accordance with 18AAC 78.274, Table B.

Contaminated stockpiled soil will be sampled at the appropriate frequency as defined in 18 AAC 78.605c and Table 1, Project Objectives. The number of samples is dependent upon the total stockpile volume. Samples will be analyzed for GRO, DRO, VOCs, RCRA Metals and may require testing for hazardous characteristics by Toxicity Characteristics Leaching Procedure (TCLP) SW1311 for RCRA metals. Any PCB-contaminated and potential RCRA-contaminated soil will be segregated from petroleum-contaminated soil and will not require additional sampling.

3.5 Contaminated Soil Management

Petroleum contaminated soil will be transported to the OIT thermal facility in Fairbanks, Alaska, after characterization results confirm contaminants meet remediation criteria (e.g. PCBs, chlorinated hydrocarbons, and metal contamination should not be present at concentrations that will exceed allowable permitted concentrations).

3.6 Monitoring Well Installation, Development, Sampling, and Decommissioning

Groundwater may be encountered while drilling soil borings and may need to be sampled to evaluate the potential impact from soil contamination in the vicinity. Additionally, at the completion of the removal action groundwater monitoring may be required in areas where groundwater was impacted or soil contamination could not be effectively removed. In order to access groundwater at these locations, groundwater monitoring wells will be installed.

The following sections discuss the general procedures for monitoring well installation, development, sampling, and decommissioning. These procedures will comply with requirements outlined in the following:

- Recommended Practices for Monitoring Well Design, Installation, and Decommissioning (ADEC 1992);
- Underground Storage Tanks Procedures Manual (ADEC 2002);
- Standard Practice for Design and Installation of Ground Water Monitoring Wells (American Society of Testing and Materials (ASTM) D5092-04);
- Standard Guide for Direct-Push Water Sampling for Geoenvironmental Investigations (ASTM D6001-96);
- Standard Practice for Direct Push Installation of Prepacked Screen Monitoring Wells in Unconsolidated Aquifers (ASTM D6725-4);
- Standard Guide for Installation of Direct Push Ground Water Monitoring Wells (ASTM D6724-04);
- Standard Guide for Purging Methods for Wells Used for Ground-Water Quality Investigations (ASTM D6452-99); and
- Standard Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities (ASTM D5299-99).

3.6.1 Monitoring Well Installation

Depending on site specific requirements, two types of groundwater monitoring wells may be installed: temporary wells and permanent wells. During the primary phase of the project where soil contamination is being delineated and groundwater is encountered with a soil boring, a temporary well will be installed. This temporary monitoring well will allow collection of a groundwater grab sample to evaluate potential impact to groundwater from subsurface soil contamination. The temporary well will be removed after a groundwater sample is collected and North Wind has received the analytical results. All results will be provided within 72 hours of receipt by the laboratory. Standard development, sampling and abandonment procedures shall be followed as defined in the SAP.

During the last phase of the project when the field data are completed and reviewed, it may be necessary to monitor groundwater at the site. At this time permanent monitoring wells will be installed to facilitate long-term groundwater monitoring. The decision to install either temporary or permanent monitoring wells will be based on site conditions and will be coordinated by the North Wind PM and USACE and DPW representatives.

All information concerning the installation of monitoring wells will be documented in the field log book by the Site Manager. This information includes but is not limited to the following:

- Soil characteristics
- Well number and location;
- Date(s) drilled;
- Drilling method, company, and driller's name;
- Site Manager's name;
- Total boring depth and diameter;
- Casing length, diameter, and type;
- Depth to water after drilling;
- Screened interval and slot size;
- Filter pack type and depth range; and
- Type and depth range of seal.

3.6.1.1 Temporary Monitoring Well Installation

Temporary groundwater monitoring wells used in this project will be installed using a direct-push rig (e.g., Geoprobe®). In order to install the temporary monitoring well, the drive casing will be advanced using the direct-push drill rig to the desired groundwater sampling depth (the inside diameter of the drive casing must be at least 1.25" to accommodate the temporary monitoring well point). An expendable ("drop-off") point or inner drive rods with a drive point attached may be used during the installation of the temporary monitoring well. If an expendable point is used, the direct-push rig operator must ensure that the point is successfully deployed after reaching the desired depth. If inner drive rods are used, they must be removed prior to installation of the temporary monitoring well. The temporary monitoring well shall consist of Schedule 40, 1-inch PVC of sufficient length to reach from the lowermost sample depth to 2-3 feet above ground surface (unless certified free of contaminants by the manufacturer, the PVC will be decontaminated prior to use). The desired sample interval will be slotted with a saw in the field at 0.5" intervals and an end cap will be fitted over the bottom of the well. PVC glue will not be used to fasten any well components. If fastening is required, stainless-steel screws can be used to hold the PVC well components. After the well is ready for installation, the well will be lowered through the drive casing. The direct-push drill rig operator will withdraw a

sufficient amount of drive casing to expose the desired portion of the slotted PVC to the surrounding saturated formation after the well has been placed. The temporary well will then be purged and sampled using a peristaltic pump. The well will be pulled from the drive casing and disposed of in accordance with Installation requirements after analytical results have been received from the laboratory. The drive casing will then be removed and the borehole will be abandoned with grout as discussed in the FSP.

3.6.1.2 Permanent Monitoring Well Installation

Permanent monitoring wells, or Standard PVC wells, will be installed with appropriate screen slot and length, riser, filter pack, seal, and surface completion. The well dimensions, screen slot size and length, annular space materials, and surface completion will be specified in the subcontract drilling scope of work and based upon site specific field conditions or project requirements.

3.6.2 Well Development and Sampling

The groundwater wells will be developed to restore the natural hydraulic conductivity of the formation and to remove fine sediment from the filter packs after wells have been installed. During development, field chemical and physical parameters (e.g., pH, conductivity, temperature, etc.) of the water will be tested. Well development will be accomplished by a combination of surging and pumping of at least 5 well volumes or until the water becomes clear and chemical and physical parameters have.

Depth to groundwater and depth to floating free-phase product (if present) will be measured in the monitoring wells before purging and sampling. Groundwater and product levels will be measured using an electronic water-level meter and a groundwater/product-interface probe, respectively.

Wells will be purged and sampled using a low-flow method, as applicable to the diameter of the well, before water samples are collected to ensure that representative formation water is sampled. Purging will occur at a rate of approximately 0.5 to 1.0 liter per minute, with water quality measurements taken every three to five minutes until water quality parameters stabilize.

Stabilization is achieved when all field water quality parameters have stabilized for three successive readings. Samples are collected immediately after stabilization.

One groundwater sample will be collected from each well and may be analyzed for the following parameters: VOCs, or just BTEX, GRO, and DRO. The analytical suite will depend on the results of soil boring samples and historical use of each site. Trip blanks will be analyzed for GRO, VOCs or BTEX. Duplicate samples will be collected from the monitoring wells at a rate of 10 percent of the total primary samples. Matrix spike (MS)/matrix spike duplicate (MSD) samples will be collected at a rate of 5 percent of the total primary samples. More details regarding purging and sampling procedures are provided in the SAP.

3.6.3 Monitoring Well Decommissioning

The purpose of decommissioning wells is to prevent the entrance of surface contaminants into the groundwater. All temporary monitoring wells will be properly abandoned after completion of sampling activities. The temporary drive point or PVC casing will be removed from each borehole. Each borehole will then be backfilled with bentonite grout from the bottom of the boring to ground surface. All decommissioning activities will be recorded in the field logbook. Decommissioning of temporary monitoring wells must be accomplished no later than 60 days after installation per ADEC requirements.

3.6.4 Permanent Monitoring Well Survey

The survey subcontractor will provide a Professional Land Surveyor to establish the location and elevation of each monitoring well. The surveying of all monitoring wells will conform to Third-Order Class 1 requirements for establishing new primary control as specified in EM 111-1-1005 Topographic Surveying. Secondary control will also conform to EM 111-1-1005.

The horizontal location, easting and northing, of the center of each well will be collected in both the Fort Wainwright grid system and Alaska State Plane coordinate systems. Horizontal accuracy will be within the nearest 0.1 foot. The vertical elevation of the boring will be collected at the ground surface above mean sea level (msl). The accuracy of the vertical

elevations will be within the nearest 0.1 foot above msl. All locations will be traceable to a US Geological Survey (USGS) monument.

The surveyor will prepare drawings showing survey control, elevations and features and store results on a compact disc in an Excel format. Original field notes, sketches, recordings, and computations made by North Wind and North Wind's subcontractors used to establish the survey points will become the part of the permanent project file.

3.7 PAH Sampling

Soil samples will be collected at a reduced frequency for PAH analysis. Sample locations will be biased toward areas of highest petroleum contamination.

3.8 PCB Sampling

Soil samples will be collected at a reduced frequency for PCB analysis. Sample locations will be biased toward areas of highest petroleum contamination or known spills.

3.9 TCLP Sampling

Soil samples with total metal results that appear to exceed RCRA-designated limits will require additional characterization by the TCLP method.

3.10 Drums

In the event that empty drums are encountered during excavation activities, North Wind will remove, handle, and dispose of the drums as solid waste. The number of drums expected is less than 30. The USACE PM will be notified if number of drums may exceed 30. The removal, handling, and disposal will be evaluated with the USACE additional drums are discovered. The scope for this field effort does not include management of more than 30 drums.

The DPW and the USACE PM will be contacted immediately when drums that are not empty are encountered during excavation activities. Handling and management is not included in the scope of this field task.

3.11 Technical Memorandum

Within 45 days of the completion of all field activities and the receipt of the final analytical, North Wind will prepare a Technical Memorandum that summarizes the field activities, laboratory analytical data, and describes results of the site investigation. Each report will provide the following:

- Description of site and purpose of field investigation,
- Tabulated analytical results,
- Maps of soil boring and groundwater well locations,
- Maps of any additional excavations,
- Copies of analytical results, case narratives, and chain-of-custody reports,
- Soil contamination delineation maps,
- Fate of contaminated soils, and
- A brief description of field activities.

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4.0 ENVIRONMENTAL PROTECTION

All procedures related to this project will be conducted in accordance with the Fort Wainwright Environmental Procedures Manual and/or additional requirements from the Environmental Coordinator and/or ADEC guidance. The Fort Wainwright Fire Department is responsible for spill and emergency response on base and will be notified of project work locations and schedule. The drilling subcontractor will be responsible for preventative action and spill response for the equipment that are used at each site.

Stockpile locations will meet ADEC 18 AAC 78 criteria and will not be improperly located near surface water or impact surface water.

Archeological, historical or human artifacts are not anticipated to be present at the sites. However, if identified all work will be discontinued until the USACE archeologist, Diane Hanson, has been contacted and has given authorization to continue field activities.

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5.0 SAMPLING AND ANALYSIS

This section includes a brief description of the project's sampling and analysis approach. Detailed procedures of soil collection methods are included in the project SAP presented in Appendix A. The FSP that describes the requirements and procedures for conducting the field activities and the SAP that establishes the analytical DQOs for this project collectively comprise the SAP.

The laboratory performing the analytical services is SGS (formerly CT&E Environmental Services, Inc.) of Anchorage, Alaska. North Wind's chemist will review the analytical data and determine usability in support of project decisions.

5.1 Soil and Groundwater Sample Analyses

Soil samples will be collected from the soil borings, the bottom of the excavated areas, the contaminated stockpiles. In addition, groundwater may be sampled and submitted for analysis. The project objectives defined in Table 1 of this work plan are supported by the DQO defined in the SAP.

All samples will be collected, handled, tested, and reported according to protocol described in the SAP.

5.2 Data Review

The North Wind Analytical Laboratory Coordinator will review of the laboratory data packages, and prepare and submit a chemical data quality review (CDQR) to the USACE. This evaluation will be used to determine data usability and identify potential data gaps. Multiple CDQRs may be provided depending on the identified tasks.

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6.0 WASTE MANAGEMENT

The anticipated waste generated during this project is expected to be excavated contaminated soils and drill cuttings generated during soil boring. The potentially contaminated soils will be temporarily stockpiled as indicated in Section 3.6. The cuttings will be treated as IDW and will be placed in a lined drum with the appropriate labeling, and stored at the soil IDW management facility at Building 3476 on Fort Wainwright. All contaminated soils generated during this project will be transported to OIT for treatment.

Other IDW may include water from equipment decontamination and monitoring well development, purging, and sampling, or solid IDW from disposable sampling equipment and personal protective equipment (PPE). The water IDW will be disposed of at the IDW management facility located on the side of Building 3489 on Fort Wainwright. All disposable sampling equipment and PPE will be collected in large plastic bags and sealed with tape. At the conclusion of the field tasks, these bags will be transported to the Fairbanks Landfill for disposal. The decontamination pad will be decontaminated and the liner disposed of at the Fairbanks Landfill. Records of all materials disposed of as part of this project will be provided to North Wind's Site Manager.

Original disposal records will become part of the project file. Information regarding waste management (records to include disposal receipts) will be included in each Technical Memorandum.

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7.0 HEALTH AND SAFETY

North Wind will use a Site-Specific Safety and Health Plan (SSHP) that establishes guidelines and practices for conducting this project and is included as Appendix B. The plan adopts, by reference, the Standard Operating Procedures (SOPs) in the *North Wind, Inc. Corporate Health and Safety Program, Program and Training Manual*, the USACE Safety and Health Requirements Manual, EM 385-1-1, and the USACE Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities, ER 385-1-92, as appropriate.

North Wind's Site Manager will also act as the project's Site Safety and Health Officer and will be familiar with these SOPs and plan contents. Project-specific health and safety requirements will be followed appropriately for the level of work conducted during all project field activities. This includes, at a minimum, the following health and safety guidelines:

- Federal Acquisition Regulation, clause 52.236-13; Accident Prevention;
- U.S. Army Corps of Engineers, Health and Safety Requirements Manual, EM-385-1-1 (3 Sept 1996);
- U.S. Army Corps of Engineers, ER 385-1-92, Appendix B, Safety and Occupational Health Document Requirements for HTRW Activities;
- NIOSH/Occupational Safety and Health Administration (OSHA)/USCG/USEPA, "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities", October 1985. [DHHS (NIOSH) Publication No. 85-115];
- Federal (OSHA), 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response; and General Industry Standards;
- Federal OSHA, 29 CFR 1926, Construction Industry Standards; and
- Fort Wainwright Environmental Procedures Manual, (16 April 2003).

Copies of worker exposure monitoring records or accident reports generated by the Contractor during the mitigation work will be provided to the North Wind's Site Manager.

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8.0 DEMOBILIZATION

Upon completion of the work and prior to demobilization, the North Wind Site Manager will perform a final inspection of all work areas to ensure field tasks are complete and site is left in acceptable condition. All final work items will be completed by the subcontractor(s) to the satisfaction of North Wind's PM or Site Manager or USACE PM prior to demobilization. All tools, materials, equipment, debris, or waste will be removed from the work areas and staging area(s). Keys issued to the subcontractor(s) will be returned and any final field reporting documents will be provided to the North Wind's Site Manager. The subcontractor(s) will notify the North Wind PM and Fort Wainwright DPW of final departure from the sites and demobilization from the base.

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9.0 REPORTING REQUIREMENTS

All subcontractors shall complete daily reports summarizing installation activities, sampling, analysis, and data and provide copies to the Site Manager prior to demobilization. North Wind will summarize the extent of all related project work in brief Technical Memorandums for each site. Field activities, including related boring, monitoring well, and sampling information and results will be summarized. Analytical results will be displayed on appropriate figures/drawings. Waste management records will also be appended to the memorandum.

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10.0 REFERENCES

Alaska Department of Environmental Conservation, 2003. *18 AAC 75 Oil and Hazardous Substances Pollution Control*. Amended effective January 30.

Alaska Department of Environmental Conservations, 2003. 18 AAC 78 *Underground Storage Tanks*. Amended effective January 30.

USACE, 1994. *Topographic Surveying*. Engineering Manual EM-1110-1-1005. August.

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APPENDIX A
SAMPLING AND ANALYSIS PLAN

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DRAFT REVISION 1

SITE CHARACTERIZATION AND REMEDIATION SAMPLING AND ANALYSIS PLAN

FORT WAINWRIGHT, ALASKA

Contract No. W911KB-04-P-0136

Prepared for:

Department of the Army
U.S. Army Corps of Engineers, Alaska District
P.O. Box 6898
Elmendorf AFB, AK 99506-6898

Prepared by:

235 East 8th Avenue, Suite 210
Anchorage, AK 99501

June 2005

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Attachment 3	Low-Flow Groundwater Sampling Procedures
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Attachment 5	RLs and QC Acceptance Criteria for EPA Method SW8260B and EPA Method SW8270C

ACRONYMS AND ABREVIATIONS

A2LA	American Association of Laboratory Accreditation
ADEC	Alaska Department of Environmental Conservation
ASTM	American Society of Testing and Materials
BFB	bromofluorobenzene
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CCC	calibration check compound
CCV	continuing calibration verification
CoC	chain-of-custody
cy	cubic yard
DQOs	data quality objectives
DRO	diesel range organic compounds
ECD	electron capture detector
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
FID	flame ionization detector
FSP	field sampling plan
FTL	Field Team Leader
ft^2	square feet
GC	gas chromatography
GC/MS	gas chromatography/mass spectroscopy
GRO	gasoline range organic compounds
Horiba	Horiba U22 water quality meter
ICP/MS	Inductively-Coupled Plasma/Mass Spectrometry
IDW	investigative-derived waste
IS	internal standard
LCL	lower control limit
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
µg/L	microgram per liter (part per billion)
mg/L	milligram per liter (part per million)

ACRONYMS AND ABREVIATIONS (continued)

MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NIST	National Institute of Standards and Technology
North Wind	North Wind, Inc.
PAH	polynuclear aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PID	photoionization detector
ppm	parts per million
QA	quality assurance
QAPjP	quality assurance project plan
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
QC	quality control
QSM	Quality Systems Manual
% R	percent recovery
RCA	recommendations for corrective action
RF	response factor
RL	reporting limit
RPD	relative percent difference
RRO	residual range organic compounds
RSD	relative standard deviation
SAP	sampling and analysis plan
SGS	SGS Environmental Services, Inc.
SIM	selective ion monitoring
SPCC	system performance check compound
SSHP	site safety and health plan
SVOCs	semi-volatile organic compounds
TCLP	Toxic characteristics leaching procedure

ACRONYMS AND ABREVIATIONS (continued)

TIC	Total Ion Chromatogram
UCL	upper control limit
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USCS	United Soil Classification System
VOC	volatile organic compound

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1.0 FIELD SAMPLING PLAN

This section of the SAP defines the requirements and describes the procedures for conducting field investigations relating to the soil sampling for this project. The procedures described in this section are designed to ensure that the data quality objectives (DQOs) for this project are met and field-sampling protocols are documented in a due-diligent, consistent manner.

1.1 Data Quality Objectives

The definable features of work for this project that are supported by DQOs defined in the field sampling plan (FSP) and the quality assurance project plan (QAPjP) are as follows:

- Characterize potentially contaminated soil at various locations on Fort Wainwright,
- Delineate the nature and extent of contamination,
- Excavate and stockpile contaminated soil,
- Collect analytical data through soil sampling to support future decisions and confirm that soil left in place is not contaminated at levels that present a risk to human health,
- Install either temporary or permanent monitoring wells to evaluate the nature and extent of groundwater contaminantion,
- Develop, purge, and sample the monitoring wells,
- Decommission the temporary monitoring wells, and
- Handle and dispose of investigation derived waste (IDW).

Procedures for field sampling and chain-of-custody (CoC) documentation, laboratory analysis, and reporting that provide valid scientific data of known and acceptable quality to satisfy the project data DQOs will be followed. Sample collection, location, and frequency requirements as defined in the ADEC 18 AAC 78 will be followed when collecting soil samples from split spoons, bottom of excavations and stockpiles. ADEC 18 AAC 75 cleanup criteria for the Under 40 Inch Zone (most stringent criteria) will be referenced to determine if contamination levels may present a human health risk and to determine if excavation was adequate to reduce contamination to levels that are below those listed in Table B of this regulation. Additionally,

laboratory reporting limits will be adequate to allow evaluation of the contaminants at the established concentration levels.

1.2 General Site Inspection

North Wind's principal on-site investigator will conduct a general site inspection before site activities commence. The site inspection will include the following:

- Identify potentially hazardous site conditions (e.g. unexploded ordnances, over head power lines, buried cable, etc.) and coordinate with the Safety and Health representative;
- A visual inspection for obvious soil contamination caused by a release or leakage;
- Screening at suspect locations;
- Classify the soil strata, to the extent possible without invasive techniques, according to Unified Soil Classification System (USCS) and the American Society of Testing and Materials (ASTM) Method D2488 from visual observations of the site; and
- Record local climatological conditions during the inspection.

This information will be recorded in the field logbook and included in the draft and final field report.

1.3 Sampling Equipment

The following is a list of sample equipment and supplies that will be used during this project. Although exhaustive, this list should be used only as a guide. Safety equipment and supplies are not included in this list. Those items are listed in the Site Safety and Health Plan (SSHP).

- Appropriate sample containers for the designated analyses;
- Laboratory-prepared trip blanks (soil);
- Sample labels and custody seals;
- CoC forms;
- Decontamination equipment (non-phosphate detergent, distilled water, buckets, garden sprayer, and brushes);
- Disposable or stainless steel sampling scoops;
- Disposable tubing;

- Disposable sampling gloves (e.g., nitrile or latex);
- Insulated sample coolers;
- Gel ice packs;
- Bubble wrap;
- Plastic strapping tape;
- Re-sealable plastic bags;
- Plastic garbage bags;
- Duct tape;
- Address labels;
- "Keep Cool Do Not Freeze", "This End Up", and "Fragile" labels;
- Indelible marking pens;
- Scissors or knife;
- Shipping document forms; and
- Field forms: field log book, soil boring log, excavation clearance, etc.

1.3.1 Sampling and Boring Equipment Decontamination

Decontamination of any non-disposable sampling equipment is required. If used, the equipment will be cleaned prior to each use by a three-step process: washing in a non-phosphate detergent solution, rinsing with tap water, with a final rinse of de-ionized or distilled water. Following all soil boring, contaminated soil excavation, soil handling activity, or groundwater sampling, all related equipment will be decontaminated by North Wind personnel or the respective subcontractor. For soil activities, a decontamination containment area will be established with an impermeable bottom liner and side berms. A hot pressure washer, non-phosphate detergent, and hand brushes will be used to clean all possible equipment; otherwise hand methods will be used. For groundwater sampling, the pump will be immersed and allowed to run for several minutes in an Alconox (anionic) detergent wash, then rinsed in potable water and finally in a de-ionized water rinse.

All decontamination water will be considered IDW. The liquid IDW will be placed in appropriately labeled containers. The liquids will be disposed of at the installation's IDW Management Facility located at Building 3489.

1.4 Sample Management

Sample handling for soil and groundwater sampling will consist of sample packing, shipping, and maintaining CoC protocol. Procedures for each sample handling activity are provided in the sections that follow.

1.4.1 Sample Packing and Shipping

The following guidelines summarize protocol to be followed to ensure that the samples are properly packaged and transported to the analytical laboratory.

All sample containers will be pre-cleaned (usually certified by the manufacturer) using the appropriate U.S. Environmental Protection Agency (USEPA)-recommended cleaning protocols for the bottle type and sample analysis. Extra containers will be available in case of breakage, contamination, or the need to collect additional samples. Completed labels will be affixed to the sample containers before use and will contain the name of the project, sample identification number, location, depth, and requested analyses. The date and time of collection and the sample technician's initials will be recorded on the sample label with indelible ink. The samples will be placed in coolers with blue or dry ice, if required, while awaiting packaging and shipment to the appropriate laboratory.

When packing samples, the following guidelines will be followed:

- Tape over the drain hole inside the cooler;
- Line the cooler bottom with bubble wrap;
- Tighten all sample jars and wrap them with bubble wrap or place in bubble wrap bags;
- Place each wrapped sample jar in a resealable plastic bag;
- Place samples with lids in the upright position in the cooler;
- Place one layer of bubble wrap over glass jars and place bags of frozen gel ice on top of the bubble wrap;
- Fill any void space in the cooler with bubble wrap to the underside of the cooler cover;
- Place the CoC form in a plastic resealable bag and tape it to the underside of the of the cooler cover;

- Close and latch the cooler cover. Ensure the closure of the cover by the use of tape wraps (clear packaging tape) around each end of the cooler;
- Seal the cooler body and lid connection with one wrap of tape along the upper and lower contact surfaces;
- The preparer of the cooler will sign and affix two cooler CoC seals perpendicular across the outside cooler cover and body: one across the opening side surfaces, and one across the hinged side surfaces; and
- Install "Keep Cool Do Not Freeze", "This End Up", and "Fragile" stickers on the cooler's exterior top and side surfaces.

1.5 Field Documentation

The Field Team Leader (FTL) will control and maintain all field documents and records. Sample documentation, shipping, and custody procedures for this project are based on USEPA-recommended procedures that emphasize careful documentation of sample collection and sample transfer. The appropriate information pertaining to each sample will be recorded in accordance with the QAPjP, which is included as Section 2 of this document. The person designated to complete the sample or FTL logbook will record items such as pre-sampling safety meeting notes, weather, and general project notes in the logbook, as appropriate. The field observations (e.g., photoionization detector (PID) screening results) will provide supplemental information that can be useful when interpreting analytical results, and provide a written record of field conditions at the time sampling occurred.

Soil lithology will be logged from visual observations in the field during the soil boring and excavation according to the USCS and the ASTM Method D 2488 guidelines. Documentation will include detail according to soil texture, color, mineralogy, moisture content and other relevant characteristics. This information will be presented in a soil boring diagram for each boring and excavation for inclusion in the project's summary report.

1.5.1 Sample Custody

Personnel will maintain standard CoC procedures for all samples collected for laboratory analysis. The project team will keep all samples within their line of sight during the sampling period and while being stored on Fort Wainwright prior to shipping. In no case will the coolers

be stored overnight on the soil boring or excavation site. Custody seals will be used to verify that the samples are undisturbed while secured. All analytical samples will be handled and transported under this protocol.

The project laboratory will provide CoC forms, which will accompany all samples from the project site to the project laboratory. SGS Environmental Services, Inc. (SGS) will be the project's primary analytical laboratory and is approved by the USACE and ADEC. All samples will be transported to the Fairbanks, Alaska, facility of SGS. Analysis will occur at SGS' Anchorage, Alaska, laboratory. An example of the SGS CoC and the *SGS Statement of Qualifications* and certifications are presented in Attachment 1.

Each CoC form will have the following information at a minimum:

- Project laboratory;
- Sampling contractor's name, address, telephone number, fax number, and email address;
- Field sampler's name;
- Project name and number;
- Sample identification number with date and time collected, number of sample containers, and analyses requested;
- Requested turn around time, deliverable level, electronic data deliverable requested; and
- Signatures accompanying any transfer of custody from the sampler to the project laboratory.

Field sampling personnel will retain a copy of each CoC form for project records and will coordinate transport of samples. The designated field sampling personnel will relinquish the CoC form, and a representative of the laboratory will accept custody of the samples upon receipt. Any individual retaining custody of sample containers throughout the transportation process will sign each cooler's respective CoC. In addition, field personnel will collect and retain any other transportation or shipment records for each project sample container in the project files.

1.6 Soil Sampling

1.6.1 Soil Field Screening

On-site soil field screening will be used during soil boring and excavation activities to monitor organic vapors levels most likely produced by petroleum hydrocarbon fuels. A PID will be used to collect semi-quantitative field screening data from unconsolidated soil grab samples and to screen ambient air on-site in the working area for health and safety monitoring of worker exposure to organic vapors. The PID will be calibrated for the detection of organic hydrocarbon vapors through heated headspace analysis. Soil screening samples will be collected at five-foot subsurface intervals during soil boring investigations and during excavation activities.

PID results that are above established background levels may indicate presence of contamination and will be confirmed by field personnel visual or olfactory senses. PID background levels will be determined prior to investigation activities by choosing a location adjacent to the work area least likely to possess soil contamination. Screening results that do not exceed background will be classified as uncontaminated.

All soil boring materials produced during this project will be considered solid IDW. Soil cuttings produced during soil boring activities will be contained in super sacks and staged on-site until receipt of analytical results, which will be used to characterize the soil and determine the proper disposition. Disposal options include using clean material for backfill (results less than Table B criteria) and thermal treatment of petroleum-contaminated soil. Soil determined to be RCRA waste will be taken to the Fort Wainwright RCRA facility. Liquid IDW generated from decontamination activities will be taken to the Fort Wainwright IDW facility located on the side of Building 3489.

The soil borings will be accomplished using hollow-stem auger drilling equipment. All screening samples will consist of soil consolidated within a standard split-barrel sampling tube from each designated screening interval. Each screening sample will be collected directly from freshly recovered soil in the sampling tube from every 5-foot interval during soil boring. During excavation activities, screening samples will be obtained either directly from inside the

excavation, after the excavation area is determined safe for entry, or directly from the excavation equipment bucket at a safe distance from the excavation edge. All screening samples will be characterized with a PID and soil lithology observations.

The headspace analysis will be conducted as follows:

- Calibrate the PID with 100 part per million (ppm) isobutylene standard calibration gas (to achieve a benzene equivalent response);
- Fill a resealable plastic freezer bag one-third to one-half full with soil, or approximately 8 ounces of soil;
- The soil will be shaken or agitated for 15 seconds immediately after inserting soil in the bag. Warm the bag to a minimum temperature of 40ºF (4ºC) with an optimum temperature of approximately 60ºF (20ºC). If the soil is frozen when inserted in the bag, reagitate after the sample has reached 40°F;
- Headspace vapors will be allowed to develop for at least 10 minutes, but less than one hour;
- The soil will be shaken or agitated again for 15 seconds at the end of the headspace vapor development period immediately before taking PID measurement;
- Insert the PID intake probe halfway into the airspace area of the bag; and
- Open one corner of the bag, allowing just enough room to insert the PID intake probe, seal opening around the PID probe, and record the resultant reading on the sample collection log. The highest PID reading, usually registered within the first 5 seconds of probe insertion, will be noted and recorded in the field logbook.

1.6.2 Soil Sample Collection

Analytical laboratory samples will be collected as described in this subsection and shall meet ADEC requirements described in 18 AAC 78 and the Underground Storage Tanks Procedures Manual (ADEC 2002). Additional soil volume will be collected for duplicate samples. The appropriate containers and soil volumes for each analysis are listed in Table 1.

Samples to be analyzed for volatile organic compounds (VOC) will be collected first, followed by samples to be analyzed for less volatile parameters in the following sequence:

1) Volatile organic compounds (VOCs);
2) Benzene, toluene, ethylbenzene, and total xylenes (BTEX);
3) Gasoline range organic compounds (GRO);

4) Diesel range organic compounds (DRO);
5) Polynuclear aromatic hydrocarbons (PAH);
6) PCBs;
7) Total RCRA Metals; and
8) Toxic characteristics leaching procedure (TCLP) Metals.

Soil sampling procedures will conform to the following general protocol:

- Calibrate the PID with 100 ppm isobutylene standard calibration gas (to achieve a benzene equivalent response);
- Measure and record in the sampling log book ambient air readings obtained from exterior air surrounding the work area;
- During soil boring, carefully open the split-spoon sampler for access to the soils;
- Fill the sample containers that will be analyzed for VOCs/GRO/BTEX first. A balance will be used to place approximately 40 grams of soil in the appropriate sample jar;
- Place the required amount of methanol preservative into the VOCs and GRO/BTEX sampling container(s);
- Place the required amount of soil into the DRO/RCRA Metals sampling container, ensuring there are no voids (no headspace) in the sample jar;
- Place the required amount of soil into the PAH/PCBs/TCLP Metals sampling container (as necessary), ensuring there are no voids (no headspace) in the sample jar;
- Cap and label the sample containers. Clean top of each container to ensure a tight seal and place in cooler with gel ice packs; and
- Record date, time, sample location, number and type of sample jars filled, soil description, sample depth, and any unusual field conditions in the field log book. Mark the sample location on a map and or on a site sketch in the field log book.

Two analytical laboratory samples will be collected from within each boring. One sample will be collected from the bottom of the borehole at 15 feet below ground surface (bgs). The second sample will be collected from the soil-boring column at the interval with the highest PID reading. When the split-barrel tube is removed, it will be laid flat and opened. Grab samples will be collected from the center of the tube and placed in appropriate sample glassware using disposable spoons. Samples duplicate quality control samples at a 10 percent frequency.

The samples collected from the soil borings will be tested for GRO (AK101), DRO (AK102), VOCs, (SW8260B) and RCRA metals (SW6010/7471A). Ten percent of the samples will be

include testing for PAHs and PCBs. These tests shall be biased toward samples with the highest field screening results.

Soil cuttings collected during the soil boring process will be contained and stored on-site but will not be tested. Disposal options will be evaluated based upon results collected from boring split-spoon samples.

Samples will be collected from areas that show highest levels of contamination at a frequency of two for the first 250 square feet (ft^2), and one sample for each additional 250 ft^2 of excavation (per 18 AAC 78.090). Soil samples will be tested for GRO, DRO, VOCs, and RCRA metals. The analytical suite may be modified based on boring results and limited to include methods for only the compounds that were detected. Soil samples will be tested for PAHs and PCBs at a reduced frequency and only in areas that identified these contaminants as a potential concern. Frequency should not exceed 10 percent of total samples.

Additional excavation of contaminated soil may be necessary if confirmation results indicate that soil remaining in the initial excavation is still considered contaminated by criteria defined in Table B, 18 AAC 75, Under 40 Inch Zone, most stringent pathway.

The sample collection process for the bottom of these additional excavations will follow the same criteria as described above. Frequency will not exceed 5 samples per 150 cubic yard (cy) excavation. This soil removal will be performed incrementally and USACE approval will be required prior to excavation of each 150 cy not to exceed a total of 600 cy. The analytical suite will include testing for GRO, DRO, VOCs, and RCRA metals but analytical suite may be modified to only include those methods that include analytes of concern. Quality control (QC) duplicate samples will be collected at a frequency of 10 percent of the total number of samples.

Contaminated soil will be temporarily stockpiled on-site until characterization results are reviewed to determine if the soil can be thermally remediated. Sample frequency as defined by 18 AAC 78.605c will be followed and number of samples will be based on total volume of soil stockpiled. Total number of grab samples is not expected to exceed 11 for the estimated volume of 2,500 cy. These soil samples will be tested for GRO, DRO, VOCs, and RCRA metals. Soil potentially containing PCBs and RCRA-levels of metals will be segregated from petroleum-

contaminated soil. Stockpiled soils will include limited testing for PCBs at a frequency of 10 percent. Characterization samples will include quality control duplicate samples at a frequency of 10 percent of total per method.

Soil considered clean by ADEC 18 AAC 75 criteria, will be used to backfill the excavations. Fuel contaminated soil will be transported to an off-site thermal treatment facility.

Post-treated soil will be tested for GRO (AK101), DRO (AK102) and BTEX (SW8260B). Samples will be collected at the frequency defined in Table C of 18 AAC 78.605b and will depend on volume of treated soil. The thermal subcontractor will treat soil in increments of 250 cy up to a total of 1,000 cy. The USACE PM will be notified prior to treatment of each 250 cy.

Sample analyses for GRO and DRO will be performed according to the Alaska Series Methods AK 101 and AK 102, respectively. The GRO and VOC samples will be preserved in the field using a pre-measured volume of methanol supplied by the analytical laboratory. Each sample cooler containing GRO, BTEX, or VOC samples shipped from the sampling area will include one methanol trip blank. A trip blank is a sample bottle filled with high performance liquid chromatography-grade methanol placed over Ottawa sand, transported to the field site, handled like a sample, and returned to the laboratory for analysis. Methanol trip blanks are only required when samples are collected for VOC or GRO analytes. Table 1 shows the required containers and sample holding times for soil analysis.

Table 1 Soil Sample Collection Information

Analysis	Method Number	Container	Preservative	Maximum Holding Times
GRO	AK 101	4 oz. septa, pre-weighed amber jar	MeOH, 4°C	28 days
VOCs or BTEX	EPA 8260B	4 oz. septa, pre-weighed amber jar	MeOH, 4°C	14 days
DRO	AK 102	8 oz. amber jar	4°C	14 days
RCRA Metals	SW 3051/6010/7471A	4 oz. amber jar	none	28 days (mercury) 180 days (other metals)
PAH	GC/MS-SIM	4 oz. amber jar	4°C	14 days to extraction, 40 days to analysis
PCBs	EPA SW8082A	8 oz. amber jar	4°C	14 days to extraction, 40 days to analysis
TCLP Metals	SW1311/6010/7470A/7471A	8 oz. amber jar	none	14 days to extraction, 180 days to analysis except mercury which is 28 days

GC = gas chromatography
GC/MS = gas chromatography/mass spectroscopy
MeOH = Methanol
SIM = selective ion monitoring

Disposable sampling equipment will be used to fill the sample containers and will not require decontamination. All reusable sampling equipment will be decontaminated between locations following the procedures described in Section 1.3.

1.6.3 Field Quality Control Samples

QC samples will consist of field duplicates, equipment blanks, matrix spikes (MSs) and matrix spike duplicates (MSDs). Field personnel will use the same collection procedures described above to collect field QC samples. The duplicate samples will be collected at a rate of ten percent of the total number of primary samples collected. The duplicate samples will be numbered such that the QC nature of the samples is not obvious to the laboratory. The primary laboratory will perform MS/MSD duplicate analyses at a rate of five percent of the total number of primary samples collected for each method and each matrix. Quality assurance samples will not be collected during these field-sampling activities.

1.6.4 Sample Identification and Management

Field soil screening and sample collection data will be recorded in a bound, sequentially-numbered field logbook. Entries will include the following:

- Date and time of reading;
- Plan and section view of excavation;
- Site sketch (hand drawn by field personnel);
- Location and depths of field screening tests;
- Location and configuration of any tanks and piping (if applicable);
- Proximity to buildings and residences;
- Any release or free product sites (if applicable);
- The facility and property boundaries;
- A bar scale and north arrow;
- Any other pertinent information.
- Local climatologically conditions (weather, temperature, etc.);
- Name of person performing the screening;
- PID screening results;
- Soil strata and classification according to American Society for Testing and Materials D2488;
- Visual and olfactory observations of the soil;
- Unusual/unexpected problems; and
- Photographic Log;
  - Location
  - Photograph number
  - Description;
  - Direction of view; and
  - Date and time of photo.

Each sample will receive a unique sample number. If soil samples are collected before boreholes have received assigned numbers, the samples will be numbered sequentially.

1.6.5 Field Equipment

The PID will be the only field instrument used during soil sampling. The minimum detection limit of 1 ppm will be used for this field effort.

For this project, field personnel will calibrate the PID according to the manufacturer's instructions on site every morning. The PID will be calibrated with 100 ppm isobutylene standard calibration gas (to achieve a benzene equivalent response). Field personnel will keep a record of daily calibration results. A copy of the manufacturer's operation manual will be kept on site during field activities.

1.6.5.1 Instrument Calibration and Maintenance of Field Equipment

The precision of this instrument, as given by the manufacturer, is 1% of calibration when calibrated with 100 ppm of isobutylene. The accuracy of this instrument, as given by the manufacturer, is +/- 10% or +/- 2 ppm, whichever is greater.

1.7 Groundwater Sampling

North Wind will perform groundwater monitoring only once during this project, in accordance with the project scope. Field personnel will use groundwater monitoring procedures that have been established for Fort Wainwright under this contract and are in accordance with Engineer Manual EM 200-1-3 (USACE, 2001). The following subsections provide a detailed description of the protocols to be followed when monitoring groundwater at Fort Wainwright.

1.7.1 Groundwater Monitoring

The data regarding the associated screened interval, total depth of the monitoring well and other pertinent well information for the new groundwater monitoring wells to be sampled will be summarized in the project summary report as shown in Table 2.

Table 2 Monitoring Well Details

Well No.	Well Type	Total Well Depth (feet from TOC)	Screened Interval (feet bgs)	Surface Completion	Analytical Parameters
TBD	4-inch PVC	TBD	TBD	Above ground	GRO, DRO, BTEX, PAHs

1.7.1.1 Field Equipment

Groundwater will be withdrawn from each monitoring well using a Peristaltic pump, which is a 2-inch submersible pump. The Peristaltic pump is a variable speed impeller pump, and will be used to draw the sample water from the groundwater monitoring well. It will be operated in a manner that is consistent with manufacturers' recommendations. Sampling equipment will be decontaminated after each well. Sections 1.3 and 1.7.2 describe decontamination procedures. Disposable polyethylene tubing with either a 1/2- or 3/8-inch inner diameter will be used with the Peristaltic pump.

The Horiba U22 water quality meter (Horiba) with flow through cell will be used to monitor the field parameters identified in Table 3. The Horiba will be calibrated at the beginning of each day according to manufacturer's guidance, and will be checked periodically throughout the day. The instrument will be recalibrated if any parameter reading varies from the standard 10% or greater.

Table 3 Water Quality Stabilization Parameters

Field Parameter	Stabilization Criteria
pH	+/- 0.2 pH units
Specific Conductivity	+/- 3 percent of reading or +/- 0.02 S/m
Temperature	+/- 0.5^{o}C Temperature ideally < 6 °C
Turbidity	10 percent variability or +/- 10 NTU
Dissolved Oxygen	10 percent variability or+/- 0.02 mg/L
Oxidation-Reduction Potential	+/- 10 percent or +/- 2 mV

Reference: Puls and Barcelona, 1996

Personnel will operate field equipment in accordance with manufacturer's recommendations. Personnel will understand the normal functioning parameters of all field equipment, and will know how to recognize and repair basic malfunctions. In the event of a more serious equipment failure, personnel will tag the faulty equipment, render it out of service, and obtain a backup piece of equipment. Copies of the operator's manuals for all equipment used during groundwater monitoring are included in Attachment 2.

1.7.1.2 Purging and Sampling

Groundwater purging and sampling is achieved using a low-flow procedure (Puls and Barcelona, 1996). The initial step in the low-flow groundwater sampling procedure entails measuring the depth to the static water level. Once the depth to water is measured, a variable speed submersible pump will be lowered in the well to the midpoint of the screened interval and groundwater purging will be initiated. The well will be purged at a rate of approximately 0.5 to 1.0 liter per minute using a variable speed impeller pump. Water levels will be checked periodically to monitor drawdown as a guide to flow rate adjustment. The goal is minimal drawdown (< 0.1 meter) during purging, however this goal may be difficult to achieve due to geologic heterogeneities within the screened interval (Puls and Barcelona, 1996). Low-flow procedures are included as Attachment 3.

Water quality measurements will be taken every three to five minutes until water quality parameters stabilize. Stabilization is achieved when all parameters have achieved the stabilization criteria listed in Table 4 for three successive readings. Attachment 4 provides groundwater monitoring forms that will used to document water quality measurements and other pertinent information.

Once the field parameters have stabilized personnel will collect groundwater samples. The sample containers will be filled in the following order for the well based on the approximate order of parameter volatility: BTEX, GRO, DRO, and PAHs. The flow output will be directed to the inside wall of the sample container to reduce volatilization. Table 4 depicts the required containers and sample holding times for each required analysis. In addition, the project QAPP provides detailed information on groundwater sample preservation.

Table 4 Groundwater Sample Collection Information

Analysis	Method Number	Container	Preservative	Maximum Holding Times
BTEX	EPA 8260B	Three 40-ml VOA vials	No headspace, HCl to pH < 2, 4 +/- 2°C	14 days
GRO	AK101	Three 40-ml VOA vials	No headspace, HCl to pH < 2, 4 +/- 2°C	14 days
DRO	AK102	Two 1-liter amber jars	HCl to pH < 2, 4 +/- 2°C	14 days[1]

Notes:
[1]Holding time for DRO per ADEC standards is 14 days, however the contracted laboratoy adheres to a 7 day holding time.
BTEX = benzene, toluene, ethylbenzene, and total xylenes
DRO = diesel range organic compounds
GRO = gasoline range organic compounds
HCl = hydrochloric acid
ml = milliliter
VOA = volatile organic analysis

1.7.1.3 Field Quality Control Samples

As defined in the project's Scope of Work, no QC samples will be taken during groundwater monitoring. However, all QC information will be left in the project QAPP (Section 4.0) in the event QC samples may be required during any future monitoring events. Should any QC samples be taken, additional volumes of water must be collected from the monitoring well. For a duplicate sample, two times the number of containers listed in Table 4 must be filled and provided to the laboratory. For a MS/MSD, three times the number of containers listed in Table 4 must be filled and provided to the laboratory.

1.7.2 Decontamination Procedures

Decontamination procedures are only applied to equipment that is reused, disposable equipment will be used when appropriate. The Horiba probe and flow through cell will be decontaminated between each well, using the same three step process used for the Peristaltic pump.

1.7.3 Investigative Derived Waste

IDW generated as a result of groundwater monitoring activities is to be handled according to existing procedures established in the Fort Wainwright Environmental Procedures Manual. Non-

hazardous solid IDW consisting of latex sampling gloves, paper towels, and sample tubing will be collected and disposed of at the Fort Wainwright Landfill.

Groundwater purging, sampling, development and equipment decontamination will produce water IDW, which will be treated and disposed of on-site as previously described.

1.7.4 Groundwater Sample Management

All sample packing, shipping, chain-of-custody protocol and documentation for the groundwater samples will be conducted as described in Section 1.4.

2.0 QUALITY ASSURANCE PROJECT PLAN

The purpose of this section of the SAP is to describe procedures that are required to meet quality requirements pertaining to this project and data usability standards. The overall QA policies and QC procedures shall be followed as delineated in this QAPjP and also the Quality Systems Manual (QSM) (DoD 2002) to ensure and document data quality. The laboratory performing the fixed lab analytical chemistry services is SGS Environmental Services of Anchorage, AK.

This section presents, in specific terms, the policies, organization, functions, and quality assurance/quality control (QA/QC) project requirements.

2.1 Data Categories

There are two general categories of data. They are defined as: (1) screening data and (2) definitive data.

Screening data are generated by rapid methods of analysis with less rigorous sample preparation, calibration and/or QC requirements than are necessary to produce definitive data. These field methods are used real-time data such as pH, conductivity, and temperature or qualitative parameters such as those determined using a PID or other field screening instruments and procedures.

Definitive data are generated using quantitative analytical procedures, such as approved USEPA methods. The off-site laboratory, SGS, will generate the data. These methods define standardized QC and documentation requirements. Definitive data are not restricted in their use unless quality control parameters are not met. Section 2.9 of this QAPjP discusses data review and usability.

2.2 Precision, Accuracy, Representativeness, Completeness, and Comparability

The basis for assessing precision, accuracy, representativeness, completeness, and comparability, the elements of data quality, is discussed in the following subsections. The data quality indicator acceptance criteria for each method and matrix are described in Section 2.7.0

2.2.1 Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Field duplicate samples and matrix duplicate spiked samples shall be analyzed to assess field and analytical precision, and the precision measurement is determined using the relative percent difference (RPD) between the duplicate sample results. The formula for the calculation of precision is provided in Table 1 as RPD. For replicate analyses, the relative standard deviation (RSD) is determined. The formula for the calculation of RSD is also provided in Table 1.

2.2.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systemic error. It therefore reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. For volatile and semivolatile organic compounds (VOC and SVOC) surrogate compound recoveries are used to assess accuracy and method performance for each sample analyzed. The formula for calculation of accuracy is included in Table 1 as percent recovery (% R).

2.2.3 Representativeness

Objectives for representativeness are defined for each sampling and analysis task and are a function of the investigative objectives. Representativeness shall be achieved through use of the standard field, sampling, and analytical procedures. Representativeness is also determined by

appropriate program design, with consideration of elements such as proper sample locations and sampling procedures. To assure that the sample results are as representative as possible, the field sampling procedures in the field sampling plan will be followed.

2.2.4 Completeness

Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples. Completeness is calculated and reported for the entire data set (defined for the project) by assessing each result. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not considered rejected (qualified with an "R"). The requirement for completeness is 95 percent and is reported for the entire project data set.

The formula for calculation of completeness is presented below:

$$\% \text{ Completeness} = \frac{\text{Number of valid results}}{\text{Total number of possible results}}$$

Valid Results are the total number of results minus the rejected results.

Table 5 Statistical Calculations

Statistic	Symbol	Formula	Definition	Uses
Mean	$\overline{X}$	$\frac{\left(\sum_{i=1}^{n} x_i\right)}{n}$	Measure of central tendency	Used to determine average value of measurements
Standard Deviation	S	$\left(\frac{\Sigma(x_i-\overline{X})^2}{(n-1)}\right)^{½}$	Measure of relative scatter of the data	Used in calculating variation of measurements
Relative Standard Deviation	RSD	$(S/\overline{X}) \times 100$	Relative standard deviation, adjusts for magnitude of observations	Used to assess precision for replicate results
Percent Difference	%D	$\frac{x_1 - x_2}{x_1} \times 100$	Measure of the difference of 2 observations	Used to assess accuracy
Relative Percent Difference	%RPD	$\left(\frac{(X_1 - X_2)}{(X_1 + X_2)/2}\right) \times 100$	Measure of variability that adjusts for the magnitude of observations	Used to assess total and analytical precision of duplicate measurements
Percent Recovery	%R		Recovery of spiked compound in pure matrix	Used to assess accuracy
Percent Recovery	%R		Recovery of spiked compound in sample matrix	Used to assess matrix effects and total precision

x = observation (concentration)
n = number of observations

2.2.5 Comparability

Comparability is the confidence with which one data set can be compared to another data set. The objective for this QA/QC program is to produce data with the greatest possible degree of comparability. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms shall support the assessment of

comparability. Historical comparability shall be achieved through consistent use of methods and documentation procedures throughout the project.

2.3 Method Detection Limits, Reporting Limits, and Instrument Calibration Requirements

This section defines the method detection limits, instrument and laboratory reporting limits and instrument calibration requirements. The sensitivity of the instrument and ability to generate reporting limits low enough to meet cleanup criteria are critical to the success of this project.

2.3.1 Method Detection Limits

The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The laboratory shall establish MDLs for each method, matrix, and analyte for each instrument the laboratory plans to use for the project. The laboratory shall revalidate these MDLs at least once per twelve-month period. Results less than the MDL shall be reported as the reporting limit (RL) value and flagged with a "U" (see Section 2.9).

2.3.2 Reporting Limits

The laboratories participating in this work effort shall ensure the method detection limit study supports the RLs for each method utilized on this project. The MDL may not be more than one-half the corresponding RL. The laboratories shall also verify RLs by including a standard at or below the RL as the lowest point on the calibration curve. This project includes methods that utilize field extraction with methanol. The RL is dependent on the amount of soil collected and volume of methanol added to the sample container in the field. The percent moisture will also impact the reporting limits. All results at or above the MDL shall be reported; however, those results greater than the MDL and below the RL will be considered estimated and qualified with a "J" flag (see Section 2.9).

2.3.3 Instrument Calibration

Analytical instruments shall be calibrated in accordance with the analytical methods. All analytes reported shall be present in the initial and continuing calibrations. All sample results reported shall be within the calibration range. Records of standard preparation and instrument calibration shall be maintained. Records shall unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards shall be traceable to the original standard materials.

Instrument calibration shall be checked using all of the analytes listed in the QC acceptance criteria table in Section 2.7 for the method. All calibration criteria shall comply with the method criteria, DoD QSM (DoD 2002) or Alaska Department of Environmental Conservation (ADEC) method requirements at a minimum. The initial calibration shall be checked at the frequency specified in the method using materials prepared independently of the calibration standards. Analyte concentrations are determined with either calibration curves or response factors (RFs). For GC and GC/MS methods, when using RFs to determine analyte concentrations the average RF from the initial five-point calibration shall be used. The continuing calibration shall not be used to update the RFs from the initial five-point calibration.

2.4 Elements of Quality Control

This section presents QC requirements relevant to analysis of environmental samples that shall be followed during all analytical activities for fixed laboratory, mobile, and field laboratories. The purpose of this QC program is to produce data of known quality that satisfy the project objectives and that meet the requirements of the standard methods of analysis. This program provides a mechanism for ongoing control and evaluation of data quality measurements through the use of QC materials.

Laboratory QC samples (e.g., blanks and laboratory control samples) shall be included in the preparation batch with the field samples. A preparation batch is a number of samples (not to exceed 20 environmental samples plus the associated laboratory QC samples) that are similar in composition (matrix) and that are extracted or digested at the same time and with the same lot of

reagents. Matrix spikes (MSs) and matrix spike duplicates (MSDs) are considered QC samples. The analytical batch is a group of samples analyzed sequentially that share the same QC. The identity of each analytical batch shall be unambiguously reported with the analyses so that a reviewer can identify the QC samples and the associated environmental samples. The type of QC samples and the frequency of use of these samples are discussed below and in the method-specific subsections of Section 2.7.

2.4.1 Matrix Spike/Matrix Spike Duplicate

A MS and MSD are aliquots of sample spiked with known concentrations of all target analytes. The spiking occurs during sample preparation and analysis. The MS and MSD shall be spiked at a level less than or equal to the midpoint of the calibration curve for each analyte. Only samples generated for this project shall be used for spiking. The MS/MSD shall be designated on the chain of custody. The MS/MSD is used to document the bias attributed to the sample matrix.

A minimum of one MS and one MSD sample shall be analyzed for every 20 samples per matrix. The performance of the MS and MSD is evaluated against the QC acceptance limits given in the tables in Section 2.7. If either the MS or the MSD is outside the QC acceptance limits, the analytes in all related samples shall be qualified according to the criteria in Section 2.9.

Quality control samples such as equipment plants will not require an MS/MSD. However, all other samples will require this designation by the field sampler.

2.4.2 Surrogates

Surrogates are organic compounds that are similar to the target analyte(s) in chemical composition and behavior in the analytical process, but that are not normally found in environmental samples. Surrogates are used to evaluate accuracy, method performance, and extraction efficiency. Surrogates shall be added to environmental samples, controls, and blanks, in accordance with the method requirements. The laboratory will provide methanol containing a surrogate for the field-extracted methods (SW8260B and AK101).

Whenever a surrogate recovery is outside the acceptance limits, corrective action (as described in Section 2.10) must be performed. After the system problems have been identified and system control has been reestablished, the sample will be reprepared and reanalyzed. If corrective actions are not performed or are ineffective, the results may require qualification, as described in Section 2.9.

2.4.3 Internal Standards

Internal standards (ISs) are measured amounts of specific compounds added to the sample extracts. They are used as a reference to control and evaluate the precision and bias introduced during analysis of the sample. These standards shall be added to all environmental samples, controls, and blanks, in accordance with the method requirements. Corrective actions shall be performed when acceptance limits are not met. After the system problems have been identified and system control has been reestablished, all effected samples shall be reanalyzed. If corrective actions as described in Section 2.10, are not performed or are ineffective, the associated results will be qualified as described in Section 2.9.

2.4.4 Retention Time Windows

Retention time windows are used in identification of analytes. They are calculated from replicate analyses of a standard on multiple days. The procedure and calculation method is defined in EPA SW-846 Method 8000A. The retention time of a compound in a daily standard may indicate the system is no longer stable or has change since the retention time windows were established. All associated samples and QC will be reanalyzed.

2.4.5 Method Blank

The method blank should be free from analytes of concern and processed simultaneously with and under same conditions as the associated samples. The method blank will be used to evaluate potential cross-contamination occurring during the preparation and testing process and shall be included in every preparation batch.

The presence of analytes in a method blank at concentrations equal to or greater than ½ the RL indicates a need for corrective action. Corrective action shall be performed to eliminate the source of contamination prior to proceeding with analysis. After the source of contamination has been eliminated, all samples in the associated batch shall be reprepared and reanalyzed. Analytical results shall not be adjusted based on compounds detected in the associated blank. When an analyte is detected in the method blank and associated samples and corrective actions were not adequate, the results in the impacted samples will be qualified as described in Section 2.9.

2.4.6 Equipment Blank

An equipment blank is a sample of analyte-free media (i.e., carbon filtered, double ionized water) that is collected after equipment decontamination and prior to sample collection. Equipment blanks are not required when disposable sample collection equipment are used. This blank is handled and tested using the same process as the associated samples. Equipment blanks will be collected with water samples only.

Equipment blanks are used to assess the effectiveness of equipment decontamination procedures and to document potential cross-contamination. An equipment blank will be collected before the first sample is collected and at a frequency of one every 3 days of sampling or one per tasks that are less than 5 days. The blank shall be analyzed for all laboratory analyses requested for the environmental samples collected at the site. When an analyte is detected in the equipment blank the corresponding results in the associated samples will be qualified as described in Section 2.9.

2.4.7 Trip Blank

The trip blanks are matrix specific, consisting of either a 40 milliliter VOC vial filled in the laboratory with analyte-free water or methanol for water samples or a 4 ounce jar filled with Ottawa sand and methanol for soil samples. The trip blanks are shipped from the laboratory with sample glassware, transported to the sampling site, handled like an environmental sample and returned to the laboratory for analysis. Trip blanks are not opened in the field. Trip blanks are

prepared only when volatile samples (SW8260B and AK101) are collected. A separate trip blank is collected for each method for water analyses and a single 4-ounce container is required when soil samples are collected.

Trip blanks are used to assess potential cross-contamination during transportation, handling, and storage. When an analyte is detected in the trip blank the associated sample results are qualifies as described in Section 2.9. One trip blank shall accompany each cooler sent to the laboratory for SW8260B and AK101 analyses. One trip blank per matrix shall be included in the cooler if both soil and water samples are shipped together. Samples with high levels of contamination shall not be shipped with water samples but shall be shipped in a separate container. Trip blanks are not required for waste samples.

2.4.8 Field Duplicates

Field duplicates are two independent samples collected at the same location and close to the same time. Duplicate samples are collected simultaneously or in immediate succession from the same source, using identical recovery techniques, stored in separate sample containers, and analyzed as two separate samples. Specific locations are designated for collection of field duplicate samples prior to the beginning of sample collection.

Duplicate samples will be collected at a minimum rate of one per every ten samples per matrix. Duplicate sample results are used to assess precision of the sample collection process.

2.5 Quality Control Procedures

This section presents a discussion of QC procedures including holding time compliance and qualitative confirmation.

2.5.1 Holding Time Compliance

All sample preparation and analysis shall be completed within the method-established holding criteria as presented in Table 6. The first holding time begins at the time of sample collection

and ends when sample preparation begins or sample is analyzed, as is the case with SW8260B or AK101 analyses. Some methods have more than one holding time requirement (e.g., methods requiring extraction AK102, SW8082A, GC/MS SIM). This is the analysis holding time calculated from the time of sample preparation is completed to the time of completion of all analytical tests, including dilutions, second column confirmations, and any required re-analyses. All results that are reported must be performed within the established holding times. The laboratory shall notify the project chemist within 24 hours of missing a holding time. This prompt notification may allow the project team to evaluate recollection of the sample while team is still in the field.

Table 6 Method Specific Water Holding Times

Method	Analysis	Water Holding Time	Soil Holding Time
SW8260B	VOCs	14 days to analysis	14 days to analysis
AK101	GRO	14 days to analysis	14 days to analysis
AK102	DRO	7 days to extraction, 40 days to analysis	14 days to extraction, 40 days to analysis

2.5.2 Confirmation

Confirmation of GC/MS positive results for SW8260B will be achieved using Mass Spectrometry. Samples will be analyzed for polynuclear aromatic hydrocarbons (PAHs) using GC/MS – SIM. Confirmation for results reported using the SIM method will be achieved evaluating retention times in conjunction with ratio of secondary ion to base peak ion.

2.6 Standard Materials

Standard materials shall be traceable to National Institute of Standards and Technology (NIST), EPA, American Association of Laboratory Accreditation (A2LA) or other equivalent approved source, if available. The laboratory shall monitor expiration dates for all standards and expired standards shall be discarded. Expiration dates shall be established based on manufacturers recommendations, chemical stability, possibility of contamination, and environmental and storage conditions. The laboratory shall label standard and QC materials with expiration dates.

2.6.1 Supplies and Consumables

The laboratory shall inspect supplies and consumables prior to their use in analysis. The materials description in the methods of analysis shall be used as a guideline for establishing the acceptance criteria for these materials. An inventory and storage system for these materials shall assure use before manufacturers' expiration dates and storage under safe and chemically compatible conditions.

2.7 Definitive Data Analytical Methods and Procedures

Section 2.7 contains brief descriptions of preparation methods. Section 2.7 contains subsections for each analytical procedure. Each subsection contains the following information:

- A brief method description;
- A table of RLs;
- A table of QC acceptance criteria; and
- A table of calibration procedures, QC procedures, and data validation guidelines.

This information was obtained from:

- SGS Anchorage Laboratory
- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (U.S. EPA SW-846, Third Edition, and its first, second, and third final update; Dec. 1996);
- ADEC UST Procedures Manual, November 7, 2002
- U.S. Army COE Shell of Analytical Chemistry, EM 200-1-3 App. I, Feb. 2001
- DOD Quality Systems Manual-Version 2 Final, June 2002

2.7.1 Preparation Methods

Extraction and digestion procedures for liquid and solid matrices are outlined in Table 7. The applicable preparation method for each analytical method is provided in the RL tables.

Table 7 Extraction and Digestion procedures

Method	Parameter
SW3510C	Separatory Funnel Liquid-Liquid Extraction
SW3550B	Ultrasonic Extraction
SW5030B	Purge and Trap Extraction and Concentration
AK101	Soil samples are field extracted using methanol
SW5035B	Soil samples are field extracted using methanol
SW1311	Soil samples are leached (TCLP)
SW3015 or 3010	Microwave acid digestion/or hot plate for totals metals analysis (waters)
SW3051	Microwave acid digestion for totals metals analysis (soil)

The following bullets provide information on each method identified in Table 7:

- *Method SW3510C* Separatory Funnel Extraction. Method SW3510C is designed to quantitatively extract nonvolatile and SVOCs from liquid samples using standard separatory funnel techniques. The sample and the extracting solvent must be immiscible in order to yield recovery of target compounds. Subsequent cleanup and detection methods are described in the organic analytical method used to analyze the extract.
- *Method SW3550B* Ultrasonic Extraction. Method SW3550B is a procedure for extracting nonvolatile and SVOCs from solids such as soils and sludges. The sonication process ensures intimate contact of the sample matrix with the extraction solvent.
- *Method SW5030B* Purge and Trap Method. Method SW5030B describes sample preparation and extraction for the analysis of VOCs. The method is applicable to nearly all types of samples, including aqueous sludges, caustic liquors, acid liquors, water, and polymeric emulsions. The success of this method depends on the level of interferences in the sample. Results may vary due to the large variability and complexity of matrices of solid waste samples. An inert gas is bubbled through a sample solution at ambient temperature to transfer the volatile components to the vapor phase. The vapor is swept through a sorbent column where the volatile components are trapped. After purging is completed, the sorbent column is heated and backflushed with inert gas to desorb the components onto a GC column.
- *Method SW5035* Extraction Method . This method is primarily used as a sample collection/preparation method for the performance of SW8260 in soils. In this project, samples will be extracted in the field using surrogate spiked methanol. Immediately after the soil is put in the preweighed jar, surrogate spiked methanol is poured over the soil.
- *Method AK 101*. Method AK 101 for soils is a method in which the sample is extracted with methanol in the field. Immediately after the soil is put in the jar, surrogate spiked methanol is poured over the soil. The soil must be

completely immersed in the methanol. The soil is to stay in contact with the methanol for at least 48 hours.

- *Method SW1311*. Leaching method for waste disposal evaluation.
- *Method SW3051* Microwave/or hot plate assisted acid digestion of soil samples for ICAP analysis.

2.8 Analytical Procedures

The analytical procedures discussed in this section are listed in Table 8. A brief description of each method is included in the following subsections.

Table 8 Analytical Procedures

Analytical Method	Parameter	Preparatory Methods (Water)	Preparatory Methods (Soil)
SW8260B	VOCs	SW5030B	Field extracted with Methanol, then SW5030
PAH-SIM	PAHs	SW3510	SW3550
AK101	GRO	SW5030	Field extracted with Methanol, then SW5030
AK 102	DRO	SW3510	SW3550
AK103	DRO	SW3510	SW3550
SW8082A	PCBs	SW3510	SW3550
SW 6010/7470A/7471A	RCRA Metals by TCLP	SW1311/3510/7470A	SW1311/3510/7470A
SW 6010/7470A/7471A	Total RCRA Metals	SW3015/3010	SW3050

2.8.1 Method SW8260B Volatile Organics

Soils to be tested for volatile organic compounds are preserved with methanol in the field and analyzed using SW8260B. Water samples are prepared using method SW5030 and analyzed using SW8260B. This purge and trap GC/MS method uses an inert gas bubbled through a water matrix to transfer the volatile compounds from the liquid to the vapor phase. The volatiles are removed from the inert gas by passing the gas through a sorbent trap, which is then backflushed into a GC/MS with a capillary column to separate and quantify the compounds of interest. The IS method is used for quantitation of analytes of interest. For quantitation, RFs are calculated from the base ion peak of a specific IS that is added to each calibration standard, blank, QC sample, and sample.

The mass spectrometer is tuned every 12 hours to give an acceptable spectrum for bromofluorobenzene. The tuning acceptance criteria are given in the following list as an ion abundance for each specified mass:

- mass 50 15 to 40 percent of m/z 95
- mass 75 30 to 60 percent of m/z 95
- mass 95 Base peak, 100 percent relative abundance
- mass 96 5 to 9 percent of m/z 95
- mass 173 Less than 2 percent of m/z 174
- mass 174 Greater than 50 percent of m/z 95
- mass 175 5 to 9 percent of m/z 174
- mass 176 Greater than 95 percent, but less than 101 percent of m/z 174
- mass 177 5 to 9 percent of m/z 176

RLs and QC criteria for method SW8260B are presented in Attachment 5. RLs for soils will vary with the amount of soil placed in the jar in the field, the percentage moisture of the sample and the amount of methanol added in the field. The calibration, QC, corrective action, and qualification requirements are given in Table 9.

Table 9 Summary of Calibration and QC Procedures for Method SW8260B

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	%RSD < 15% for RFs	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Second-source calibration verification	Once per five-point initial calibration	All analytes within ±25% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Retention time window calculated for each analyte	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
Calibration verification	Daily, before sample analysis and every 12 hours	SPCCs average RF ≥ 0.05; and CCCs < 20% drift; and all calibration analytes within ±20% of expected value. If samples are ND and CCV has a high bias, no further action will be taken	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description (section 2.7.1)	Retune instrument and verify	Apply R to all results for all samples associated with the tune
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Tables 5 and 6	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
Method blank	One per analytical batch	No analytes detected ≥ 1/2 the RL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
MDL study	Once per 12 month period	Detection limits established shall be 1/3 to 1/2 < the RLs in Tables 5 and 6	None	Apply R to all results for the specific analyte(s) in all samples analyzed
Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Tables 5 and 6	Correct problem then reextract and analyze sample	If %R > UCL for any surrogate, apply J to all positive results If %R < LCL for any surrogate, apply J to all positive results, apply R to all non-detects If any surrogate recovery is < 40%, apply R to all results
LCS/LCSD	Minimum of one per analytical batch	QC acceptance criteria Tables 5 and 61	Correct problem then reextract and reanalyze	If %R>UCL for any analyte, apply J to all positive results If %R,<LCL for any analyte, apply R to all non detects, apply JL to all detects
Results reported between MDL and RL	None	None	None	Apply J to all results between MDL and RL

[1]All corrective actions associated with USACE project work shall be documented in the case narrative and records shall be maintained by the laboratory.
[2]Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.
LCL = lower control limit
LCS/LCSD = laboratory control sample/laboratory control sample duplicate
UCL = upper control limit
BFB = bromofluorobenzene
CCC = check compound
CCV = continuing calibration verification
SPCC = system performance check compound

2.8.2 Modified Method SW8270C PAH SIM

Samples will be analyzed using the modified SW8270C GC/MS-SIM method for PAHs . The SIM mode increases the sensitivity due to the scanning of only three ion peaks instead of the entire ion chromatogram, i.e. all ion peaks per the SW8270C version of the procedure. Water samples are extracted with methylene chloride and are then concentrated through Turbo Vap evaporation. Soils are extracted by sonication using methylene chloride and are then concentrated through Turbo Vap evaporation. Compounds of interest are separated and quantified using a capillary column GC/MS. The RLs are listed in Attachment 5.

One internal standard is used to calculate surrogate recoveries and the surrogates in turn are used as internal standards to calculate target analyte results. For quantitation, RFs are calculated from the base ion peak of a specific IS that is added to each calibration standard, blank, QC sample, and sample. The calibration, QC, corrective action, and data flagging requirements are given in Table 10.

Table 10 Summary of Calibration and QC Procedures for Modified Method SW8270C GC/MS-SIM

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs average RF ≥ 0.05 and %RSD for CCCs < 30%; and %RSD for all other calibration analytes ≤ 15%	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Second-source calibration verification	Once per five-point initial calibration	Analytes within ±40%of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Retention time window calculated for each analyte	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
Calibration verification	Daily, before sample analysis and every 12 hours of analysis time	SPCCs average RF ≥ 0.05; and CCCs < 30% drift; and all calibration analytes within ±30% of expected value. If samples are ND and CCV has a high bias, no further action will be taken	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 8.	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 10 Summary of Calibration and QC Procedures for Modified Method SW8270C GC/MS-SIM (cont.)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
ISs	Immediately after or during data acquisition of calibration check standard	Retention time ±30 seconds: EICP area within -50% to +100% of equivalent initial calibration standard	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning	Apply R to all results for specific analytes for all samples associated with the IS
Method blank	One per analytical batch	No analytes detected ≥ ½ the RL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank except if compound is a suspected lab contaminate, then flag	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 8.	Correct problem, then reextract and reanalyze	If %R > UCL for any surrogate, apply J to all positive results If %R < LCL for any surrogate, apply J to all positive results, apply R to all non-detects If any surrogate recovery is < 20%, apply R to all results
LCS/LCSD	A minimum of one per analytical batch	QC acceptance criteria, Table 8.	Correct problem, then reextract and reanalyze	If %R>UCL for any analyte, apply J to all positive results If %R<LCL for any analyte, apply R to all non detects, apply JL to all positive results
MS/MSD	A minimum of one MS/MSD per every 20 project samples per matrix	QC acceptance criteria, Table 8.	None	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if;(1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCLor (3) MS/MSD RPD > CL
MDL study	Once per 12 month period	Detection limits established shall be 1/3 to 1/2 < the RLs in Table 8.	None	Apply R to all results for the specific analyte(s) in all samples analyzed
Results reported between MDL and RL	None	None	None	Apply J to all results between MDL and RL

[1]All corrective actions associated with USACE project work shall be documented, and all records shall be maintained by the laboratory.
[2]Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

2.8.3 Method AK 101 Gasoline Range Organic Compounds

Gasoline Range Organic compounds in water and soils are analyzed using AK101. Soil samples require field preservation (i.e. extraction). This method includes the volatile hydrocarbons between C6 and C10 and volatile aromatic hydrocarbons, and is a purge and trap GC method. An inert gas is bubbled through a water matrix to transfer the volatile hydrocarbons from the liquid to the vapor phase. The volatiles are removed from the inert gas by passing the gas through a

sorbent trap, which is then backflushed onto a GC column with a flame ionization detector (FID) to separate and quantify the range of compounds of interest. Soil samples are extracted/preserved in the field using laboratory provided surrogate spiked methanol. Reporting Limits for method AK101 are presented in Table 11. Reporting Limits for soils will vary with the amount of soil and methanol added in the field and the moisture content of the sample. The calibration, QC, corrective action, and data flagging requirements are given in Tables 12 and 13.

Table 11 RLs for Method AK 101

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
AK101	GRO	90	µg/L	2.5	mg/kg

Table 12 QC Acceptance Criteria for Method AK 101

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
AK 101	GRO	60-120	≤ 20	60-120	≤ 20
	Surrogates				
	4-BFB(LCS)	60–120		60–120	
	4-BFB(Sample)			50-150	

Table 13 Summary of Calibration and QC Procedures for Method AK 101

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[1]	Flagging Criteria[2]
Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	%RSD < 25% for RFs	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Second-source calibration verification	Once per five-point initial calibration	All analytes within ±25% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Retention time window calculated for each analyte	Each initial calibration and calibration verifications	Per method	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
Initial calibration verification	Daily, before sample analysis	All analytes within ±25% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Continuing calibration verification	After every 20 samples and at the beginning and end of the analysis sequence	All analytes within ±25% of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results for the specific analyte(s) in all samples since the last acceptable calibration verification

Table 13 Summary of Calibration and QC Procedures for Method AK 101 (cont.)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[1]	Flagging Criteria[2]
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 12	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
Method blank	One per analytical batch	No analytes detected ≥ the RL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
MDL study	Once per 12 month period	Detection limits established shall be 1/3 to ½ < the RLs in Table 11	None	Apply R to all results for the specific analyte(s) in all samples analyzed
Surrogate spike	Every sample, spiked sample, standard, and method blank.. Sample shall be spiked with surrogate containing methanol at the time of sample collection. A second surrogate shall be added prior to analysis	QC acceptance criteria, Table 12	Correct problem then reextract and reanalyze sample, for water. In soil, if lab surrogate passes and field surrogate fails, no further action is necessary. If lab surrogate fails, reprepare and reanalyze.	If %R > UCL for any surrogate, apply J to all positive results if the %R < LCL for any surrogate, apply JL to all positive results, apply R to all non-detects
LCS/LCSD	A minimum of one per analytical batch	QC acceptance criteria, Table 12	Correct problem and reprepare and reanalyze samples in the batch	If %R>UCL for any analyte, apply J to all positive results If %R <LCL for any analyte, apply R to all non detects, apply JL to all positive results

[1]All corrective actions associated with USACE project work shall be documented, and all records shall be maintained by the laboratory.
[2]Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

2.8.4 Method AK 102 for Diesel Range Organic Compounds

Diesel Range Organic compounds found in various petroleum products are extracted by the laboratory using method SW3510C (separatory funnel liquid-liquid extraction) for water-based matrices and by method SW3550B (sonication extraction) for solid matrices. The diesel range is defined as any compound eluting that responds to a FID and elutes between C10 and to the beginning of C25 and the residual range elutes between C25 to C36. The sample analysis is accomplished on a GC equipped with a capillary column and a FID. RLs for DRO are shown in Table 14. The calibration, QC, corrective action, and data flagging requirements are given in Tables 15 and 16.

Table 14 RLs for Method AK102

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
AK 102	DRO	0.3	mg/L	20	mg/kg

Table 15 QC Acceptance Criteria for Method AK102

Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
DRO	75-125	≤ 20	75-125	≤ 20
Surrogates:				
5α Androstane LCS	60–120		60–120	
5α Androstane Sample	50-150		50-150	

Table 16 Summary of Calibration and QC Procedures for Method AK 102

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[1]	Flagging Criteria[2]
Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	%RSD < 25% for RFs	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Second-source calibration verification	Once per five-point initial calibration	All analytes within ±25% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Retention time window calculated for each analyte	Each initial calibration and calibration verifications	Per method	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
Initial calibration verification	Daily, before sample analysis	All analytes within ±25% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	All analytes within ±25% of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results for the specific analyte(s) in all samples since the last acceptable calibration verification
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 14	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
Method blank	One per analytical batch	No analytes detected ≥ the RL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch

Table 16 Summary of Calibration and QC Procedures for Method AK 102 (cont.)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[1]	Flagging Criteria[2]
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 14	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
Method blank	One per analytical batch	No analytes detected ≥ the RL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
MDL study	Once per 12 month period	Detection limits established shall be 1/3 to 1/2 < the RLs in Table 14	None	Apply R to all results for the specific analyte(s) in all samples analyzed
Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 15	Correct problem then reextract and reanalyze sample	If %R > UCL for any surrogate, apply J to all positive results If %R < LCL for any surrogate, apply J to all positive results, apply R to all non-detects, if any; provided dilution has not adversely impacted surrogate concentration
LCS/LCSD	A minimum of one per analytical batch	QC acceptance criteria, Table 15	Correct problem and reextract and reanalyze batch	If %R >UCL for any analyte, apply J to all positive results If %R <LCL for any analyte, apply R to all non detects, apply JL to all positive results
MS/MSD	A minimum of one MS/MSD per every 20 project samples per matrix	QC acceptance criteria, Table 15	None	For specific analyte(s) in all samples collected from same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL

[1]All corrective actions associated with USACE project work shall be documented, and all records shall be maintained by the laboratory.

[2]Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

2.8.5 Method SW6010/6020–ICP/MS for Metals

The Inductively-Coupled Plasma/Mass Spectrometry (ICP/MS) is used to measure low concentrations of metals in water and soil samples. The samples are digested using method SW3015A/3010 or leached using SW1311 TCLP. Analyte species originating in a liquid are nebulized and the resulting aerosol transported by argon gas into the plasma torch. The ions produced are entrained in the plasma gas and introduced, by means of an interface into the MS. The ions produced in the plasma are sorted according to their mass to charge rations and quantified with a channel electron multiplier. Interferences must be assessed and valid corrections applied or the data flagged to indicate problems. Control limits and RLs for the

3015/6020 analysis are listed in Table 17. Reporting limits for 1311/6020 analyses are presented along with the calibration, QC, corrective action, and data flagging requirements in Table 18. Summary of the calibration and QC procedures for metals by methods SW6010/6020 are found in Table 19.

Table 17 RLs/QC Acceptance Criteria for Method SW6020B/3015 Digestion

Water Reporting Limits (ug/L)	Soil Reporting Limits (mg/kg)	Accuracy Water (% R)	Precision Water (% R)	Accuracy Soil (% R)	Precision Soil (% RPD)
2.0	0.1	80-120	≤ 15	80-120	≤ 20
10	1.8	80-120	≤ 15	80-120	≤ 20
3.0	0.3	80-120	≤ 15	80-120	≤ 20
2.0	0.2	80-120	≤ 15	80-120	≤ 20
4.0	0.4	80-120	≤ 15	80-120	≤ 20
1.0	0.2	80-120	≤ 15	80-120	≤ 20
10	0.5	80-120	≤ 15	80-120	≤ 20
0.0002	0.04	85-115	≤ 15	83-118	≤ 20

Table 18 RLs/QC Acceptance Criteria for Method SW6010B/1311 Leach

Analyte	Soil Reporting Limits (mg/L)	Accuracy Water (% R)	Precision Soil (% RPD)
Ag	0.2	80-120	≤ 20
As	0.5	80-120	≤ 20
Ba	0.1	80-120	≤ 20
Cd	0.05	80-120	≤ 20
Cr	0.2	80-120	≤ 20
Pb	0.5	80-120	≤ 20
Se	1.0	80-120	≤ 20
Hg	0.0002	85-115	≤ 20

Table 19 Summary of Calibration and QC Procedures for Metals by Methods SW6010/6020

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
Initial multipoint calibration (minimum 3 standards and a blank)	Daily initial calibration prior to sample analysis	Correlation coefficient ≥0.995 for linear regression	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
Second-source calibration check standard	Once per initial daily multipoint calibration	Analyte within ±10% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
Calibration blank	Once per initial daily multipoint calibration	No analyte detected ≥ RL	Correct problem then reanalyze calibration blank and all samples associated with blank	Apply B to all results for the specific analyte in all samples associated with the blank
Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	The analyte within ±10% of expected value	Correct problem then repeat calibration and reanalyze all samples since last successful calibration	Apply R to all results for the specific analyte in all samples since the last acceptable calibration
Interference check solution	Beginning of analytical sequence and at the end	Result within ±\20% of expected value	Correct problem then repeat calibration and reanalyze all samples since last successful calibration	Apply R to all results for the specific analyte in all samples since the last acceptable ICS
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 17	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
Method blank	One per analytical batch	No analytes detected ≥ RL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank. If contamination levels found in sample is ND or >10 X amount in blank – sample will not be reprepared.	Apply B to all results for the specific analyte in all samples in the associated analytical batch
TNew matrix check; five-fold dilution test	Each new sample matrix	Five times dilution sample result must be ±10% of the undiluted sample result	Perform recovery test	Apply J to all sample results if either of following exist: (1) new matrix check not run (2) RPD ≥10%
Recovery test	When new matrix check fails	Recovery within 85-115% of expected results	Run all samples by the method of standard addition	Apply J to all sample results (for same matrix) in which method of standard addition was not run when recovery outside of 85-115% range
MS/MSD	One MS/MSD per every 20 project samples per matrix as a minimum	QC acceptance criteria, Table 17	none	For the specific analyte in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
MDL study	Once per 12 month period	Detection limits established shall be < the RLs in Table 5-12	none	Apply R to all results for the specific analyte in all samples analyzed
Results reported between MDL and RL	none	none	none	Apply F to all results between MDL and RL

[1]All corrective actions associated with USACE project work shall be documented, and all records shall be maintained by the laboratory.
[2]Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

2.8.6 SW8082A Polychlorinated Biphenyls

Polychlorinated biphenyls are extracted by method SW3510C (separatory funnel liquid-liquid extraction) for water-based matrices or by method SW3550B (sonication extraction) for soil/sludge matrices. The sample analysis is accomplished on a GC equipped with a capillary column and an ECD (electron capture detector). Seven aroclors are included in the identification process; although, the initial calibration only contains Aroclors 1260 and 1016. The RLs for PCBs are shown in Table 20. The calibration, QC, corrective action, and data flagging requirements are given in Tables 21 and 22.

Table 20 Reporting Limits for Polychlorinated Biphenyls by Method SW8082A

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
SW8082A	Aroclor 1016	0.1	µg/L	0.05	mg/kg
	Aroclor 1221	0.1		0.05	
	Aroclor 1232	0.1		0.05	
	Aroclor 1242	0.1		0.05	
	Aroclor 1248	0.1		0.05	
	Aroclor 1254	0.1		0.05	
	Aroclor 1260	0.1		0.05	

Table 21 QC Acceptance Criteria for SW8082A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8082A	Aroclor 1016	53-107	≤ 25	54-112	≤ 30
	Aroclor 1260	56-116	≤ 25	61-131	≤ 30
	Surrogate:				
	decachlorobiphenyl	42-133		60-125	

Table 22 Summary of Calibration and QC Procedures for Method SW8082A

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
Initial five-point initial calibration for two aroclors, 1260 and 1016. If other aroclors are found, calibrate with appropriate arolcor and reananlyze	Initial calibration prior to sample analysis	%RSD < 20% for RFs	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Second-source calibration verification	Once per five-point initial calibration	All analytes within ±25% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Retention time window calculated for each analyte	Each initial calibration and calibration verifications	Per method	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
Initial calibration verification	Daily, before sample analysis	All analytes within ±20 of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	All analytes within ±20 of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results for the specific analyte(s) in all samples since the last acceptable calibration verification
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 20	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
Method blank	One per analytical batch	No analytes detected ≥ the RL	Correct problem then reprepare and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
MDL study	Once per 12 month period	Detection limits established shall be 1/3 to 1/2 < the RLs in Table 20	None	Apply R to all results for the specific analyte(s) in all samples analyzed
Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 21	Correct problem then reextract and reanalyze sample	If %R > UCL for any surrogate, apply J to all positive results If %R < LCL for any surrogate, apply J to all positive results, apply R to all non-detects, if any. provided that dilution has not adversely impacted surrogate concentration
LCS/LCSD	A minimum of one per analytical batch	QC acceptance criteria, Table 21	Correct problem and reextract and reanalyze batch	If %R>UCL for any analyte, apply J to all positive results If the %R<LCL for any analyte, apply R to all non detects, apply JL to all positive results
MS/MSD	A minimum of one MS/MSD per every 20 project samples per matrix	QC acceptance criteria, Table 21	None	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL

[1]All corrective actions associated with USACE project work shall be documented, and all records shall be maintained by the laboratory.

[2]Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

2.9 Screening Analytical Methods

Soils are screened using a portable PID. The purpose of this screening measurement is to determine which samples to send to the fixed lab. The PID response is a measure of the volatile saturated hydrocarbons present. The instrument is calibrated using an isobutylene standard each morning prior to use.

2.10 Data Reduction, Review, Verification, Reporting, and Record Keeping

The data reduction, review, reporting, and validation procedures described in this section will ensure complete documentation is maintained, transcription and data reduction errors are minimized, the data are reviewed and documented, and the reported results are qualified if necessary. Laboratory data reduction and verification procedures are required to ensure the overall objectives of analysis and reporting meet method and project specifications.

2.10.1 Data Review and Reporting Requirements for Definitive Data

In each laboratory analytical section, the analyst performing the tests shall review 100 percent of the definitive data. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently by a senior analyst or by the supervisor of the respective analytical section using the same criteria.

The definitive data methods are identified in Section 2.7. The calibration, QC requirements, corrective action requirements, and flagging criteria required for definitive data are shown in the tables in Section 2.7. The flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

Laboratory data qualifiers shall be added by the analyst and reviewed for accuracy by the laboratory project manager. The nonconformances identified during the data quality review process shall be documented in the case narrative. The contractors project chemist will perform an additional review of the data and apply data validation qualifiers to the final data set and determine usability. The data qualifiers are defined in Table 23.

Table 23 Data Qualifiers

Qualifier	Description
J	The analyte was positively identified, result below RL but greater than MDL or acceptance criteria were not met. Result is considered estimated.
U	The target analyte was not detected at a concentration greater than the MDL.
R	The data are only usable for screening purposes because quality control standards were not met to the degree necessary to meet data quality objectives.
B	The analyte detected in the sample was also detected in the associated method blank.
M	A matrix effect was identified.

2.10.2 Quality Assurance Reports

The laboratory QA staff shall issue QA reports to the laboratory management, laboratory supervisors and task leaders. These reports shall describe the results of QC measurements, performance audits, and systems audits, and confirmation sample comparisons performed for each sampling and analysis task. Quality problems associated with performance of methods, completeness of data, comparability of data including field and confirmatory data, and data storage shall be documented with the corrective actions that have been taken to correct the deficiencies identified.

2.10.3 Record keeping

The laboratory shall maintain electronic and hardcopy records sufficient to recreate each analytical event conducted pursuant to the Statement of Work for a minimum of ten years. The minimum records the laboratory shall keep contain the following elements:

- Chain of custody forms;
- Initial and continuing calibration records including standards preparation traceable to the original material and lot number;
- Instrument tuning records (as applicable);
- Method blank results;
- Internal standard results;
- Surrogate spiking records and results (as applicable);
- Spike and spike duplicate records and results;
- Laboratory records (bench sheets, preparation logs, etc.);
- Raw data, including instrument printouts, chromatograms with compound identification and quantitation reports;

- Corrective action reports;
- Other method and project required QC samples and results; and
- Laboratory-specific written standard operating procedures for each analytical method and QA/QC function in place at the time of analysis of project samples.

2.10.4 Definitive Data Package

The lab will generate a comprehensive data package that will include the following items and adhere to the requirements of the QSM (DoD 2002):

- original chain-of-custody
- cooler receipt form
- case narrative explaining all deficiencies or variances to the laboratory SOP or analytical method that occurred during sample processing and analysis including all control limit exceedances
- surrogate recoveries summarized in table format
- LCS/LCSD recoveries summarized in table format
- MS/MSD recoveries summarized in table format
- blank data to include method blanks and any instrument blanks with positive results
- chromatograms for fuel methods (AK101, and AK102), and Total Ion Chromatograms (TICs) for GC/MS methods (SW8260B)
- summary forms and raw data for ICAL standards, second source verification standards, and internal standard recoveries to include retention times and quantitation ions
- summary forms and raw data for CCV standards
- summary reports shall include RLs and control limits for all analytes
- report shall be paginated
- Electronic data deliverable (EDD) in COELT1.2a format
- EDD in Access format
- Two copies of all deliverables

2.11 Corrective Action

Corrective action will be initiated when potential or existing field or laboratory conditions are identified that may adversely affect data quantity or quality as defined in previous tables for each method. Events that may lead to corrective action include the following:

- Violation of established analytical controls
- Performance, system, or QA audits
- Laboratory/field comparison studies
- Violation of shipping requirements
- Violation of holding times

Corrective action may take several forms, but the following steps generally are included:

- Check the calculations
- Check the instrument for proper setup
- Reextract and/or reanalyze the control item, as appropriate
- Resample

The project manager, project chemist, sampling personnel, and contract laboratory project manager may be involved in the corrective action. The corrective action may be immediate or long term. An immediate corrective action may be recalculating, reanalyzing, or repeating sample collection. Long-term corrective action may be identified through performance evaluation samples, standards, control charts, or other devices

Corrective actions, if necessary, are to be completed once. If acceptance criteria were not met and a corrective action was not successful or corrective action was not performed, the appropriate flagging criteria will be applied. Requirements and procedures for documenting the need for corrective actions are described in the following sections. Any significant corrective action shall be reported ASAP to the senior chemist at North Wind.

2.11.1 Corrective Action Report

Problems requiring corrective action in the laboratory are documented by the use of a corrective action report. Corrective actions that warrant data as unusable shall be provided to the North Wind project chemist within 24 hours so recollection can be evaluated immediately. The QA coordinator or any other laboratory member can initiate the corrective action request in the event QC results exceed acceptability limits, or upon identification of some other laboratory problem. Corrective actions can include reanalysis of the sample or samples affected, resampling and analysis, or a change in procedures, depending upon the severity of the problem.

2.11.2 Corrective Action System

A system for issuing, tracking, and documenting completion of formal Recommendations for Corrective Action (RCA) exists for addressing significant and systematic problems. Each RCA addresses a specific problem or deficiency, usually identified during QA audits of laboratory or project operations. An RCA requires a written response from the party to whom the RCA was issued. An RCA requires verification by the QA group that the corrective action has been implemented before the RCA is considered to be resolved. In the event there is no response to an RCA within 30 days, or if the proposed corrective action is disputed, the recommendation and/or conflict is pursued to successively higher management levels until the issue is resolved.

2.12 Chemical Data Quality Review

The North Wind senior chemist or designee will conduct a comprehensive data review and generate a Chemical Data Quality Report. Included will be a review of the holding time criteria, cooler and sample receipt condition, and evaluation of the data based on the acceptance criteria defined this QAPjP. The senior chemist will assign flagging based on the criteria of the QAPjP. Qualification criteria are discussed in section 2.9.1. Tables of all flagged data will be generated. Tables of the comparison between QC samples will be generated. Preceding the tables will be a cover page, report contents, pertinent project information, and an executive summary.

The data quality assessment will include the following tabulated information:

- List of all samples, organized by analytical method, indicating which samples were qualified, and directing the reader to subsequent tables of specific qualifications
- All known field/lab general sampling, documentation, and/or reporting discrepancies
- Sample shipping/receipt condition qualifications (if necessary)
- Analytical hold time qualifications (if necessary)
- Surrogate qualifications (if necessary)
- Lab blank qualifications (if necessary)
- MS/MSD qualifications (if necessary)
- Serial dilution qualifications (if necessary)
- LCS/LCSD qualifications (if necessary)

- CCV qualifications (if necessary)
- Precision qualifications (if necessary)
- Rejected data (if necessary)
- PQL qualifications (if necessary)
- Comparison of primary/QC samples with USACE comparability criteria
- Comparison of results with project-specific sensitivity requirements.

2.13 Sample and Extract Preservation

Samples and extracts shall be retained 45 days after the definitive data package is delivered.

3.0 REFERENCES

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U.S. Army, 1999, *Record of Decision for Operable Unit 5,* Fort Wainwright, Alaska. May.

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ATTACHMENT 1

SGS ENVIRONMENTAL SERVICES, INC.

Example Chain-of-Custody
Statement of Qualifications
Certifications

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Statement of Qualifications

CT&E Environmental Services Inc.
Alaska/Hawaii Division

Laboratory: 200 W. Potter Road, Anchorage, AK 99518
ph (907) 562-2343, fax (907) 561-5301

Fairbanks Office: 3180 Peger Road, Fairbanks, AK 99701
ph (907) 474-8656, fax (907) 474-9685

Hawaii Office: 255 Sand Island Access Red., Unit 1B
ph (808) 224-6217, fax (808)845-2287

Website: www.sgsenvironmental.com

General Manager

Charles G. Homestead – charles_homestead@sgs.com

Business Development

George Wolters – george_wolters@sgs.com
Joyce L. Doughty – joyce_doughty@sgs.com

Revised: 15 March 2004

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I. Introduction to CT&E Environmental Services Inc.

A. History

CT&E Environmental Services Inc. (CT&E ESI) began business more than *35 years ago* as **Chemical & Geological Laboratories of Alaska, Inc. (known as Chem Lab).** Initially, our primary emphasis was servicing the needs of the Cook Inlet oil fields.

In 1974, the vision of Chem Lab began to expand. Diversified analytical tests and scientific personnel were added, forming the core of professionalism, which led to CT&E ESI's later success.

Over the years, the demand for environmental testing grew. Chem Lab met this challenge head-on by becoming **the first laboratory to be certified by the Alaska Department of Environmental Conservation (ADEC)**. We worked with ADEC, developing analytical techniques, regulations and training in all facets of the environmental arena. We soon became a formidable leader in the environmental industry, providing superior analytical and consulting services for a host of engineering firms, oil companies and governmental agencies.

The continued growth of Chem Lab was exemplarized in 1990 through its acquisition by **Commercial Testing & Engineering Co.**. This fortifying transition initiated a new design for technical excellence. Commercial Testing & Engineering Co., a member of the **Societe Generale de Surveillance Group (SGS)**, brought with them the necessary resources that enabled Chem Lab to grow professionally and competitively on a national level. Now, as CT&E ESI we were prepared to meet the increasingly sophisticated analytical and regulatory requirements of the environmental industry.

Throughout this decade, CT&E ESI facilities and resources have expanded, including the creation of sample receiving and laboratory facilities in Fairbanks, AK and Honolulu, HI, as well as the implementation and development of a state-of-the-art laboratory information management system (LIMS). Obtaining SGS's resources has enabled us to effectively grow and expand globally, leading the environmental industry in the new millennium.

B. Expertise

CT&E ESI is a member of SGS, the world's largest control and inspection company. Represented in more than 140 countries by 210 affiliated companies, this vast network of companies yields more than 1,000 offices that maintain over 230 laboratories.

It is no surprise then that SGS is recognized globally for analytical and technical excellence in environmental assessment. This undisputed reputation is based upon an exceptional record of progressive growth and development by continuing to exceed the standards of most full-service environmental laboratories.

As such, the growth of CT&E ESI is a prodigy of SGS's strength and experience, designed to fulfill the necessary demands of our clientele by keeping abreast of ever-changing environmental standards.

Parent Company:

SGS North America Inc.
42 Broadway, New York, NY 10004

Incorporated in the State of Delaware in 1994
Richard Tobin, President

C. Mission & Quality Statement

CT&E ESI pledges to provide *quality analytical services* that conform to every client and regulatory requirement. We will achieve this performance level by *thoroughly understanding our clients' needs*, anticipating and responding to changes in regulatory requirements, and examining ways to continually improve our services.

We are committed to leading the industry globally through electronic management of operations and instrument automation. We will continue to provide a *full-service laboratory*, keeping *client service* a top priority. The standard by which we measure the quality of our service is *100% client satisfaction and regulatory compliance.*

D. Statement of Integrity

"For over a hundred years, SGS people have been building our reputation as the world leader in independent, reliable and high verification, testing and certification services. The rock upon which this reputation is built is integrity. Our integrity is our asset. It is our balance sheet, it defines us to our shareholders, our customers, ourselves and to the public. Whatever current or future strategies we pursue and whatever future businesses we develop, they will all depend on the universal acknowledgment of SGS as an honest and trustworthy partner.

"Our codes of ethics and of conduct outline in detail the foundations upon which this integrity is based:

* Obey the applicable laws governing our business conduct worldwide
* Be honest, fair and transparent in all SGS activities and relationships
* Avoid all conflicts of interest
* Through leadership at all levels, sustain a culture where ethical conduct is recognized and valued

"Follow these principles strictly, not only their rules, but their spirit. If you are concerned about what is proper conduct, raise this with your manager. Nothing, not customer service, nor revenue growth, nor profitability, nor order from a superior, is more important than integrity and all employees, managers and executives are responsible for making compliance a vital part of our business process.

"Our Chairman and our Board, our Senior Management and I are totally committed to unyielding integrity as the central feature of our current activities and future success."

Anthony M. Czuru
Chief Executive Officer
January 1999

E. Company Organization

The organization chart, noting personnel for each section, appears in the attachments to this document.

II. Credentials

A. Business License & Federal Tax ID

CT&E ESI holds an Alaskan business license (BL 202039) under the Standard Industry Code 8700 and 8730. Our Federal Tax ID number is 22-3334380.

B. Accreditations & Certifications

CT&E ESI maintains accreditation through the Alaska Department of Environmental Conservation (ADEC), Environmental Protection Agency (EPA), United States Army Corps of Engineers (USACE), United States Air Force Center for Environmental Excellence (AFCEE), Brooks AFIERA/SDC (Brooks), and United States Navy (USN).

ADEC certifications held include the Underground Storage Tank (UST) Program (since 1995), Microbiology and Drinking Water (DW) Programs (since 1976). Analyses include: GRO, DRO, RRO, UST Metals and PCB analyse of soil & water; Primary & Secondary Inorganic Contaminants, VOC & TTHMs, Total Coliform & Heterotrophic Plate Count analyses of drinking waters.

USACE (since 1990), AFCEE and Brooks' (since 1994), and USN (since 2001) accreditations certify CT&E ESI to perform analyses under the Hazardous, Toxic, and Radioactive Waste (HTRW) Program and the Resource Conservation and Recovery Act (RCRA). USACE and USN validated analyses currently include: VOC, AVO, HVO, SVOC, PAH SIM, PCB, Organo-Pesticides, TOC, TAL Metals and Anions.

Each accreditation requires successful performance of check samples, audit of QA/QC procedures and analytical SOPs, and comprehensive site evaluations. CT&E ESI participates in national and regional "round robin" studies; including the Water Supply Study (for DW) and the Water Pollutant Study (for NPDES/DRM). CT&E ESI is also a voting member of the American Society for Testing and Materials (ASTM).

C Project Experience

CT&E ESI has been involved in a wide variety of analytical projects, ranging from small remediation jobs to large site assessments. These projects have helped develop the core of CT&E ESI's extensive experience.

Private Industry Projects

* USS Missouri PCB Survey in Hawaii
* Seafood Industry Effluent Studies of the Bering Sea
* Six-Mile Site Assessment & Monitoring for Shannon & Wilson
* Sagwon Site Assessment & Remediation for Arctic Slope Regional Corporation and BP Exploration
* MAPCO and Tesoro Monitoring
* TECK COMINCO Red Dog Mine Monitoring
* TAPS Project for Alyeska Pipeline Service Company
* Exxon Valdez Oil Spill for America North and VECO Environmental

Government Projects

* Hazardous Waste Analysis for US Air Force, Army, Coast Guard and Navy in locations throughout Alaska, Hawaii, Guam, Korea and Japan
* Alaska Total Environmental Restoration Contract (TERC)
* Nikolski Site Assessment for AFCEE
* Adak Monitoring for USN
* Galena Landfill Closure for USACE
* HTRW Contracts for USACE; including SERA VII and Moses Point
* Transformer PCB Testing for Municipality of Anchorage - ML&P
* Solid Waste Site Monitoring for Kenai Peninsula Borough
* Site Assessments for US Bureau of Land Management
* Stream Evaluation for US Park Service and US Fish & Wildlife
* Peters Creek Mobile Laboratory for ADEC
* Haines Mobile Laboratory for USACE

CT&E ESI also performs analytical testing for smaller jobs, including small businesses and private individuals. We understand that their needs are no less important than the commercial needs of larger firms. Our client services and technical support teams are here to support the analytical requirements of all clients.

SGS

III. Capabilities

A. Analytical Capabilities

CT&E ESI is a full-service, environmental laboratory. Analyses are performed locally on a variety of matrices, including: soil, sludge and other solids, air, industrial and municipal effluents and wastes, groundwater and surface water, drinking water, petroleum products, capacitor and transformer oils.

CT&E ESI personnel are proficient in diverse methodologies, including:

* ADEC AK Series for GRO, DRO and RRO
* Solid Waste (SW 846) Procedures for Metals, TOC, AVO, HVO, VOC, SVOC, Pesticide and PCBs, EP Toxicity & TCLP
* EPA and Standard Methods for the Examination of Water and Wastewater
* ASTM Methods for Petroleum Testing
* NIOSH Methods for Air Testing

The following analytical tests are routinely performed at CT&E ESI's Anchorage Laboratory. Additional parameters are available upon request. Please contact us for additional information.

Organic Analyses (also see programs listed below)

Gasoline Range Organics	AK101
Diesel Range Organics	AK102
Residual Range Organics	AK103
BTEX	EPA602/SW8021/8260
EDB/DBCP	SW504/8011
Aromatic Volatile Organics	EPA624/SW8260
Halogenated Volatile Organics	EPA624/SW8260
Volatile Organic Compounds	EPA524.2/624/SW8260
PAHs <Ref Lab: CT&E Michigan>	EPA610/SW8310
Semivolatile Organic Compounds	EPA625/SW8270
PAH SIM (8310 analyte list)	PAH SIM
PCBs	SW8082
Pesticides	SW8081
Light Gases	ASTMD1945M
VPH/BTEX (SS Cylinder)	SW8015M/8021

Glycols &/or Alcohols	SW8015M
<Ref Lab: CT&E West Virginia>	
Explossives	SW8330
<Ref Lab: CT&E Michigan>	
Herbicides	SW8151
<Ref Lab: CT&E West Virginia>	

Inorganic Analyses (also see programs listed below)

Metals:

Aluminum	EPA200.7/200.8/SW6010/6020
Antimony	EPA200.7/200.8/200.9/SW6010/6020/7041
Arsenic	EPA200.7/200.8/200.9/SW6010/6020/7060
Barium	EPA200.7/200.8/SW6010/6020
Beryllium	EPA200.7/200.8/200.9/SW6010/6020/7091
Boron	EPA200.7/200.8/SW6010/6020
Cadmium	EPA200.7/200.8/200.9/SW6010/6020/7131
Calcium	EPA200.7/200.8/SW6010/6020
Chromium	EPA200.7/200.8/200.9/SW6010/6020/7191
Chromium, Hexavalent	SM3500CR/SW7196
Cobalt	EPA200.7/200.8/SW6010/6020
Copper	EPA200.7/200.8/SW6010/6020
Iron	EPA200.7/200.8/SW6010/6020
Lead	EPA200.7/200.8/200.9/SW6010/6020/7421
Magnesium	EPA200.7/200.8/SW6010/6020
Manganese	EPA200.7/200.8/SW6010/6020
Molybdenum	EPA200.7/200.8/SW6010/6020
Nickel	EPA200.7/200.8/SW6010/6020
Potassium	EPA200.8/SW6020
Selenium	EPA200.7/200.8/200.9/SW6010/6020/7740
Silicon	EPA200.7/200.8/SW6010/6020
Silver	EPA200.7/200.8/200.9/SW6010/6020/7761
Sodium	EPA200.7/200.8/SW6010/6020
Thallium	EPA200.8/SW6020
Strontium	EPA200.7/SW6010
Vanadium	EPA200.7/200.8/SW6010/6020
Zinc	EPA200.7/200.8/SW6010/6020
Mercury	EPA245.1/SW7470/7471

Waters:

Nitrate	EPA300.0
Nitrite	EPA300.0
Bromide	EPA300.0
Chloride	EPA300.0/SM4500
Sulfate	EPA300.0/375.4
Fluoride	EPA300.0
Ortho-Phosphate	EPA365.2
Salinity by Chloride	EPA300.0
PH	EPA150.1
Acidity	EPA305.1/305.2
Alkalinity	SM2320B
Conductivity	SM2510B
Turbidity	EPA180.1
Hardness	SM2340C
Color, True or Apparent	SM2120
Odor	EPA140.1
Cyanide, Total	SM4500CN-C,E
Cyanide, Weak Acid Dissociable	SM4500CN-C,E
Chemical Oxygen Demand	EPA410.1
Total Organic Carbon	EPA415.1
Dissolved Organic Carbon	EPA415.1
Total Phosphorus	EPA365.2
Total Kjeldahl Nitrogen	EPA351.3
Ammonia	EPA350.2
Total Phenols	EPA420.1/SW9065
Sulfide	EPA376.2
Total Dissolved Solids	SM2540C
Langlier/Corrosivity	SM203

Hazardous Waste Profiling (also see organic & inorganic methods)

TCLP Metals	SW1311/6010/7000
TCLP Volatiles	SW1311/8260
TCLP Semivolatiles	SW1311/8270
TCLP Pesticides	SW1311/8081
TCLP Herbicides <Ref Lab>	SW1311/8151
Corrosivity	SW9040/9045
Reactivity	SW846 Ch7
Ignitability	SW1010/1020

Underground Storage Tank Program

Gasoline Range Organics	AK101
Diesel Range Organics	AK102
Residual Range Organics	AK103
BTEX	SW8021/8260
Volatile Organic Compounds	SW8021/8260
PCBs	SW8082
PAHs	SW8310/8270
UST Metals:	
Arsenic	SW6020/7060
Cadmium	SW6010/6020/7131
Chromium	SW6010/6020/7191
Lead	SW6010/6020/7421
Barium	SW6010/6020
Nickel	SW6010/6020
Vanadium	SW6010/6020

Drinking Water Program

Total Coliforms	SM9222B
Nitrate	EPA300.0
Volatile Organic Compounds	EPA524.2
Total Trihalomethanes	EPA524.2
EDB/DBCP	EPA504.1
Lead & Copper Rule	EPA200.7/200.8/200.9
Primary Inorganic Contaminants:	
Arsenic	EPA200.8/200.9
Barium	EPA200.7/200.8
Cadmium	EPA200.8/200.9
Chromium	EPA200.8/200.9
Fluoride	EPA300.0
Mercury	EPA245.1
Nitrate & Nitrite	EPA300.0
Selenium	EPA200.8/200.9
& Phase V:	
Antimony	EPA200.8/200.9
Beryllium	EPA200.8/200.9
Cyanide	SM4500CN
Nickel	EPA200.7/200.8
Thallium	EPA200.8/200.9

Secondary Inorganic Contaminants:	
Aluminum	EPA200.7/200.8
Chloride	EPA300.0
Color	SM2120B
Copper	EPA200.7/200.8
Corrosivity/Langlier	SM203
Fluoride	EPA300.0
Iron	EPA200.7/200.8
Manganese	EPA200.7/200.8
Odor	SM2150B
PH	EPA150.1
Silver	EPA200.8/200.9
Sodium	EPA200.7/200.8
Sulfate	EPA300.0
Total Dissolved Solids	SM2540C
Zinc	EPA200.7/200.8
Gross Alpha/Beta <Ref Lab>	EPA900

Microbiology (additional methods available upon request)

Biochemical Oxygen Demand	EPA405.1
Residual Chlorine	SM4500CL
Total Suspended Solids	EPA160.2
Total Solids	EPA160.3
Volatile Solids	EPA160.4
Settleable Mater	EPA160.5
Microscopic Examination	CTESOP
Total Coliforms (MF, P/A)	SM9222B/9223
Fecal Coliforms (MF)	SM9222D
Heterotrophic Plate Count	SM9215
Sheen Screen/Oil Degrading Bacteria	CTESOP

Petroleum Testing (additional methods available upon request)

Diesel Fuel Specifications	ASTMD975
Fuel Stability Test	UPO413
API Gravity	ASTMD287
Cetane Index	ASTMD976
Boiling Point	ASMT
Cloud Point	ASTMD2500
Freeze Point	ASTMD2386
Pour Point	ASTMD97
Flash Point	ASTMD3828
Engler Distillation	ASTMD86
Heating Value	ASTMD240
Total Halogens	ASTMD808
Millipore Filter Solids	ASTMD2276
Reid Vapor Pressure	ASTMD323
Specific Gravity	ASTMD287
Sulfur Content	ASTMD129
Viscosity	ASTMD445/2270/88
Viscosity Temperature Curve	ASTMD341
Water Content	ASTMD95
Karl Fisher	ASTMD1744
Water & Sediment	ASTMD1796
Ash Content	ASTMD482
Oil Burn Specifications:	
PCBs	SW8082
Arsenic	SW7060
Cadmium	SW6010
Chromium	SW6010
Lead	SW6010
Ignitability	SW1020
Total Halogens	ASTMD808

Clean Water Act/NPDES (also see Organic, Inorg. & Micro. Methods)

Aromatic Volatile Organics	EPA602 by 624
Halogenated Volatile Organics	EPA601 by 624
Volatile Organic Compounds	EPA624
PAHs <Ref Lab: CT&E Michigan>	EPA610
Semivolatile Organic Compounds	EPA625
Oil & Grease	EPA1664O&G
Total Petroleum Hydrocarbons	EPA1664TPH
Acute Whole Effluent Toxicity <Ref Lab>	40CFR136

Miscellaneous

Cation-Anion Balance	SM1030F
End of Well Analysis	(various)
Routine Oil Field Water Analysis	(various)
Routine Glycol w/o Scale	(various)
Routine Scale Analysis	(various)
Hatchery Specifications	(various)
Waste Management Profile	(various)

B. Facilities & Equipment

CT&E ESI operations utilize two buildings with a combined size of approximately 22,000 square feet. Building One houses most of the administrative offices (including project management, sample receiving, data management, information systems management, quality control, accounting and purchasing) and all of the analytical facilities except volatile and semi-volatile gas chromatography. Building Two houses the gas chromatography departments, sample control (with over 900 cubic feet of refrigerated storage), and the warehouse.

Major equipment includes: Gas Chromatograms and Mass Spectrophotometers for volatile and semivolatiles; GC/ECD for PCB and Pesticide analyses; HPLC Ion Chromatograph; Mercury Cold Vapor Analyzer, Inductively Coupled Plasma Analyzer, Inductively Coupled Plasma/Mass Spectrophotometer, Graphite Furnaces, and Atomic Absorption Spectrophotometers for metals; Shimadzu TOC Analyzer; and Baker Solid Phase Extractor for HEM 1664.

C. Personnel & Experience

CT&E ESI maintains a professional staff of over 50 scientists, technicians and support personnel, *fully committed to providing quality data and 100% client satisfaction.* Our high ratio of degreed professionals in chemistry, biochemistry, biology, microbiology, metallurgy, computer science, environmental science, and business management allow for a diverse mixture of experience that exceeds the high standards established by the environmental industry. Senior staff includes:

Charles G. Homestead, General Manager, has over 24 years experience in environmental assessment. His background as an analyst, supervisor, and assistant technical director has prepared him for his responsibilities as the manager of Alaska's largest laboratory.

David A. Meyer, Jr., US Business Director, has over 15 years experience in management. Before moving to Anchorage to develop our project management team, he opened our sample receiving station in Fairbanks and brought on-line their analytical capabilities for the UST program.

Stephen C. Ede, Technical Director, has over 30 years experience in environmental assessment. His in-depth knowledge of analytical procedures and regulations makes him uniquely qualified for his responsibilities, which include overseeing the accuracy of all data.

Marina I Mitchell, Quality Assurance Manager, has over 5 years experience relating to environmental analytical chemistry. She has vast experience in data review and data quality control assessment pertaining to inorganic, organic, and microbiological parameters. She is well versed with program and project specific QA requirements, and oversees the quality system of the laboratory.

Kevin W. Maher, Organic Department Supervisor, has over 13 years experience as an analytical chemist, including all GC and GC/MS instruments in this department. His responsibilities include overseeing production, operations and budgeting for the organic department.

Karen A. Waak, Inorganic Department Supervisor, has over 13 years experience as an analytical chemist, including wet chemistry and metals analyses. Her responsibilities include overseeing production, operations and budgeting for the inorganic department.

IV. Client Services

A. A Better Way to Serve You

At CT&E ESI, we understand that time is your most valuable resource. To facilitate more effective communication between the client and the laboratory, each client will be assigned a project manager.

The project manager is the point of contact for all inquiries; including: requests for quotes and sample kits, tracking of incoming samples, status of samples/analyses in the laboratory, change orders, clerical and technical accuracy of reports and invoice.

The project manager may seek assistance from, or refer specific inquiries to, the following personnel as needed:

*	Accounting/Quotes/Contracts:	Joyce Doughty
*	Quotes/Contracts:	George Wolters
*	QA/QC Information:	Steve R. Crupi
*	Technical Information:	Stephen C. Ede and Shane J. Poston

B. Project Management

In addition to facilitating communication between the client and the laboratory, the project manager serves as an invaluable resource and advocate for the client, assisting with all aspects of the project:

* Pre-Project Planning
* Evaluating and Implementing Data Quality Objectives
* Tracking Status of Analyses and Work Orders
* Preparation of Final Reports and Electronic Data
* Interpretation of Analytical Results
* General Inquiries

The Project Manager Coordinator oversees and monitors the progress of all project managers to facilitate laboratory operations.

C. Your Project Manager

Your assigned project manager has been selected based on his/her specific areas of expertise. The project management team includes:

Mark Abe, Hawaii Manager, has 17 years environmental assessment experience. Most recently, he owned and operated a shipping/receiving company, expediting samples for environmental engineering firms. Mark also has analytical experience as a laboratory analyst, section supervisor, and project manager.

Steve R. Crupi, Project Manager, has over 18 years experience in environmental assessment. His experience at the bench, performing organic extractions and analyses, and in project management helped prepare him for his role overseeing data quality for 2 years. Steve is now back serving the clients directly as a project manager.

Melody Debenham, Fairbanks Manager, has 7 years environmental assessment experience, primarily with sample collection protocols and data management. Her field work includes projects for ADEC UST and USACE. As our Fairbanks facility manager, Melody is experienced with sample receiving and control, as well as client services.

Heather L. Hall, Project Manager, has over 17 years environmental assessment experience. She has extensive experience with the microbiological examination of water and wastewater, as well as immunoassay field test kits. Heather is well versed in federal and state drinking water and wastewater discharges regulations, USACE, AFCEE and Brooks programs. She is also familiar with the DOD Korean and Japan Environmental Governing Standards and international shipping.

Shane J. Poston, Assistant Technical Director/Project Manager, has over 13 years environmental assessment experience. As an analyst, he has experience with a variety of volatile and semivolatile analyses (including GRO, DRO, RRO, RGA, and VOCs by 524, 8021 and 8260), as well as various analyses characterizing petroleum products. Shane has been instrumental in the development of our peer review program and training analysts throughout the laboratory.

Rhonda L. Strucher, Project Manager, Reference Laboratory and Drinking Water Program Coordinator, has over 14 years environmental assessment experience. She is very knowledgeable in assessing clients' needs for their sampling events and has experience in all areas of sample receiving and control. Rhonda's project management experience includes a variety of USACE and AFCEE projects. Her experience in business development includes successfully bidding on large projects throughout the nation for the CT&E ESI network.

Forest Taylor, Project Manager, has over 2 years environmental experience. He works with our water quality clients and the consumer product testing clients. He has experience in our sample receiving area and is able to assist clients with their sampling questions.

V. Attachments

A. Organization Chart

B. Federal Standard Form 254

C. Federal Standard Form 255

D. US Army Corps of Engineers Letter

E. Brooks AFIERA/SDC Letter

F. US Navy Letter

G. NELAP Accreditation

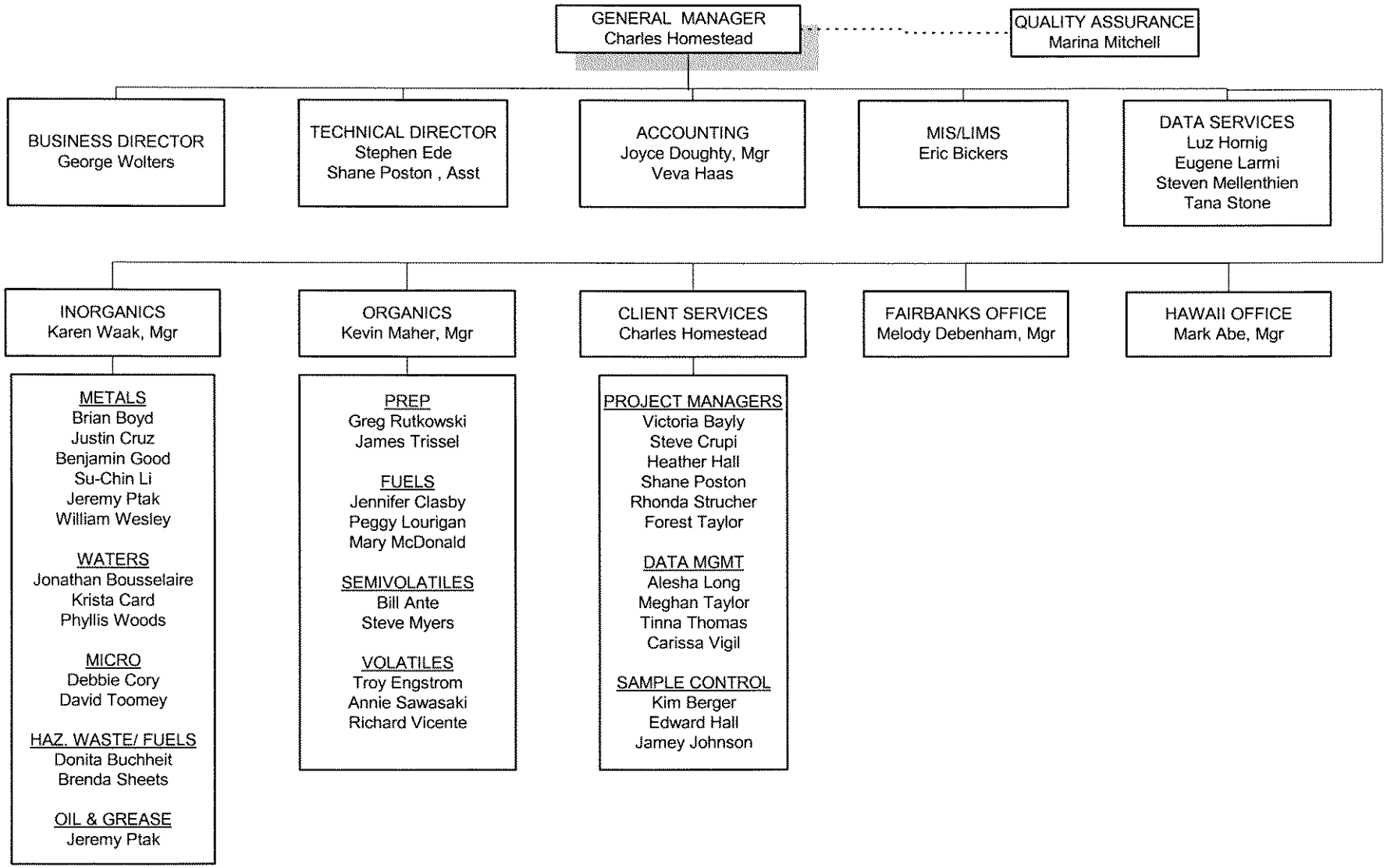
H. ADEC Underground Storage Tank Program Certificate

I. ADEC Drinking Water Program Certificate

J. ADEC Microbiological Certificates

SGS / CT&E Environmental Services Inc.
Alaska Division

February 1, 2004



STANDARD FORM (SF)

254

Architect-Engineer and Related Services Questionnaire

1. Firm Name/Business Address:

CT&E Environmental Services Inc..
Dba SGS Environmental Services
200 West Potter Drive
Anchorage, Alaska 99518-1605

2. Year Present Firm Established: 1964

3. Date Prepared: 09/09/03

4. Specify type of ownership *and* check below, if applicable.

Corporation

	A. Small Business
	B. Small Disadvantaged Business
	C. Woman-owned Business

1a. Submittal is for:

	Parent Company	X	Branch or Subsidiary Office

5. Name of Parent Company, if any:
SGS North America Inc.

5a. Former Parent Company Name(s), if any, and Year(s) Established:

6. Names of not more than Two Principals to Contact: Title/Telephone

1) Charles G Homestead, General Manager, Alaska Division (907) 562-2343
2) David A. Meyer Jr., Business Director (907) 562-2343

7. Present Offices: City/State/Telephone/No. Personnel Each Office

7a. Total Personnel 59

CT&E Environmental Services Inc.
200 West Potter Drive
Anchorage, Alaska 99518-1605

8. Personnel by Discipline: (List each person only once, by primary function.)

7	Administration	__	Electrical Engineers	__	Oceanographers	17	Chemists
__	Archaeologist-Historian	__	Estimators	__	Planners	2	Microbiologist
__	Chemical Engineers	__	Geologists		Public Involvement Specialists	11	Lab Technicians
__	Civil Designers	__	Hazardous Waste Specialists	__	Recycling Coordinators	3	Lab Assistants
__	Civil Engineers	__	Hydrologists	__	Seismic Engineers	5	Quality Control
__	Construction Inspectors	__	Landscape Architects	__	Soils Engineers	7	Clerical
__	Draftsmen	__	Mechanical Engineers	__	Specification Writers	7	Project Managers
__	Economists	__	Meteorologists-Air Quality	__	Structural Engineers	59	Total Personnel

9. Summary of Professional Services Fees Received: (Insert index number)

	Last 5 Years (most recent year first)				
	2002	2001	2000	1999	1998
Direct Federal contract work, including overseas	5	5	5	5	5
All other domestic work	6	6	6	6	6
All other foreign work*	1	1	1	none	none

* Firms interested in foreign work, but without such experience, check here:

Ranges of Professional Services Fees
INDEX
1. Less than $100,000
2. $100,000 to $250,000
3. $250,000 to $500,000
4. $500,000 to $1 million
5. $1 million to $2 million
6. $2 million to $5 million
7. $5 million to $10 million
8. $10 million or greater

10. Profile of Firm's Project Experience, Last 5 Years								
Profile Code	Number of Projects	Total Gross Fees (in thousands)	Profile Code	Number of Projects	Total Gross Fees (in thousands)	Profile Code	Number of Projects	Total Gross Fees (in thousands)
1) 033	30	11900	11)			21)		
2)			12)			22)		
3)			13)			23)		
4)			14)			24)		
5)			15)			25)		
6)			16)			26)		
7)			17)			27)		
8)			18)			28)		
9)			19)			29)		
10)			20)			30)		

11. Project Examples, Last 5 Years

Profile Code	"P", "C", "JV", or "IE"	Project Name and Location	Owner Name and Address	Cost of Work (in thousands)	Completion Date(Actual or Estimated)
033	P	1 Alaska Analytical/Environmental Testing US Army Corps of Engineers (TERC)	Jacobs Engineering Group 4300 B Street, Suite 600 Anchorage, AK 99503	1700	on-going
033	P	2 Alaska Environmental Testing, Site Remediation UST Removal, AK Dept Env Cons	URS Corporation 2700 Gambell, Ste 200 Anchorage, AK 99503	570	on-going
033	P	3 Alaska Environmental Testing, Site Remediation UST Removal, AK Dept Env Cons	Shannon & Wilson 5430 Fairbanks St., #3 Anchorage, AK 99518	2040	on-going
033	P	4 Alaska Hazardous Waste Analysis	US Air Force, DRMO/Brooks P O Box 875 Elmendorf AFB, AK 99506-0875	100	on-going
033	P	5 Elmendorf AFB Analytical/Environmental Testing	US Air Force Bioenviromental Eng/Brooks P O Box 875 Elmendorf AFB, AK 99506-0875	550	on-going
033	P	6 Eielson AFB Analytical/Environmental Testing	US Air Force, 343 CES/DEV/Brooks 2258 Central Ave., #1 Eielson AFB, AK 99702-2225	650	on-going
033	P	7 Alaska Environmental Testing, Site Remediation	Foster Wheeler Environmental Corp No Creek Pl 1, 12100 NE 195th Street #200 Bothell, WA 98011	100	On going

033	P	8 Alaska Analytical/Environmental Testing,	US Coast Guard P O Box 3-5000 Juneau, AK 99802-1217	75	2001
033	P	9 Alaska Analytical/Environmental Testing, ADAK	US Navy PSC 486, Box 1202 FPO AP 96506-1202	5	2000
033	P	10 Alaska Analytical/Environmental Testing, US Army Corps of Engr	US Army Corps of Engineers Portland District 1491 NW Graham Ave Troutdale, OR 97060-9503	100	on-going
033	P	11 Alaska Analytical/Environmental Testing	Gilfilian Engr& Env Testing Inc. 2605 Denali St., #203 Anchorage, AK 99503-2749	250	2002
033	P	12 Alaska Analytical/Environmental Testing	ENSR Consulting & Engineering 35 Nagog Park Acton, MA 01720	850	on-going
033	P	13 Alaska Station Monitoring Well Testing	Williams Express 3201 C St, #700 Anchorage, AK 99503-3934	350	2001
033	P	14 Alaska Kenai Environmental Monitoring	Tesoro AK Petroleum PO Box 196272 Anchorage, AK 99519	620	on-going
033	P	15 Alaska Pit Evaluation	Harding ESE, Inc. 601 57th Place Anchorage, AK 99518	240	on-going
033	P	16 Beluga Power Plant, Discharge Evaluation Transformer Testing	Chugach Electric Association P O Box 196300 Anchorage, AK 99518	140	on-going
033	P	17 Alaska Transformer Testing	MOA-Municipal Light & Power P O Box 196650 Anchorage, AK 99519-6650	300	on-going
033	P	18 Kenai, Alaska Solid Waste Site Monitoring	Kenai Peninsula Borough Box 850 Soldotna, AK 99669	200	on-going
033	P	19 Alaska Analytical/Environmental Testing	ConocoPhillips Alaska P O Box 103240 Anchorage, AK 99510	open	on-going
033	P	20 Alaska Analytical/Environmental Testing	B P Exploration P O Box 196612 Anchorage, AK 99519-6612	open	on-going

033	P	21 Alaska Hazardous Waste Analysis	Northwind Inc. 235 E 8th Ave, Ste 210 Anchorage, AK 99501	410	on-going
033	P	22 AK DOT, DEC, Corrections, Fish & Game Misc. Water Analysis	State of Alaska Anchorage, AK	100	on-going
033	P	23 Alaska Analytical/Environmental Testing	Oasis Environmental 807 G Street, Ste 250 Anchorage, AK 99501	375	on-going
033	P	24 Hawaii/Korea Analytical/Environmental Testing	Myounghee Noh & Associates LLC 98-099 Uao Place, #1101 Aiea, HI 96701	150	on-going
033	P	25 Alaska Hazardous Waste Analysis	Fairbanks Environmental Services 748 Gaffney Rd, Ste 200 Fairbanks, AK 99701	200	on-going
033	P	26 Alaska TAPS Project	Alyeska Pipeline 1835 S Bragaw Anchorage, AK 99512	855	on-going
033	P	27 Alaska Analytical/Environmental Testing	Paug-Vik Development Corp 810 N Street, #201 Anchorage, AK 99501	250	on-going
033	P	28 Alaska Mining NPDES	Teck Cominco Alaska Inc 3105 Lakeshore Dr, Bldg A, Ste 101 Anchorage, AK 99517	600	on-going
033	P	29 Alaska Analytical/Environmental Testing	BGES Inc. PO Box 110126 Anchorage, AK 99511	5	on-going
033	P	30 Alaska Analytical/Environmental Testing	Bering Sea Eccotech, Inc. 4300 B Street, #402 Anchorage, AK 99503	140	on-going

12. The foregoing is a statement of facts

Date: 09/09/03

Signature: C. Homestead Typed Name and Title: Charles G Homestead, General Manager

STANDARD FORM (SF) **255** Architect-Engineer Related Services for Specific Project	1. Project Name / Location for which Firm is Filing:	2a. ***Commerce Business Daily*** Announcement Date, if any:	2b. Agency Identification Number, if any:

3. Firm (or Joint-Venture) Name & Address
CT&E Environmental Services Inc.
DBA SGS Environmental Services
200 W Potter Drive
Anchorage, AK 99518-1605

3a. Name, Title & Telephone Number of Principal to Contact
Charles G. Homestead, General Manager 907 562-2343
David A. Meyer Jr., Business Director 907 562-2343

3b. Address of office to perform work, if different from Item 3

4. Personnel by Discipline: (List each person only once, by primary function.) Enter proposed consultant personnel to be utilized on this project on line (A) and in-house personnel on line (B).

(A)	(B) 7	Administrative	(A)	(B)	Electrical Engineers	(A)	(B)	Oceanographers	(A)	(B) 17	Chemists
(A)	(B)	Architects	(A)	(B)	Estimators	(A)	(B)	Planners: Urban/Regional	(A)	(B) 2	Microbiologist
(A)	(B)	Chemical Engineers	(A)	(B)	Geologists	(A)	(B)	Sanitary Engineers	(A)	(B) 11	Lab Technician
(A)	(B)	Civil Engineers	(A)	(B)	Hydrologists	(A)	(B)	Soils Engineers	(A)	(B) 3	Lab Assistants
(A)	(B)	Construction Inspectors	(A)	(B)	Interior Designers	(A)	(B)	Specification Writers	(A)	(B) 5	Quality Control
(A)	(B)	Draftsmen	(A)	(B)	Landscape Architects	(A)	(B)	Structural Engineers	(A)	(B) 7	Clerical
(A)	(B)	Ecologists	(A)	(B)	Mechanical Engineers	(A)	(B)	Surveyors	(A)	(B) 7	Project Manager
(A)	(B)	Economists	(A)	(B)	Mining Engineers	(A)	(B)	Transportation Engineers	(A)	(B) 59	Total Personnel

5. If submittal is by JOINT-VENTURE list participating firms and outline specific areas of responsibility (including administrative, technical and financial) for each firm: (Attach SF 254 for each if not on file with Procuring Office.)

5a. Has this Joint-Venture previously worked together? ☐ yes ☐ no

6. If respondent is not a joint-venture, list outside key Consultants/Associates anticipated for this project (Attach SF 254 for Consultants/Associates listed, if not already on file with the Contracting Office).

Name & Address	Specialty	Worked with Prime before (Yes or No)
1)		
2)		
3)		
4)		
5)		
6)		
7)		
8)		

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.	
a. Name & Title: Charles G Homestead General Manager	b. Project Assignment: Senior Consultant
c. Name of Firm With Which Associated: SGS / CT&E Environmental Services Inc.	d. Years Experience: With This Firm 22 With Other Firms 2
e. Education: Degree(s)/Year/Specialization: BS Chemistry , pending	f. Active Registration: Year First Registered/Discipline:

g. Other Experience and Qualifications Relevant to the Proposed Project:

Sets Laboratory goals and plans for attaining these goals. Directs the operations of SGS / CT&E Environmental Services Inc. Provides management expertise for laboratory projects and goals. Directs project's planning.

SGS / CT&E Environmental Services Inc.
Laboratory Manager: (Sept. 95 - Present)
As Laboratory Manager for CT&E Environmental Service Mr. Homestead is responsible for the overall Quality and financial performance of the laboratory. This includes implementing a reorganization of the laboratory to improve efficiency with the main purpose of improving performance for clients. Some of the areas under his direction are: analytical chemistry analysis production, project management, client service, data management, sample control, and safety. Mr. Homestead is responsible for assuring that all operations in the laboratory conform with the high quality standards that our client have come to expect from CT&E- Alaska.

Analytical Technologies:
Laboratory Manager: (Feb. 1994 - Sept 95)
As Laboratory Manager for Analytical Technologies Inc., Mr. Homestead was responsible for the overall design and operation of this new laboratory. This included setting short and long term goals for the development of the laboratory. He was also responsible for all aspects of the laboratory including analytical chemistry analysis production, project management, client service, data management, QA/QC, sample control, and safety.

CTE Environmental Services Inc.
Assistant Technical Director: (Apr. 1992 - Feb. 1994)
As an Assistant Technical Director, Mr. Homestead worked with the Technical Director to service laboratory and client needs. His responsibilities included approval of final laboratory reports, approval of final quality control reports, supervising of method development, addressing any technical issues that may arise internally or externally, project management for AFCEE projects, State of Alaska Underground Storage Tank program, Army Corps of Engineers, National Pollution Discharge Elimination System and State of Alaska Drinking Water Program. Supervisor of Inorganic Section, May 1990 to April 1992; Supervisor of Petroleum and Hazardous Waste Section, September 1987 to May 1990; Laboratory Technician: Hazardous Waste/Metals Section, July 1984 to September 1987; Laboratory Technician: Petroleum Section, August 1980 to July 1984.

Throughout his many years in the environmental industry, Mr. Homestead has been responsible for drinking water, waste water, hazardous waste and petroleum analyses. He has also been responsible for analysis for site assessments and analysis for closure of remediated sites. Mr. Homestead's duties included scheduling of work flow, data and quality control review and training of personnel. In addition, he has been responsible for performing characterization and analysis of hazardous waste samples under the EPA Solid Waste Program. These activities included performing many of the wet chemistry and instrumental techniques found in Test Methods for Evaluating Solid Waste (SW846). Mr. Homestead has also managed numerous remote site petroleum hydrocarbon analyses projects such as fuel contaminated soil excavations, oil field water and gas analyses, and monitor well sampling.
20 Years of Environmental Assessment Experience

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.	
a. Name & Title: David A Meyer, Jr. National Business Director	b. Project Assignment: Business Director
c. Name of Firm With Which Associated: SGS / CT&E Environmental Services Inc.	d. Years Experience: With This Firm 11 With Other Firms 8
e. Education: Degree(s)/Year/Specialization: BS Physiology/Minor Chemistry, Purdue University (1984)	f. Active Registration: Year First Registered/Discipline:

g. Other Experience and Qualifications Relevant to the Proposed Project:

SGS Environmental Services

National Business Director: (12/02-present)

Responsible for national sales for the environmental sector. Actively market the laboratory's services to maintain and expand the existing customer base throughout the United States and the Pacific Rim.

CT&E Environmental Services Inc.

Anchorage Business Director: (9/95 12/02)

Responsible for client quotations. Actively market the laboratory's services to maintain and expand the existing customer base.

Fairbanks District Manager: (5/92 - 9/95)

Respond to client questions and concerns regarding different analytical approaches. Maintain up-to-date information on state drinking water and underground storage tank regulations. Duties include receiving of samples, preparation of necessary documentation for chain of custody, and transportation of samples to the Anchorage facility for testing. Provide a high level of customer service and follow through for clients. Field activities include sampling of soil, surface and ground water, fuels, waste material drums and unknown materials.

Chemist: (4/92 - 5/92)

Prepare materials through the extraction process for analysis using Gas Chromatography and Mass Spectrometry. Monitor and manage quality control aspects of lab activities including multi-point calibration of equipment, matrix spikes, and duplicates.

AREAS OF EXPERTISE:

- Career experience in analytical laboratory operations.
- Strong background in chemistry.
- Skilled in the operation, calibration, and maintenance of laboratory apparatus.
- Proven skills in facility and management: laboratory, construction and retail.
- Qualified as a hazardous materials site coordinator.

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.	
a. Name & Title: Stephen C Ede Technical Director	b. Project Assignment: Technical Director
c. Name of Firm With Which Associated: SGS / CT&E Environmental Services Inc.	d. Years Experience: With This Firm 29 With Other Firms
e. Education: Degree(s)/Year/Specialization: BS Chemistry , University of California 1974	f. Active Registration: Year First Registered/Discipline: ASTM, ACS

g. Other Experience and Qualifications Relevant to the Proposed Project:

Directs the technical operations of SGS / CT&E Environmental Services Inc.
Composes analytical techniques and approves the procedures utilized by personnel. Reviews projects for accuracy and proper testing procedures.
Researches new testing techniques and equipment.
Monitors the Quality Assurance activities of the laboratory documents, summarizes and reports quality control data. Coordinates double blind samples, inter-laboratory check samples and all regulatory Quality Control check samples. His principle responsibility is to oversee the laboratory quality assurance program, and to supervise the on going quality assurance program in all laboratory analytical departments. He is also the liaison with the client regarding laboratory quality assurance.

SGS / CT&E Environmental Services Inc.

Technical Consultant: (1980 - Present)
Directs the technical operation of all departments. Writes and approves all analytical procedures utilized by chemists and technicians.

Directly responsible for the accuracy of test results, resource and development of analytical procedures and laboratory quality control.

Consults with clients on their needs for laboratory testing. He directs clients in proper techniques and methods necessary to properly fulfill the requirements of Environmental Protec Agency (EPA), Alaska Department of Environmental Conservation (ADEC), Army Corps of Engineers and other regulatory entities.

Supervises and trains personnel in new techniques and "trouble shoots" analytical problem areas.

Mr. Ede has 20 years of experience as an analytical chemist. As technical consultant, he is responsible for client liaison, proposal writing, and report preparation. He has in depth knowledge of EPA analytical procedures, standard methods, American Standard Testing Methods (ASTM), federal, state, and local regulations. He is a voting member of ASTM and is on the Executive Committee of The Alaska Chapter of the American Chemical Society.

Senior Chemist: (1974 - 1977)
Performed petrochemical, water quality, RCRA hazardous waste and environmental quality testing. Maintained and operated all laboratory instruments.

Chemist: (1974 - 1977)
Responsible for training and supervising chemists and technicians on the routine daily operation.
Performed petrochemical and water analysis according to ASTM and EPA.

26 years of Environmental Assessment Experience.

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.	
a. Name & Title: Marina I. Mitchell Quality Assurance Manager	b. Project Assignment: Quality Assurance Programr
c. Name of Firm With Which Associated: SGS / CT&E Environmental Services Inc.	d. Years Experience: With This Firm 5 With Other Firms
e. Education: Degree(s)/Year/Specialization: BA Biology, University of Montana (1997)	f. Active Registration: Year First Registered/Discipline:

g. Other Experience and Qualifications Relevant to the Proposed Project:

SGS / CT&E Environmental Services

Quality Assurance Manager: (April 2003 - present)

Responsible for planning, directing and supervising the quality assurance function for laboratory compliance to SOPs, QAPPs, and state and federal regulations. Maintains laboratory certifications and administers performance evaluation sample programs. Hosts client and regulatory inspections and assists the Technical Director with staff training, MDL studies review, corrective actions, and document control.

Northern Testing Laboratories, Inc.

Quality Control Chemist (June 2001 – March 2003)

Responsible for the secondary review and approval of all analytical chemistry and some microbiological data produced within the laboratory, involving EPA Drinking Water, Wastewater, and SW-846; ADEC UST, ASTM, and Standard Methods. She served as a laboratory contact for clients and regulatory agencies, and functioned as the primary contact for quality control matters for the facility. Responsible for the generation and review of IDC and PE samples, MDL studies, control charts, and the documentation of staff training. She was also responsible for the technical review and development of SOPs and fulfilled the duties of the Laboratory Manager in her absence.

Severn Trent Laboratories, Inc.

Data Review Specialist (December 1999 – June 2001)

Responsible for the review and interpretation of GC and GC/MS Air Toxics and GC/MS VOC data, mass spectral TIC identification, verification of data compliance with contract and client specifications, report forms generation, and assemblage and review of final data packages. This work included EPA CLP, Drinking Water, 40 CFR, SW-846; and ASTM methodologies.

Data Review Chemist ***(March 1999 – December 1999)***

Responsibilities included the secondary review and reporting of metals and wet chemistry data, including inorganic CLP, EPA and SM methodologies.

Administrative Assistant (September 1998 – March 1999)

Responsibilities included the collaboration with technical staff, revision of SOPs, generation of preliminary narratives, assorted clerical duties, and overall laboratory support.

5 years experience in laboratory operations and varying State and Federal Environmental Programs.

PROFESSIONAL CERTIFICATIONS:

Water Treatment OIT, Awarded by State of Alaska, Department of Environmental Conservation, April 2002 Water Distribution OIT, Awarded by State of Alaska, Department of Environmental Conservation, April 2002

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.	
a. Name & Title: Karen Waak Inorganic Department Supervisor	b. Project Assignment: Supervisor for the Inorganic Department
c. Name of Firm With Which Associated: SGS / CT&E Environmental Services Inc.	d. Years Experience: With This Firm 7 With Other Firms 6
e. Education: Degree(s)/Year/Specialization: BS Natural Sciences, University of Alaska Anchorage (1991)	f. Active Registration: Year First Registered/Discipline: ACS

g. Other Experience and Qualifications Relevant to the Proposed Project:

SGS / CT&E Environmental Services Inc., Anchorage, AK.

Inorganic Supervisor: (Mar 2001 - Present)
Review inorganics raw data, reports, and QC packages.
Oversee scheduling and monitor all aspects of data production to ensure timely and accurate results.

STL Anchorage (formerly Quanterra, Inc.), Anchorage, AK.

- Quality Assurance Chemist – Support Services (Dec 1999 – Mar 2001)
- Validated portions of NPDES and oil process data.
- Assessed analyst compliance with procedures at field sites.
- Maintained the Standard Operating Procedures library and Nonconformance system.
- Conducted a systems audit at the Valdez Marine Terminal (VMT) laboratory.
- Acted as group lead at the VMT and as support services manager as necessary.

Quanterra, Inc., Anchorage, AK.

- Chemist – Semi-Volatiles Department (Aug 1999 – Dec 1999)
- Analyst, Diesel Range and Residual Range Organics.
- Chemist – Metals Department (Jan 1996 – Aug 1999)
- Initial method development on three different instrument types.
- Performed metals analysis of environmental samples utilizing EPA methods.
- Performed analyses utilizing ICP, GFAA, and Leeman Mercury Analyzer. Responsible for maintenance of instruments and compliance with methods.

CT&E Environmental Services Inc., Anchorage, AK.

- Analyst, Metals Department (Mar 1991 – Jan 1996)
- Performed metals analysis of environmental samples utilizing EPA methods.
- Performed spectroscopic analysis utilizing ICP and GFAA and responsible for maintenance of instruments as well as compliance with methods.
- Provided back up coverage for supervisor and other analysts.
- Technician, Wet Bench – Oil & Grease Department (May 1990 – Mar 1991)
- Extracted petroleum hydrocarbons from samples and analyzed extract with infrared spectrometer.

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.	
a. Name & Title: Kevin W. Maher Organic Department Supervisor	b. Project Assignment: Supervisor for the Organic Department
c. Name of Firm With Which Associated: SGS / CT&E Environmental Services Inc.	d. Years Experience: With This Firm 13 With Other Firms
e. Education: Degree(s)/Year/Specialization: BS Chemistry, University of Alaska, Anchorage (1992)	f. Active Registration: Year First Registered/Discipline:

g. Other Experience and Qualifications Relevant to the Proposed Project:

SGS / CT&E Environmental Services Inc.

Organics Department Supervisor: (1994 - present)

- Directs the operation of the organics section.
- Writes and approves analytical procedures used by the section chemists and technicians.
- Responsible for the development of analytical methods and section quality control.
- Supervises and trains personnel in new techniques and procedures.
- Oversees instrument maintenance and problem " trouble shooting ".
- Reviews and approves analytical data and quality control reports for the section.
- Performs chromatographic testing using GCMS.
- Responsible for maintaining section production.
- Other aspects of responsibility include client liaison, proposal and report preparation, analyst schedules, personnel reviews, software development, and annual section budget preparation.

Lead Chemist: (1991 - 1994)

Assisted the organics department in data review, training of personnel, and "trouble shooting" of instruments. Responsible for scheduling work in the section. Responsible for installing new equipment. Lead analyst for GC and GCMS methods.

Technician: (1990 - 1991)

Performed sample preparation of samples for the GC section. responsible for the routine analysis of PCBs, 8100s, and VOCs.

10 years experience as an analytical chemist.

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.	
a. Name & Title: Steven R Crupi Project Manager	b. Project Assignment: Project Manager
c. Name of Firm With Which Associated: SGS / CT&E Environmental Services Inc.	d. Years Experience: With This Firm 3 With Other Firms 14
e. Education: Degree(s)/Year/Specialization: BA Chemistry and Math, Jamestown College, Jamestown, ND (1986)	f. Active Registration: Year First Registered/Discipline:

g. Other Experience and Qualifications Relevant to the Proposed Project:

SGS / CT&E Environmental Services Inc.

Project Manager: Nov. 1999 - present
Manages analytical and sampling projects for specific clients. Duties include project consultation with clients and coordination of analytical work. Is familiar with and stays current with the EPA, ADEC, and COE requirements on soil and drinking water.

Quality Assurance Manager: (May 2000 – May 2002t)
Responsible for planning, directing and supervising the quality assurance function for laboratory compliance to SOPs, QAPPs, and state and federal regulations. Host client and regulatory inspections and administer performance evaluation sample programs. Assist the Technical Director with staff training.

Northern Lake Service, Inc.
Client Services Manager (July 1995 – May 2000)
Responsible for laboratory-client interactions, quotations, and subcontractor management. Involvement in marketing/sales functions, analysis scheduling, and management of varying client requirements. Review final reports for accuracy and completeness relative to client requests.

PACE, Inc.
Federal Program Project Manager (October 1994 – July 1995)
Managed environmental projects for federal (e.g., USEPA CLP, AFCEE) and nonfederal program clients. Duties include assuring the completeness and quality of analytical reports, generation and review of Quality Assurance Plans, and interaction with federal and state regulatory agencies. Provided technical and regulatory information and insured completion of projects within defined budgets and timetables.

Huntingdon Engineering and Environmental, Inc. (now Maxim Technologies)
Quality Assurance Manager (January 1994 – October 1994)
Responsible for planning, directing and supervising the quality assurance function for division compliance to SOPs, QAPPs, and state/federal regulatory requirements. Supervised and trained QAO staff, drafted operational SOPs, monitored overall laboratory compliance to all applicable regulatory requirements and hosted client and government inspections. Participated in Corporate Quality initiatives.

PACE, Inc.
Federal Program Project Manager/Client Services Mgr. (January 1990 – January 1994)
Manage project management staff and provide direction for the laboratory on client service issues. Defined and implemented a project management process to ensure consistent and complete documentation of project activities. Managed projects under federal agency and state agency oversight. Assisted in the compilation and review of Level 4 data packages.

14 years experience in laboratory operations and varying State and Federal Environmental Programs.

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.	
a. Name & Title: Heather Hall Project Manager	b. Project Assignment: Project Management
c. Name of Firm With Which Associated: SGS / CT&E Environmental Services Inc.	d. Years Experience: With This Firm 7 With Other Firms
e. Education: Degree(s)/Year/Specialization: BS Microbiology, University of Maryland, College Park (1985) MS Microbiology, University of Maryland, College Park (1990)	f. Active Registration: Year First Registered/Discipline:

g. Other Experience and Qualifications Relevant to the Proposed Project:

SGS / CT&E Environmental Services Inc.
Project Manager: (August 1996 - Present)
Manages analytical and sampling projects for specific clients. Duties include project consultation with clients and coordination of analytical work. Familiar with a host of environmental regulations.

Alaska Scientific, Inc.
Environmental Account Manager: (1995 - 1996)
Technical sales representative specializing in immunoassay field testing kits.

Charles County Community College
Assistant Professor: (1991 - 1994)
Taught undergraduate classes in Anatomy & Physiology, Concepts of Biology, Microbiology and Zoology. Served on several college-wide committees, including the Senate Executive Board. Trained and functioned as Advisor for Student Services during registration.

Montgomery College
Adjunct Professor: (1990 - 1994)
Taught undergraduate classes in Microbiology, Human Structure & Function, Basic Human Science and Oceanus. Additionally, developed and taught workshops for all ages and ability levels through the Office of Continuing Education.
Instructional Laboratory Technician: (1986 - 1991)
Prepared materials, maintained pure cultures, inventoried and ordered supplies, maintained equipment, and supervised student laboratory aides for two dozen laboratories and six instructors each semester. Designed and produced educational displays. Assisted faculty in development of courses to include biotechnology.

University of Maryland
Graduate Teaching Assistant: (1987 - 1990)
Taught undergraduate laboratories in Microbiology and Biology. Coordinated seven teaching assistants, supplies and equipment for thirteen sections of Microbiology each semester (1987 - 1988).
Laboratory Technician: (1983 - 1986)
Prepared materials, maintained pure cultures, conducted experiments, recorded and analyzed data, and trained visiting scientists in DNA methodology.

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.	
a. Name & Title: Shane J Poston Assistant Technical Director/Project Manager	b. Project Assignment: Technical Review and Consulting Project Management
c. Name of Firm With Which Associated: SGS / CT&E Environmental Services Inc.	d. Years Experience: With This Firm 11 With Other Firms 1
e. Education: Degree(s)/Year/Specialization: BS Double Major Chemistry & Biology, University of Southern Colorado (1988)	f. Active Registration: Year First Registered/Discipline:

g. Other Experience and Qualifications Relevant to the Proposed Project:

SGS / CT&E Environmental Services

Assistant Technical Director/Project Manager: May 1994 - present

Assists Technical Director in all duties. Refer to Technical Director for specifics. Project Management duties include overseeing project completion dates and, when necessary, re assigning people or authorizing overtime to complete projects on time. Supervises sample control from receipt to disposal.

Chugiak North Technical Services

Senior Laboratory Technician Jan 1993 - May 1994

Primary responsibilities included Reid Vapor Pressure measurement of producer crude oil streams, and development and implementation of new vapor pressure measurement methodology (bubble point determination of crude oil) using Ruska PVT instrumentation. additional duties included special sampling, Karl Fischer titration of water in crude oil, specific gravity of crude oil, and development of spreadsheets/macros/database for data calculation, quality control, statistical analysis, archive, and general data management using Microsoft Excel/Word software.

University of Alaska - Anchorage

Organic Chemistry/Biochemistry Instructor Sep 1991 - Dec 1992

Lecture and laboratory instruction for organic chemistry and biochemistry, including laboratory experiment preparation and all other related duties.

Commercial Testing & Engineering

Analytical Chemist Jun 1990 - Jan 1993

Performed rigorous production analysis under strict accordance with EPA, ADEC, and US Army Corps of Engineers for volatile/semivolatile organic contaminants by GC/MS, and GC/PID, FID, ELCD, TCD instrumentation. Familiarity with test methods 524, 8240, 8010, 8020, modified 8015 GRO/DRO, RGA-GPA standard 2286-86, and GPA standard 2261-90, and numerous other GC related special analysis. Additional duties included all aspects of instrumentation maintenance and troubleshooting. Familiarity with software included HP-RTE, Lotus, Maxima, and Microsoft Excel/Word software.

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.	
a. Name & Title: Rhonda Strucher Project Manager	b. Project Assignment: Project Management
c. Name of Firm With Which Associated: SGS / CT&E Environmental Services Inc.	d. Years Experience: With This Firm 13 With Other Firms
e. Education: Degree(s)/Year/Specialization: High School, 2 yrs college	f. Active Registration: Year First Registered/Discipline:

g. Other Experience and Qualifications Relevant to the Proposed Project:

SGS / CT&E Environmental Services Inc.

Project Manager: Nov. 1999 - present
Manages analytical and sampling projects for specific clients. Duties include project consultation with clients and coordination of analytical work. Is familiar with and stays current with the EPA, ADEC, and COE requirements on soil and drinking water.

Fairbanks District Manager: May 1998 – Nov. 1999
Oversees and directs all aspects of the Fairbanks operation. Responsibilities include project coordination of analytical and sampling projects, project consultation with clients, coordination of analytical work, receiving of samples, and transportation of samples to the Anchorage facility for analysis. Provide a high level of customer service and follow through for clients.

Sales/Project Manager Denver, CO Oct 1995 – Apr 1998
Actively market the laboratory's services to maintain and expand the existing customer base in the west. Manage analytical and sampling projects. Duties include project consultation with clients and coordination of analytical work. Is familiar with and stays current with the EPA, ADEC, and COE requirements on soil and drinking water.

Sample Control Manager Mar 1992 – Sept. 1995
Responsible for overseeing the operation of all aspects involved with sample receiving, sample custody, and laboratory assistants. Works with Operations Manager to coordinate analytical and sampling projects. Consults with clients on analytical needs under the direction of the Technical Director. Is familiar with and stays current with the EPA, ADEC, and COE requirements on soil and drinking water.

Sample Receiving Mar 1990 - May 1991
Responsible for receiving and inspection of client COC and documentation of irregularities of all samples. Distributed work orders to appropriate departments. Input work orders into computer and prepared lab instructions for department. At their request provide clients with sample container, and where appropriate, proper preservative solution. Consult clients on their needs for laboratory testing under the direction of the technical director.

8. Work by firm or joint-venture which best illustrates current qualifications relevant to this project (list not more than 10 projects).					
a. Project Name & Location	b. Responsibility	c.	d. Completion Date (actual or estimated)	e. Estimated Cost (in thousands)	
				Entire Project	Work for which Firm Was/Is Responsible
(See below)					
Jacobs Engineering Group, Inc. US Army Corps of Engr TERC (Total Env Restoration Contract) Eareckson AFS, Akutan, Amaknak Haines	Environmental Engineering for, Site Assessment and Site Remediation	Jacobs Engineering Group, Inc. 4300 B Street, Suite 600 Anchorage, AK 99503 Gloria Beckman 907 563-3322	2006	1,000	Analytical Testing
URS Corporation Alaska US Army Corps of Engineers	Hazardous Waste, Environmental Monitoring, Site Remediation, UST Removal Eval., and AK Dept Env Cons	URS Corporation 2700 Gambell St, Ste 200 Anchorage, AK 99503 Mark Vania 907 562-3366	2002	200	"
Shannon & Wilson Alaska US Army Corps of Engineers	Hazardous Waste, Environmental Monitoring, Site Remediation, UST Removal Eval., and AK Dept Env Cons	Shannon & Wilson 5430 Fairbanks St, #3 Anchorage, AK 99518 Staford Glashan 907 561-2120	2002	200	"
US Air Force (DRMO) Waste Drum Evaluation Alaska Armstrong (Brooks)	Hazardous Waste Testing	US Air Force - Elmendorf PO Box 875 Elmendorf AFB, AK 99506 Carl Hornig 907 552-1617	2002	550	"
US Air Force/Brooks Bio Enviromental Engineering	Envrionmental Site Monitoring and AK Dept Env Cons	US Air Force – Elmendorf/Brooks PO Box 875 Elmendorf AFB, AK 99506 Sgt Shavers 907 552-4152	2003	500	"
US Navy Installations Waste Evaluation Adak, AK	Hazardous Waste, Environmental Monitoring, and Site Remediation Testing	US Navy PSC 486, Box 1202 FPO AP 96506-1202 Shawn Wales 907 592-4184	1997	100	"

8. Work by firm or joint-venture which best illustrates current qualifications relevant to this project (list not more than 10 projects).					
a. Project Name & Location	b. Responsibility	c.	d. Completion Date (actual or estimated)	e. Estimated Cost (in thousands)	
				Entire Project	Work for which Firm Was/Is Responsible
(see below)					
ENSR Consulting & Engr. Alaska US Army Corps of Engineers	Hazardous Waste, Environmental Monitoring, Site Remediation, UST Removal Eval., and AK Dept Env Cons	ENSR Consulting & Engineering 4600 Business Pk Blvd, #22 Anchorage, AK 99503-7143 Sandy Mapes 907 561-5700	on going	300	Analytical Testing
Arctic Slope Construction Inc. Alaska AFCEE	Hazardous Waste, Site Remediation, UST Removal Eval,. and Air Force Center for Environmental Excellence	Arctic Slope Construction Inc. 5631 Silverado Way Unit F#101 Anchorage, AK 99518 Gretchen Stoddard 907 550-7823	2001	200	"
ICF Kaiser Dew Line Sites, Alaska	Hazardous Waste, Environmental Monitoring, Site Remediation, UST Removal Eval., and Air Force Center for Environmental Excellence Projects	ICF Kaiser Engineering 601 Williams Blvd, 4th Floor Richland, WA 99352-3258 John Frerich 509 943-4640	1994	300	"
Jacobs Engineering Group, Inc. AFCEE Eareckson AFS, Granite Mountain	Environmental Monitoring, Site Remediation, UST Removal Eval., and Air Force Center for Environmental Excellence Projects	Jacobs Engineering Grounp, Inc. 600 Seventeenth St, #1100N Denver, CO 80202 Chris Williams 907 563-3322	1995	300	"

9. All work by firms or joint-venture members currently being performed directly for Federal Agencies.					
				e. Estimated Cost (in thousands)	
a. Project Name & Location	b. Nature of Firm's Responsibility	c. Agency (Responsible Office) Name & Address	d. Percent Complete	Entire Project	Work for which Firm was/is responsible
Not Applicable					

10. Use this space to provide any additional information or description of resources (including any computer design capabilities) supporting your firm's qualifications for the proposed project.

SGS / CT&E Environmental Services Inc. has been performing Hazardous Material testing, Environmental Site Evaluation testing, Site Remediation testing and discharge analysis for NPDES since 1978. SGS / CT&E Environmental Services Inc. has performed analyses for Under Ground Storage Tank Removals since the inception of the program. All data submitted has been fully acceptable to regulatory agencies as legally defensible data.

SGS / CT&E Environmental Services Inc. has been certified by the Alaska Department of Environmental Conservation for the Title 18 Chapter 80 Drinking Water Testing and UST Analysis.

SGS / CT&E Environmental Services Inc. is evaluated for Environmental Testing by the US Army Corps of Engineers.

SGS / CT&E Environmental Services Inc. is evaluated for Environmental Testing by AFCEE (Air Force Center for Environmental Excellence.)

SGS / CT&E Environmental Services Inc. is evaluated for Environmental Testing by Armstrong Labs, Brooks Air Force Base.

SGS / CT&E Environmental Services Inc. is evaluated for Environmental Testing by the Department of the Navy.

SGS / CT&E Environmental Services Inc. is evaluated for Environmental Testing by State of Illinois EPA for accreditation of NELAP.

Copies of the Certificates and evaluations are available upon request.

SGS / CT&E Environmental Services Inc. maintains a table-based, Laboratory Information Management System (LIMS) designed to coordinate laboratory operations. The LIMS tracks and monitors sample log-in, preparation, analysis and reports. Data storage capabilities allow the integration of sample information and instrument data to generate final reports and data deliverables. Customized management reports can also be produced in addition to the following EDD formats:

COELT
COELF
EDF
EDM
ERPIMS
CLP

Additional information is available upon request.

11. The foregoing is a statement of facts.

Signature: C. Homestead

Typed Name and Title: Charles G. Homestead, General Manager

Date: September 10, 2003

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
12565 WEST CENTER ROAD
OMAHA NE 68144-3869

REPLY TO
ATTENTION OF

February 13, 2004

Hazardous, Toxic and Radioactive Waste
Center of Expertise

Marina Mitchell
SGS/CT&E Environmental Services
200 West Potter Drive
Anchorage, AK 99518-1605

Dear Ms. Mitchell

This correspondence addresses the ongoing validation status of SGS/CT&E Environmental Services of Anchorage, AK by the U.S. Army Corps of Engineers (USACE) for chemical analysis in support of the Hazardous, Toxic and Radioactive Waste Program.

Your laboratory is now validated for the parameters listed below

METHOD	PARAMETERS	MATRIX(1)
300.0	Anions(5)	Water(2)
8021B	BTEX	Water(2)
8021B	BTEX	Solids
8081A	Organochlorine Pesticides	Water(2)
8081A	Organochlorine Pesticides	Solids
8082	Polychlorinated Biphenyls	Water(2)
8082	Polychlorinated Biphenyls	Solids(2)
8270C-SIM	Semivolatile Organics	Water(2)
8270C-SIM	Semivolatile Organics	Solids(2)
8270C	Semivolatile Organics	Water(2)
8270C	Semivolatile Organics	Solids(2)
6010B/7000A	TAL Metals(3)	Water(2)
6010B/7000A	TAL Metals(3)	Solids(2)
6020/7470A	TAL Metals(3)	Water(2)
6020/7471A	TAL Metals(3)	Solids(2)
8015M	TPH-DRO/GRO/RRO	Water(4)
8015M	TPH-DRO/GRO/RRO	Solids(4)
8260B	Volatile Organics	Water(2)
8260B	Volatile Organics	Solids

Remarks: 1) 'Solids' includes soils, sediments, and solid waste

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2) The laboratory has successfully analyzed a performance evaluation sample for this method/matrix.

3) TAL Metals: Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. (Analysis by ICP/GFAA.)

4) Approval for these analyses is based on review of SOPs only.

5) Anions: chloride, fluoride, sulfate, nitrate, and ortho-phosphate.

Based on acceptable past performance of your laboratory, the validation of your laboratory is hereby extended from February 8, 2004 to June 30, 2004 to provide time to complete the revalidation process.

The USACE reserves the right to conduct additional laboratory inspections or to suspend validation status for any or all of the listed parameters if deemed necessary. It should be noted that your laboratory may not subcontract USACE analytical work to any other laboratory location without the approval of this office.

Any questions or comments can be directed to Richard Kissinger at (402) 697-2569. General questions regarding laboratory validation may be directed to the Laboratory Validation Coordinator at (402) 697-2574.

Sincerely,

for Marcia C. Davies, Ph.D.
Director, USACE Hazardous,
Toxic and Radioactive Waste
Center of Expertise

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 311TH HUMAN SYSTEMS WING (AFMC)
BROOKS AIR FORCE BASE TEXAS

7 February 2000

MEMORANDUM FOR: CT&E ENVIRONMENTAL SERVICES INC.
ATTN: STEPHEN C. EDE

FROM: SSGT. KEITH W. TICKLE
AFIERA/SDC
2402 E. DRIVE
BROOKS AFB, TX 78235-5114

SUBJECT: Laboratory On-Site Evaluation Conducted by AFIERA/SDC.

1. Thank you for your *Corrective Action Responses* to the deficiencies sited during the laboratory evaluation conducted on 16 – 21 September 1999. The evaluation team has thoroughly reviewed your responses and has found them to be sufficient and in compliance with AFIERA/SDC standards. We will be notifying Elmendorf and Eielson Air Force Base of your successful completion of the on-site evaluation. We appreciate your cooperation in allowing us to visit your fine laboratory and extend to you and your laboratory continued success in the environmental field of analysis.

2. If you have any questions or comments regarding to the completion of the on-site evaluation, please contact me at (210) 536-5858. Thanks again for your time and support.

Keith W. Tickle

KEITH W. TICKLE, SSGT, USAF
NCOIC, Laboratory Evaluation Program

DEPARTMENT OF THE NAVY

NAVAL FACILITIES ENGINEERING SERVICE CENTER
1100 23RD AVE
PORT HUENEME CA 93043-4370

IN REPLY REFER TO:

NFESC 413
May 25, 2004

Ms. Marina Mitchell
Quality Assurance Manager
SGS/CT&E Environmental Services
200 W. Potter Drive
Anchorage, AK 99518-1605

Dear Ms. Mitchell,

This correspondence addresses the status of SGS/CT&E Environmental Services of Anchorage, AK in the Navy Installation Restoration (IR) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

Your laboratory is accepted to perform sample analysis for the methods listed in Table 1. The period of acceptance expires June 25, 2004. This acceptance does not guarantee the delivery of any analytical samples. Acceptance is facility specific and can not be transferred to an affiliated or subcontract laboratory.

Acceptance is based on the last assessment executed under the auspices of the Navy IR QA Program. The period of acceptance is consistent with the evaluation cycle identified by the Navy IR QA Program. The assessment included an onsite inspection performed October 16-18, 2001, and the review of proficiency testing (PT) results.

The Navy reserves the right to conduct additional laboratory assessments or to suspend or revoke acceptance status for any or all of the listed parameters if deemed necessary.

Table 1

METHOD[1]	PARAMETER	MATRIX
8021B	BTEX	Water/Solid
2320B	Alkalinity	Water
8081A	Organochlorine Pesticides	Water/Solid
8082	Polychlorinated Biphenyls	Water/Solid
8270C	Semivolatile Organics	Water/Solid
8015B Mod	TPH – GRO/DRO/RRO	Water/Solid
AK[2] 101	TPH – GRO	Water/Solid
AK[2] 102/103	TPH – DRO/RRO	Water/Solid

[1] The assessment included a review of Toxicity Characteristic Leaching Procedure (TCLP; EPA Method 1311).
[2] State of Alaska method.

8270 Mod (SIM)	Polyaromatic Hydrocarbons (PAH)	Water/Solid
6000/7000 Series	TAL Metals: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium and Zinc	Water/Solid
8260B	Volatile Organics	Water/Solid
300.0	Anions	Water
415.1	Total Organic Carbon	Water
ASTM D1945	Dissolved Methane	Water
7196A	Hexavalent Chromium	Water/Solids

Acceptance for use for parameters not identified on the table will be determined by Navy project personnel.

The laboratory should notify NFESC if there are parameters not presented on Table 1 that the laboratory expects to run on a routine basis in support of Navy installation restoration projects. In these circumstances the laboratory's capability to run the tests will be reviewed and the table will be modified accordingly.

Questions concerning the information provided should be directed to the NFESC IR QA Program coordinator, Ms. Patricia Moreno at (805) 982-1659, or via email at morenop@nfesc.navy.mil.

Sincerely,

For Robert J. Kratzke
Supervisor, Consultation/Information
Management Branch

NFESC FAX

1100 23rd Avenue, Port Hueneme, Ca 93043

Number of pages: ***3***
(Including cover page)

Date: January 26, 2004

From: Pati Moreno
Org: NFESC
PH: (805) 982-1659
Fax: (805) 982-4304

To: Marina Mitchell
Org: CT & E
Fax: 907-561-5301

Remarks:

Ms. Mitchell,

The attached is a copy of your updated acceptance letter.

The letter reflects a 2 month extension to your current acceptance period.

The extension will allow time to assess and initiate a re-evaluation of your facility as needed under the Navy IR QA Program.

Sincerely,

Pati Moreno
NFESC IR QA Program Coordinator

STATE OF ILLINOIS

ENVIRONMENTAL PROTECTION AGENCY

ENVIRONMENTAL LABORATORY ACCREDITATION

is hereby granted to

SGS ENVIRONMENTAL SERVICES - ALASKA DIVISION
200 W. POTTER DRIVE
ANCHORAGE, AK 99518-1605

ACCREDITATION NUMBER #100316

According to the Illinois Administrative Code, Title 35, Subtitle A, Chapter II, Part 186, ACCREDITATION OF LABORATORIES FOR DRINKING WATER, WASTEWATER AND HAZARDOUS WASTES ANALYSIS, the State of Illinois formally recognizes that this laboratory is technically competent to perform the environmental analyses listed on the scope of accreditation detailed below.

The laboratory agrees to perform all analyses listed on this scope of accreditation according to the Part 186 requirements and acknowledges that continued accreditation is dependent on successful ongoing compliance with the applicable requirements of Part 186. Please contact the Illinois EPA Environmental Laboratory Accreditation Program (IL ELAP) to verify the laboratory's scope of accreditation and accreditation status. Accreditation by the State of Illinois is not an endorsement or a guarantee of validity of the data generated by the laboratory.

Janet Cruse

Janet Cruse
Accreditation Officer
Environmental Laboratory Accreditation Program

Certificate No.: 000878
Expiration Date: 08/31/2004
Issued On: 08/28/2003

State of Illinois
Environmental Protection Agency

Certificate No.: 000878

Awards the Certificate of Approval

SGS Environmental Services - Alaska Division
200 W. Potter Drive
Anchorage, AK 99518-1605

According to the Illinois Administrative Code, Title 35, Subtitle A, Chapter II, Part 186, ACCREDITATION OF LABORATORIES FOR DRINKING WATER, WASTEWATER AND HAZARDOUS WASTES ANALYSIS, the State of Illinois formally recognizes that this laboratory is technically competent to perform the environmental analyses listed on the scope of accreditation detailed below.

The laboratory agrees to perform all analyses listed on this scope of accreditation according to the Part 186 requirements and acknowledges that continued accreditation is dependent on successful ongoing compliance with the applicable requirements of Part 186. Please contact the Illinois EPA Environmental Laboratory Accreditation Program (IL ELAP) to verify the laboratory's scope of accreditation and accreditation status. Accreditation by the State of Illinois is not an endorsement or a guarantee of validity of the data generated by the laboratory.

Hazardous and Solid Waste, Inorganic

1010

Ignitability

1020A

Ignitability

1311

TCLP (Organic and Inorganic)

6010B

Aluminum	Antimony	Arsenic
Barium	Cadmium	Calcium
Chromium	Cobalt	Copper
Iron	Lead	Magnesium
Manganese	Molybdenum	Nickel
Selenium	Silver	Sodium
Strontium	Vanadium	Zinc

6020

Aluminum	Antimony	Arsenic
Barium	Beryllium	Cadmium
Calcium	Chromium	Cobalt
Copper	Iron	Lead
Magnesium	Manganese	Nickel
Potassium	Selenium	Silver
Sodium	Thallium	Vanadium
Zinc		

7060A

Arsenic

7131A

Cadmium

7191

Chromium

7196A

Chromium VI

7421

Lead

7470A

Mercury

State of Illinois
Environmental Protection Agency

Certificate No.: 000878

Awards the Certificate of Approval

SGS Environmental Services - Alaska Division
200 W. Potter Drive
Anchorage, AK 99518-1605

Hazardous and Solid Waste, Inorganic

7471A

Mercury

7740

Selenium

9040B

Hydrogen Ion (pH)

Hydrogen Ion (pH)

9045C

Hydrogen Ion (pH)

9056

Bromide	Chloride	Fluoride
Nitrate	Nitrite	Phosphate
Sulfate		

9060

Total Organic Carbon (TOC)

9065

Phenolics

Hazardous and Solid Waste, Organic

8015B

Diesel range organics (DRO)

Gasoline range organics (GRO)

8021B

Benzene	Ethylbenzene	m-Xylene
o-Xylene	p-Xylene	Toluene

8081A

4,4'-DDD	4,4'-DDE	4,4'-DDT
Aldrin	alpha-BHC	alpha-Chlordane
beta-BHC	delta-BHC	Dieldrin
Endosulfan I	Endosulfan II	Endosulfan sulfate
Endrin	Endrin aldehyde	Endrin ketone
gamma-BHC (Lindane)	gamma-Chlordane	Heptachlor
Heptachlor epoxide	Methoxychlor	Toxaphene

8082

PCB-1016	PCB-1221	PCB-1232
PCB-1242	PCB-1248	PCB-1254
PCB-1260		

8260B

1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene
1,1-Dichloropropene	1,2,3-Trichlorobenzene	1,2,3-Trichloropropane
1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene	1,2-Dibromo-3-chloropropane (DBCP)
1,2-Dibromoethane (EDB)	1,2-Dichlorobenzene	1,2-Dichloroethane
1,2-Dichloropropane	1,3,5-Trimethylbenzene	1,3-Dichlorobenzene
1,3-Dichloropropane	1,4-Dichlorobenzene	2,2-Dichloropropane
2-Butanone (Methyl ethyl ketone, MEK)	2-Chloroethyl vinyl ether	2-Chlorotoluene
2-Hexanone	4-Chlorotoluene	4-Methyl-2-pentanone (Methyl isobutyl ketone, I

State of Illinois
Environmental Protection Agency

Certificate No.: 000878

Awards the Certificate of Approval

SGS Environmental Services - Alaska Division
200 W. Potter Drive
Anchorage, AK 99518-1605

Hazardous and Solid Waste, Organic

8260B

		Acetone
Benzene	Bromobenzene	Bromochloromethane
Bromodichloromethane	Bromoform	Bromomethane
Carbon disulfide	Carbon tetrachloride	Chlorobenzene
Chlorodibromomethane (Dibromochloromethan	Chloroethane	Chloroform
Chloromethane	cis-1,2-Dichloroethene	cis-1,3-Dichloropropene
Dibromomethane	Dichlorodifluoromethane	Dichloromethane (Methylene chloride)
Ethylbenzene	Hexachlorobutadiene	Isopropylbenzene
Methyl ethyl ketone	Methyl isobutyl ketone	m-Xylene
n-Butylbenzene	n-Propylbenzene	o-Xylene
p-Xylene	sec-Butylbenzene	Styrene
tert-Butylbenzene	Tetrachloroethene	Toluene
trans-1,2-Dichloroethene	trans-1,3-Dichloropropene	Trichloroethene
Trichlorofluoromethane	Vinyl chloride	Vinylidene chloride

8270C

1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene
1,4-Dichlorobenzene	1-Chloronaphthalene	2,4,5-Trichlorophenol
2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol
2,4-Dinitrophenol	2,4-Dinitrotoluene (2,4-DNT)	2,6-Dichlorophenol
2,6-Dinitrotoluene (2,6-DNT)	2-Chloronaphthalene	2-Chlorophenol
2-Methylnaphthalene	2-Nitroaniline	2-Nitrophenol
3,3'-Dichlorobenzidine	3-Nitroaniline	4,6-Dinitro-2-methylphenol
4-Bromophenyl phenyl ether	4-Chloro-3-methylphenol	4-Chloroaniline
4-Chlorophenyl phenyl ether	4-Nitroaniline	4-Nitrophenol
Acenaphthene	Acenaphthylene	Aniline
Anthracene	Benzo(a)anthracene	Benzo(a)pyrene
Benzo(b)fluoranthene	Benzo(g,h,i)perlyene	Benzo(k)fluoranthene
Benzoic acid	Benzyl alcohol	Bis(2-chloroethoxy) methane
Bis(2-chloroethyl) ether	Bis(2-chloroisopropyl) ether	Bis(2-ethylhexyl) phthalate
Butyl benzyl phthalate	Chrysene	Dibenz(a,h)anthracene
Dibenzofuran	Diethyl phthalate	Dimethyl phthalate
Di-n-butyl phthalate	Di-n-octyl phthalate	Fluoranthene
Fluorene	Hexachlorobenzene	Hexachlorobutadiene
Hexachlorocyclopentadiene	Hexachloroethane	Indeno(1,2,3-cd) pyrene
Isophorone	m-Cresol (3-Methylphenol)	Naphthalene
Nitrobenzene	N-Nitrosodimethylamine	N-Nitrosodi-n-propylamine
N-Nitrosodiphenylamine	o-Cresol (2-Methylphenol)	o-Cresol (2-Methylphenol)
p-Cresol (4-Methylphenol)	Pentachlorophenol	Phenanthrene
Phenol	Pyrene	Pyridine

STATE OF ALASKA

DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
CONTAMINATED SITES PROGRAM

LABORATORY APPROVAL

LABORATORY: SGS/CT&E ENVIRONMENTAL SERVICES, INC.
200 W. POTTER DR.
ANCHORAGE, AK 99518-1605

APPROVAL NUMBER: UST-005 EXPIRES: DECEMBER 18, 2004

APPROVED FOR THE ANALYSIS OF:

AROMATIC/ALIPHATIC SEPARATION FUEL METHOD (AK101AA) IN WATERS AND SOILS;
GASOLINE RANGE ORGANICS BY AK101 IN WATERS AND SOILS;
DIESEL RANGE ORGANICS BY AK102 IN WATERS AND SOILS; RESIDUAL RANGE ORGANICS BY AK103 IN SOILS;
SW-846 PREP METHOD 3546 IN CONJUNCTION WITH AK102 & AK103 SOILS;
BTEX BY AK101/8021B/8260B IN WATERS AND AK101/8260B SOILS;
PAHS BY 8270C-SIM IN WATERS AND SOILS; PCBS BY 8082 IN WATER AND SOILS
VCSS BY 8021B IN WATERS AND 8260B IN WATERS AND SOILS;
AS, BA, CD, CR, NI, PB, AND V BY 6020; BA, CR, NI, AND V BY 6010B;
AS BY 7060A; CD BY 7131A; CR BY 7191; PB BY 7421 IN WATERS AND SOILS

Sara Rairick

SARA RAIRICK
CS LAB APPROVAL OFFICER

STATE OF ALASKA

DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Laboratory Certification Program

Certification for Drinking Water Analysis

SGS/CT&E Environmental Services
200 West Potter Drive
Anchorage, AK 99518-1605

Certificate Number: AK971-04 **Expires:** November 4, 2004

Fully certified for:
EPA 150.1 pH
EPA 200.7 Aluminum, Arsenic, Barium, Beryllium, Calcium, Chromium, Copper, Iron, Magnesium, Manganese, Nickel, Sodium, Zinc
EPA 200.8 Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Manganese, Nickel, Selenium, Silver, Thallium, Zinc, Vanadium
EPA 200.9 Antimony, Arsenic, Cadmium, Chromium, Lead, Selenium, Silver, Thallium
EPA 245.1 Mercury
EPA 300.0 Chloride, Fluoride, Nitrate, Nitrite, Sulphate, o-Phosphate
EPA 415.1 TOC
EPA 504.1 EDB, DBCP
EPA 524.2 Trihalomethanes (THMs) and Volatile Organic Compounds (VOCs)
SM 2120 B Color
SM 2130 B Turbidity
SM 2150 B Odor
SM 2320 B Alkalinity
SM 2330 B Corrosivity
SM 2510 B Conductivity
SM 2540 C Total Dissolved Solids (TDS)
SM 4500-CN C,E Cyanide
SM 5540 C Foaming Agents

David Clover
Certification Officer - Chemistry

12/2/03
Date

THE SEAL OF THE STATE OF ALASKA

STATE OF ALASKA

DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

Laboratory Certification Program

Certificate of Approval for Drinking Water Analyses

Laboratory: **SGS/CT&E Environmental Services**
200 W. Potter Drive
Anchorage AK 99518

Issued: **December 18, 2003**

Lab Identification Number: **AK00971**

Expires: **December 31, 2004**

FULLY CERTIFIED TO PERFORM MICROBIOLOGICAL ANALYSIS BY THE FOLLOWING METHODS: Membrane Filter, Chromogenic/Fluorogenic, Heterotrophic Plate Count

Veronica D Boer
Veronica DeBoer
State of Alaska Certification Officer

12/18/2003
Date

Thomas K Hathaway
Thomas Hathaway
State of Alaska Certification Authority

12/18/2003
Date

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
STATE LABORATORIES DIVISION
2725 WAIMANO HOME ROAD
PEARL CITY, HAWAII 96782-1496

In reply, please refer to:
File: EHASB/Chemistry

November 4, 2003

Ms. Marina I. Mitchell
Quality Assurance Manager
SGS/CT&E Environmental Services
200 West Potter Drive
Anchorage, Alaska 99518-1605

Dear Ms. Mitchell:

After a review of the required documents, we are pleased to recommend that the data for drinking water analyses be "accepted" for regulatory purposes by the Hawaii Department of Health, Safe Drinking Water Branch, until **November 4, 2004** for the parameters listed on the following pages. **All testing for regulatory drinking water purposes must be done with approved methods that are specified in this certification, and PE studies should be passed using these methodologies. The laboratory annually must successfully complete a PE study for each analyte to be certified. Failure to do so would result in the loss of approval status with this state. In addition, the laboratory should perform its first PE study within the first half of the year.**

It is the laboratory's responsibility to keep the Department of Health Certification Program informed by continuing to submit results of applicable PE studies, copies of in-state on-site evaluation reports, and immediate notification of any significant changes. The certification of your laboratory in Hawaii is based on your in-state and/or on your NELAP certification. As a result, any changes to your in-state and/or on your NELAP certification status must be submitted immediately.

All samples that are contracted out by your laboratory for Hawaii regulatory drinking water monitoring purposes must be analyzed by laboratories that have been approved by the Hawaii Safe Drinking Water Program. A list of Hawaii approved certified laboratories is available from Richard Kiyokane (808-453-6679) or from the Hawaii Safe Drinking Water Program (808-586-4271).

To avoid interruption of your approval, you must submit a written request for renewal <u>at least two months prior to the expiration date indicated above</u>.

If you have any questions, please contact Richard Kiyokane, Laboratory Certification Officer, at (808) 453-6679. Thank you for your time and efforts.

Sincerely,

VERNON K. MIYAMOTO, Ph.D.
State Laboratories Administrator

VKM:rk
Enclosure
c: W. Wong, Chief, Safe Drinking Water Branch

It is recommended that data from the following laboratory be accepted for regulatory purposes by the Hawaii Department of Health, Safe Drinking Water Branch for the contaminants listed on the following pages until **November 4, 2004**.

SGS/CT&E ENVIRONMENTAL SERVICES INC.
200 W. POTTER DRIVE
ANCHORAGE, AK 99518-1605
Marina I. Mitchell, Quality Assurance Manager
(907) 562-2343

Inorganic Chemistry and Physical Properties of Drinking Water

Chloride	EPA 300.0
Fluoride	EPA 300.0
Nitrate	EPA 300.0
Nitrite	EPA 300.0
Sulfate	EPA 300.0
Ortho-Phosphate-P	EPA 300.0
pH	EPA 150.1
Conductivity	SM2510B
Corrosivity	SM2330B
Alkalinity	SM2320B
Total Dissolved Solids	SM2540C
Turbidity	SM2130B
Odor	SM2150B
Color	SM2120B
Foaming Agents	SM5540C
Cyanide, total	SM4500CN-C-E

Inorganic Chemistry Trace Metals of Drinking Water

Aluminum	EPA 200.7, 200.8
Antimony	EPA 200.8, 200.9
Arsenic	EPA 200.8, 200.9
Barium	EPA 200.7, 200.8
Beryllium	EPA 200.7, 200.8
Cadmium	EPA 200.8, 200.9
Calcium	EPA 200.7
Chromium	EPA 200.7, 200.8, 200.9
Copper	EPA 200.7, 200.8
Iron	EPA 200.7
Lead	EPA 200.8, 200.9
Manganese	EPA 200.7, 200.8
Mercury	EPA 245.1
Nickel	EPA 200.7, 200.8
Selenium	EPA 200.8, 200.9
Silver	EPA 200.8, 200.9
Sodium	EPA 200.7
Thallium	EPA 200.8, 200.9
Zinc	EPA 200.7, 200.8

Organic Chemistry of Drinking Water

1,2-Dibromoethane (EDB)	EPA 504.1
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1
Volatile Organic Compounds	EPA 524.2
Vinyl Chloride	EPA 524.2
Trihalomethanes	EPA 524.2

RECOMMENDED:

11/4/03

Richard Kiyokane Date
Laboratory Certification Officer

APPROVED:

NOV - 5 2003

Vernon K. Miyamoto, Ph.D. Date
State Laboratories Administrator

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
STATE LABORATORIES DIVISION
2725 WAIMANO HOME ROAD
PEARL CITY, HAWAII 96782-1496

In reply, please refer to:
File: EHASB/Chemistry

April 2, 2004

Ms. Marina I. Mitchell
Quality Assurance Manager
SGS/CT&E Environmental Services
200 W. Potter Drive
Anchorage, Alaska 99518-1605

Dear Ms. Mitchell:

This letter of certification is to append the certification letter of November 4, 2003. After review of the required documents, and based on your State of Alaska Drinking Water Certification, we are pleased to recommend that data for drinking water analyses be "accepted" for regulatory purposes by the State of Hawaii, Department of Health, Safe Drinking Water Program, until **November 4, 2004** for the analysis of **1,2,3-trichloropropane by EPA method 504.1.**

If you have any questions, please call Richard Kiyokane, Laboratory Certification Officer, at (808) 453-6679. Thank you for your time and efforts.

Sincerely,

Vernon K. Miyamoto, Ph.D.
State Laboratories Administrator

VKM:rk

Enclosure

c: W. Wong, Chief Safe Drinking Water Program

It is recommended that data from the following laboratory be accepted for drinking water analyses by the State of Hawaii, Department of Health, Safe Drinking Water Branch for regulatory purposes, for the listed analyte until **November 4, 2004.**

SGS/CT&E ENVIRONMENTAL SERVICES INC.
200 W. POTTER DRIVE
ANCHORAGE, ALASKA 99518-1605

Marina I. Mitchell, Quality Assurance Manager
(907) 562-2343

Organic Chemistry of Drinking Water

1,2,3-Trichloropropane	EPA 504.1

RECOMMENDED:

Richard Kiyokane 4/2/04
Richard Kiyokane Date
Certification Officer

APPROVED:

4/2/04
Vernon K. Miyamoto, Ph.D. Date
State Laboratories Administrator

Soil Permit

Permit Number: S-38195 Revised

UNITED STATES DEPARTMENT OF AGRICULTURE

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

Issued To: CT&E Environmental Services, Inc.
(Charles G. Homestead)
200 W. Potter
Anchorage, Alaska 99518-1605

TELEPHONE: (907) 562-2343

Under the authority of the Federal Plant Pest Act of May 23, 1957, permission is hereby granted to the facility/individual named above subject to the following conditions:

1. Valid for shipments of soil not heat treated at the port of entry, only if a Compliance Agreement (PPQ Form 519) has been completed and signed. Compliance Agreements and Soil Permits are non-transferable. If you hold a Soil Permit and you leave your present employer or Company, you must notify your local USDA office promptly. A copy of this permit must accompany all shipments.
2. To be shipped in sturdy, leakproof, containers.
3. To be released without treatment at the port of entry to permittee or authorized user.
4. To be used only for analysis and only in the facility of the permittee at CT&E Environmental Services, Inc., located in Anchorage, Alaska.
5. No use of soil for growing purposes is authorized, including the isolation or culture of organisms imported in soil.
6. All unconsumed soil, containers, and effluent is to be autoclaved, incinerated, or heat treated by the permittee at the conclusion of the project as approved and prescribed by PPQ.
7. This permit authorizes shipments from all foreign sources, including Guam, Hawaii, Puerto Rico, and the U.S. Virgin Islands through any U.S. port of entry.

SEPTEMBER 30, 2008
Expiration Date

Lia Stewart
Approving Official LIA STEWART

WARNING: Any alteration, forgery, or unauthorized use of this Federal form is subject to civil penalties of up to $250,000 (7 U.S.C. s 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C. s 1001).

PPQ FORM 525B (8/94)

PART 1 - PERMITTEE

USDA

Soil Permit

Permit Number: HON-S-210

United States Department of Agriculture

Issued To: CT & E Environmental Services, Inc.
255 Sand Island Access Road. #1B
Honolulu, Hawaii 96819
Telephone: (808)224-6217

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

Under the authority of the Federal Plant Protection Act of 2000, permission is hereby granted to the facility/individual named above subject to the following conditions:

1. Valid for shipments of soil not heat treated at the port of entry, only if a compliance agreement (PPQ Form 519) has been completed and signed.
2. To be shipped in sturdy, leakproof containers.
3. To be released without treatment at the port of entry.
4. To be used only for analysis and only in the facility of the permittee, CT & E Environmental Services, Inc. located in, Honolulu, Hawaii.
5. No use of soil for growing purposes is authorized, including the isolation or culture of organisms imported in soil.
6. All unconsumed soil, containers and effluent is to be autoclaved, incinerated or heat treated by the permittee at the conclusion of the project as approved and prescribed by Plant Protection and Quarantine.
7. This permit authorizes shipments from all foreign sources, including Guam, Hawaii, Puerto Rico and the U.S. Virgin Islands through any U.S. port of entry staffed by Plant Protection and Quarantine.
8. Permittee shall notify the office of USDA-APHIS-PPQ at (808) 861-8446 or Fax (808) 861-8450 of all shipments arriving at or through any military facility (Hickam AFB, Barbers Point NAS, Kaneohe MCBH) at least 24 hrs. prior to arrival.

JANUARY 28, 2007
Expiration Date

Alan N. Yamiya
Approving Official - Alan N. Yamiya

*** A COPY OF THIS PERMIT MUST ACCOMPANY EACH SHIPMENT**

ATTACHMENT 2

OPERATOR'S MANUALS FOR FIELD EQUIPMENT

Photoionization Detector
Peristaltic Pump
Horiba U22 Water Quality Meter

(This page intentionally left blank).

2020 Photoionization Air Monitor

User's Manual

PE PHOTOVAC

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Reference No. 600762

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Notices and Warnings

FCC Warning

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Subpart B, Class B of Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

2020 I/S Notice

Listed
ETL®
77463
ETL C®

CONFORMS TO
UL STANDARD 913

CERTIFIED TO
CSA STANDARD
CSA 22.2 No. 157

Intrinsically safe/Sécurité intrinsèque for use in Class I, Division 1, Groups A, B, C, D, Hazardous Locations, Temperature Code T4, Exia

2020 I/S IS CLASSIFIED FOR USE IN CLASS I, DIVISION 1, GROUPS A, B, C, D HAZARDOUS LOCATIONS. T4 (135°C) RATING.

It has been listed by ETL® to comply with Underwriters Laboratories® Inc. UL® 913 *Standard for Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, Division 1, Groups A, B, C, D Hazardous (Classified) Locations*, Fourth Edition.

2020 I/S IS NOT INTENDED TO DETECT COMBUSTIBLE LEVELS OF GASES. 2020 I/S IS CLASSIFIED FOR USE IN ATMOSPHERES CONTAINING COMBUSTIBLE LEVELS OF GASES.

These PE Photovac accessories are for use with 2020 I/S in a hazardous location:

350006	Calibration Regulator
350007	Wrist Strap
350008	Belt-Clip Holster
350010	Carrying Case
350014	User's Reference Card
390006	Long Sample Probe
395001	Short Sample Probe

Do not use any other accessories with 2020 I/S in a hazardous location.

Substitution of components may affect safety rating.

CAUTION

To reduce the risk of fire or injury to persons, read and follow these instructions:

1. All calibration, maintenance and servicing of this device, including battery charging, must be performed in a safe area away from hazardous locations.
2. For replacement battery pack use only Part No. 350009.
3. Do not dispose of the battery pack in a fire. The cell may explode. The battery pack must be disposed of properly or returned to PE Photovac for recycling. Check with local codes for possible special disposal instructions.
4. Do not open or mutilate the battery pack.
5. Exercise care in handling battery packs in order not to short the terminals with conducting materials such as rings, bracelets and keys. The battery or conductor may overheat and cause burns.
6. Do not defeat proper polarity orientation between the battery pack and battery charger.
7. Charge the battery pack using the AC adapter provided with or identified for use with this product only in accordance with the

instructions and limitations specified in this manual. For AC adapter use only Part No. 350002 (115 Volts AC), 396013 (220 Volts AC).

ATTENTION

2020 I/SC EST CLASSIFIÉ POUR USAGE DANS LES EMPLACEMENTS DANGEREUX DE CLASSE I, DIVISION 1, GROUPES A, B, C, D. ÉVALUATION T4 (135°C).

2020 I/SC est conforme à la norme des Underwriters Laboratories Inc. UL 913 *Standard for Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, Division 1, Groups A, B, C, D Hazardous (Classified) Locations*. Quatrième édition.

2020 I/SC est conforme à la norme de *CSA Standard 22.2 No. 157-92 - Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations.*

2020 I/SC C'EST NE PAS INTENDER POUR DETECTER DES NIVEAUX DE COMBUSTION DES GAZ. CET APPAREIL EST CLASSIFIÉ POUR USAGE DANS DES ATMOSPHÈRES CONTENANT DES NIVEAUX DE COMBUSTION DES GAZ.

Les accessoires PE Photovac suivants peuvent également être utilisés avec l'appareil dans un emplacement dangereux:

350006	Régulateur de calibration
350007	Sangle de poignet
350008	Étui de ceinture
350010	Étui de transport
350014	Carte de référence
390006	Gamme d'échantillons
395001	Petite Gamme d'échantillons

Ne pas utiliser d'autres accessoires avec cet appareil dans un emplacement dangereux.

La substitution des composantes peut nuire à la sécurité d'emploi.

MISE EN GARDE

Afin de réduire les risques d'incendie et les blessures, lire et suivre ces instructions:

1. Tout étalonnage, entretien et réparation de cet appareil, y compris le chargement de la pile, doit être effectué dans un endroit sûr, à l'écart des zones dangereuses.

2. N'utiliser que la pièce numéro 350009 lorsqu'il faut remplacer le bloc-pile.
3. Ne pas jeter la pile dans un feu. La cellule pourrait exploser. Vérifier les codes locaux, qui peuvent comporter des instructions de mise au rebut particulières.
4. Ne pas ouvrir et ne pas abîmer le bloc-pile.
5. Manipuler le bloc-pile avec soin, afin de ne pas court-circuiter les bornes avec des matériels conducteurs tels qu'une bague, un bracelet ou des clés. La pile ou le conducteur pourraient surchauffer et causer des brûlures.
6. Ne pas modifier l'orientation de la polarité appropriée entre le bloc-pile et le chargeur.
7. Charger le bloc-pile fourni avec ou reconnu pour usage avec ce produit seulement conformément aux instructions et restrictions spécifiées dans ce manuel. Pour le chargeur, n'utiliser que la pièce numéro 350002 (115 Volts AC), 396013 (220 Volts AC).

2020 Ex Notice

CONFORMS TO
EEx ib m IIC T4.
DEMKO NO. 95D 119 472

CLASSIFIED BY DEMKO AS INSTRINSICALLY SAFE FOR USE IN ZONE 1 LOCATIONS. EEx ib m IIC T4.
DEMKO NO. 95D 119 472

2020 Ex complies with the harmonized European Standards EN50014 incl. amd. 1 - 5, EN50020 incl. amd. 1 - 5.and EN50028, First Edition (1987).

2020 EX IS NOT INTENDED TO DETECT COMBUSTIBLE LEVELS OF GASES. 2020 EX IS CLASSIFIED FOR USE IN ATMOSPHERES CONTAINING COMBUSTIBLE LEVELS OF GASES.

These optional accessories may be used with 2020 Ex in a hazardous location:

350006	Calibration Regulator
350007	Wrist Strap
350008	Belt-Clip Holster
350010	Carrying Case
350014	User's Reference Card
390006	Long Sample Probe
395001	Short Sample Probe

Do not use any other accessories with 2020 Ex in a hazardous location.

Substitution of components will invalidate certificate.

CAUTION

To reduce the risk of fire or injury to persons, read and follow these instructions:

1. All calibration, maintenance and servicing of this device, including battery charging, must be performed in a safe area away from hazardous locations.
2. For replacement battery pack use only Part No. 350009.
3. Do not dispose of the battery pack in a fire. The cell may explode. The battery pack must be disposed of properly or returned to PE Photovac for recycling. Check with local codes for possible special disposal instructions.
4. Do not open or mutilate the battery pack.
5. Exercise care in handling battery packs in order not to short the terminals with conducting materials such as rings, bracelets and keys. The battery or conductor may overheat and cause burns.
6. Do not defeat proper polarity orientation between the battery pack and battery charger.
7. Charge the battery pack using the AC adapter provided with or identified for use with this product only in accordance with the instructions and limitations specified in this manual. For AC adapter use only Part No. 350002 (115 Volts AC), 396013 (220 Volts AC).

CE Directive

CE

CONFORMS TO
COUNCIL DIRECTIVE 89/336/EEC
COUNCIL DIRECTIVE 91/157/EEC

Council Directive 89/336/EEC - Electromagnetic Compatibility and the Applicable Standards. 2020 complies with EN50082-01 Generic Immunity Standard for Electromagnetic Compatibility Part 1: Light Industrial Environment. 2020 has been tested and conforms to the guidelines specified in EN50082-02 Generic Immunity Standard for Electromagnetic Compatibility Part 2: Industrial Environment

Council Directive 91/157/EEC - Recovery and Disposal of Spent Batteries

You must use the 220 V battery charger (Part No. 396013) in order to comply with the requirements of the applicable Council Directives.

1. Introduction

1.1. About this Manual

This manual provides detailed instructions for setup, operation and maintenance of the PE Photovac 2020™ Photoionization Air Monitor.

Before unpacking the instrument, please read Section 1.2 Warnings and Safety Practices. This section describes possible hazards that might injure the user, damage the instrument or compromise its operation. Some general safety information is also provided.

To help you learn to use 2020 quickly, this manual is organized by tasks beginning with a tutorial and description of operation in Chapter 2. More detailed operational instructions are provided in Chapter 3. Accessories are covered in Chapter 4. Routine maintenance is covered in Chapter 5. Troubleshooting techniques are covered in Chapter 6. Chapter 7 provides a technical description of 2020.

The 2020 manual uses a few conventions for key names on the keypad and for text that is shown on the display.

UPPERCASE	Fixed key names are denoted by uppercase text.
"Display Text"	Text that appears on the 2020 status display is in quotation marks.

	Soft key names are also shown in quotation marks.
<Angle Brackets>	Computer keyboard names are denoted by angle brackets, e.g. <Ctrl>.
C:\2020	Text that must be typed in using the computer keyboard is shown in italics.

In the text you will find various warnings and notes.

Warning: A warning indicates an operation that could cause personal injury if precautions are not followed.

Note: A note indicates an operation that could cause instrument damage if precautions are not followed. A note also indicates significant information.

1.2. Warnings and Safety Practices

Please read this section before operating 2020.

1.2.1. Approved Models of 2020

This manual provides operational information for all models of 2020. The 2020 I/S and the 2020 Ex are intrinsically safe and approved for use in hazardous locations. Refer to the manual introduction for details of each approval.

Throughout the manual, notes are provided to inform you of the limitations of usage for the 2020 I/S and 2020 Ex models.

Warning: If the 2020 you are using is not specifically identified as intrinsically safe, do not use it in a location were flammable concentrations of gases and vapors may exist.

1.2.2. Compressed Gases

Cylinders of compressed gas, such as calibration gas, must be handled with extreme care. For safety, the calibration gas cylinders must be secured before use.

Please observe the following handling procedures:

1. Mark each new regulator with its intended gas service and never use a regulator for more than one service. To ensure safety and avoid contamination, regulators should be dedicated to one service. Do not change gas service or adapt equipment without consulting your gas supplier.
2. Do not heat or expose cylinders or regulators to temperatures above 52°C (125°F). The cylinders may rupture at high temperatures.
3. Use only the specified regulator for the calibration gas. Confirm regulator type and material with your specialty gas supplier.
4. Always secure cylinders before removing the cylinder valve protection cap.
5. Do not drag or roll cylinders. Large cylinders should only be moved on carts designed for compressed gas cylinders. Do not move cylinders without the valve protection cap in place.
6. Wear safety glasses when working with compressed gases.
7. Do not store cylinders in a hazardous location. Store cylinders in an upright position away from possible sources of heat or sparks.
8. Never plug, obstruct or tamper with safety relief devices.

1.2.3. Regulators for Compressed Gases

When connecting a regulator to a large cylinder:

1. Ensure cylinder valve and regulator connection match.
2. Ensure regulator construction materials are compatible with the gas, and that the cylinder pressure gauge will withstand the cylinder pressure.
3. Never use the regulator as a shut-off valve. Close the cylinder when it is not in use.
4. Do not subject the regulator to an inlet pressure greater than recommended.
5. Do not move or detach the regulator when it is pressurized or when it is in use.
6. Before connection, ensure the gas cylinder valve and the regulator CGA connection are clean.

7. Turn the pressure control valve on the cylinder all the way out (close the cylinder). Turn the regulator outlet to off. Open the gas cylinder valve slowly and check for leaks. Adjust the delivery pressure and then open the regulator outlet valve.

1.2.4. Calibration Gas

Adequate ventilation must be provided when 2020 is being calibrated.

If compound threshold limit values (TLV™) are exceeded, you should use a gas bag for sampling and calibration.

To determine the TLV of the compounds contained in the calibration gas, refer to the Material Safety Data Sheet (MSDS) supplied with your calibration gas cylinder. See Section 3.3 for details of calibration using a gas bag.

1.2.5. Battery Pack Care

Leaving 2020 for more than 3 months, without turning it on, may result in the loss of recorded data and setup parameters. If 2020 is not used for long periods of time, turn the instrument on for a few hours every month to avoid loss of data. See Section 1.5 for instructions on charging the battery.

Please observe the following:

1. For replacement battery pack use only Part No. 350009.
2. Do not dispose of the battery pack in a fire. The cell may explode.
3. The battery pack is 24% cadmium (Cd) by weight. This battery pack must be disposed of properly. Check with local codes for special disposal instructions. Alternatively, you can return the battery pack to the nearest PE Photovac facility for recycling.
4. Do not open or mutilate the battery pack.
5. Exercise care in handling battery packs in order not to short the terminals with conducting materials such as rings, bracelets and keys. The battery or conductor may overheat and cause burns.
6. Charge the battery pack using the AC adapter provided with or identified for use with this product only in accordance with the

instructions and limitations specified in this manual. For AC adapter use only Part No. 350002 (North America) or 396013 (Europe).

1.2.6. Excessive Heat and Cold

Do not expose the instrument to intense sunlight for prolonged periods.

Exposure to excessive heat or cold may result in erroneous readings.

1.3. Unpacking

The following accessories are included with your 2020:

1. Sample Probe
2. User's Manual
3. Multi-Tool
4. AC Adapter or AC Adapter with AC Line Cord
5. Wrist Strap
6. Replacement Sample Inlet Filters (10 pieces)
7. Reference Card

Ensure all of these accessories have been included with the instrument. If any items are missing or damaged, contact PE Photovac immediately.

1.4. Support Equipment and Consumables

1.4.1. Calibration

For normal operation these items are required:

1. Calibration Gas Regulator (Part No. 350006).
2. Calibration gas containing 100 ppm isobutylene. (Part No. 350012). Other concentrations of the calibration gas may be required. This will depend on your application.
3. Zero air. Occasionally, clean, ambient air is suitable for calibration.

Alternatively, you can use a gas sampling bag and a source of hydrocarbon free air. Air should not have more than 0.1 ppm total hydrocarbons (THC).

If you will be using large tanks of gas, specify a single stage, high purity regulator with a CGA 590 connection at the inlet. The regulator should also have a 1/8" parallel, compression fitting with which to connect the regulator to the gas bag adapter. The delivery pressure must be adjustable to between 5 and 20 psig (34.5 and 138 kPa). You may require a gas bag and gas bag adapter (Part No. 395072 - gas bag, 395073 - gas bag and adapter).

4. If compound threshold limit values (TLVs) are exceeded, you should use a gas bag for sampling and calibration.

   To determine the TLV of the compounds contained in the calibration gas, refer to the Material Safety Data Sheet (MSDS) supplied with your calibration gas cylinder.

   If you will be using a gas bag for calibration, you should obtain the calibration kit (Part No. 390033). The calibration kit contains a regulator, a gas sampling bag and a gas bag adapter. See Section 3.3 for details of calibration using a gas bag.

1.4.2. Field Operation

For field operation, a 2020 Field Kit (Part No. 350005) is available. The field kit includes a cable kit, a carrying case and a calibration regulator, spare battery pack and a cylinder of 100 ppm isobutylene calibration gas.

Refer to the check list in Section 3.7 to ensure you have all the necessary accessories and equipment before beginning field operation.

1.4.3. Printer

2020 may be used with a printer to generate printed reports. The printer must have a printing width of at least 65 characters and must use fixed spaced fonts. See Section 4.1 for details of connecting a printer to 2020.

If you are using a parallel printer, you will need the serial to parallel converter (Part No. 380145). See Section 4.3 for details of connecting and operating 2020 with a serial to parallel converter.

Note: 2020 is not classified for use in hazardous locations with a printer.

1.4.4. Computer

2020 may also be connected to a computer. The computer must be 100% compatible with an IBM PC. Use the cable kit (Part No. 350011) to connect 2020 to the computer.

You will also need terminal emulation software. Software packages such as Crosstalk®, and Procomm® are recommended for use with 2020. If you are using Microsoft® Windows™ you do not need to purchase any separate software. If you are already using another type of communication or terminal emulation software package, it is not necessary to purchase separate software for 2020. See Section 4.2 for details.

Note: 2020 is not classified for use in hazardous locations with a computer.

1.5. Battery Charging

Before beginning operation of 2020, the battery pack must be charged. You can also remove the battery pack and replace it with a fully charged, spare battery pack (Part No. 350009).

Note: You must use the 220 V battery charger (Part No. 396013) in order to comply with the requirements of the applicable Council Directives.

1.5.1. Removing and Replacing the Battery Pack

Note: Do not remove or recharge the battery pack in a hazardous location

1. If the instrument has been turned on, turn it off by pressing the ON/OFF key momentarily and then releasing it.

Note: If you do not turn 2020 off before removing the battery pack, you will reset the instrument and you will lose all logged data and setup parameters.

2. Locate the battery hatch on the back of the instrument. See Figure 1.
3. Loosen the two screws in the battery hatch.
4. The battery hatch can now be removed.
5. Lift the battery pack out of the case and carefully disconnect the connector from 2020.
6. Attach the connector from the charged battery pack to the 2020.

Note: The connector is polarized. It will only fit one way. Do not force the connection.

7. Place the battery pack in the 2020 case. Ensure the battery wires are not pinched or strained.
8. Ensure the wrist strap ring is in place. This ring holds the wrist strap in place.
9. Replace the battery hatch and then replace the two screws. Do not over-tighten the screws as you will damage the case.

1.5.2. Charging the Battery Pack

Note: Only use the AC adapter specified for use with 2020. Using another AC adapter will result in damage to the battery pack, 2020 or the adapter itself.

1. Plug the AC adapter into the jack located on the back of the 2020. See Figure 1.
2. Plug the AC adapter into an AC outlet. If you are using the European AC adapter, ensure the correct plug is installed on the line cord. If it is not correct for the wall outlet in your area then it must be replaced. See Appendix 8.4.
3. The LED on the 2020 indicates the charge state. Red indicates the battery is being charged. Green indicates the battery is fully charged and ready for use.

   It is normal for a fully charged battery to indicate it is charging (red light) when first plugged in. The LED will turn green as the battery charges.

4. When the battery pack is fully charged remove the AC adapter, first from the wall outlet and then from 2020.

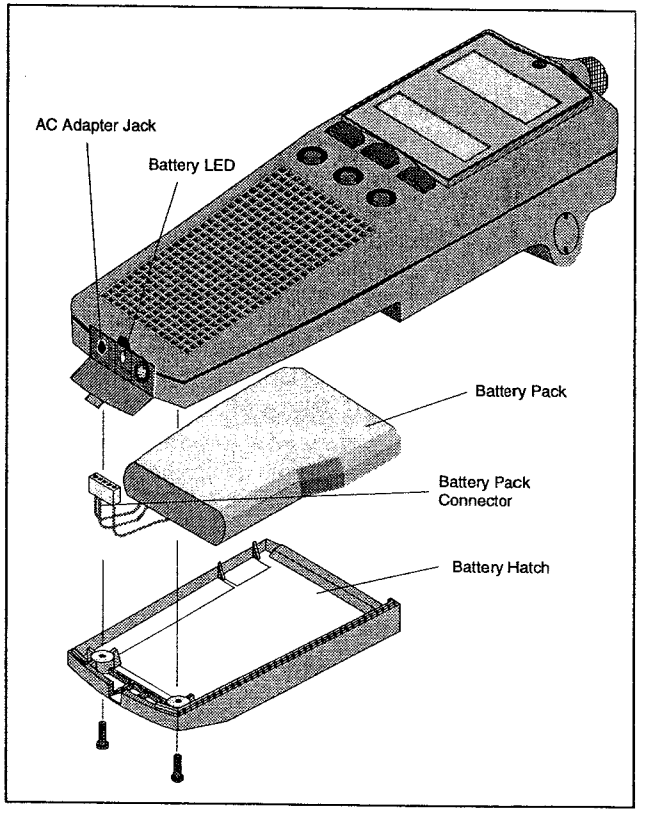

Figure 1 Battery Pack Removal and Replacement

Charging a fully discharged battery pack will take approximately 4 hours.

Optionally you can use the off line charger (Part No. 350015, 350019) to charge the battery pack independently of the instrument. See Section 4.8.

If you are charging the battery pack in the instrument you can use all the features of 2020 while the battery pack is being charged.

Leaving the AC adapter connected to 2020 will not harm the battery or the AC adapter in any way. If 2020 is to be left indefinitely, leave it connected to the AC adapter so that the battery will be fully charged and ready for operation.

On average a fully charged battery pack will provide 8 hours of continuous operation. Battery life is shorter if the instrument is turned off and then on again repeatedly or if the backlighting is turned on.

I.6. Overview

2020 measures the concentration of airborne photoionizable gases and vapors and automatically displays and records these concentrations. It does not distinguish between individual pollutants. The reading displayed represents the total concentration of all photoionizable chemicals present in the sample. 2020 is factory set to display concentration in units of ppm or mg/m^3.

2020 operates automatically. The meter display updates itself once per second. You can read concentrations directly from the meter display. If you are using the dilution probe (Part No. 350013) you must multiply the displayed reading by the dilution factor. See Section 4.5 for details.

2020 is always performing short term exposure limit (STEL), time weighted average (TWA) and PEAK calculations. You can view any of these results, but only one mode may be viewed at a time.

2020 has many datalogging options. You can select an averaging interval, or you can use manual operation. If you select an averaging interval, the minimum, maximum, and average concentrations measured in each period are automatically recorded in 2020's datalogging memory. 2020 can log up to 1000 entries

In manual operation, 2020 prompts you to locate a site and then to record a background and sample readings for the site. You can record up to 1000 manual entries. There is no averaging of data in manual operation.

Recorded data can be reviewed on the display, sent to a printer in either tabular or graphical format, or sent to a computer. Data are recorded by date and time.

2020 has 6 keys for alphanumeric entry and for accessing 2020's functions. The keys are used to set up and calibrate 2020. They allow you to manipulate the concentration data in various ways.

All information entered with the keys and stored in 2020's memory is retained when the instrument is switched off. The clock and calendar continue to operate and do not need to be set each time 2020 is turned on.

Tutorial Session

Displays

The 2020 has a meter display for reporting detected concentration, and a status display used to display status information and guide you through configuration options. All functions of the 2020 will be controlled or reported using one of these displays.

2.1.1. Meter Display

The meter display is a 4 digit display. It will always be used for reporting detected concentration. When the detector and pump are off, the meter display will be blank.

In order to accommodate the range of concentrations 2020 can detect, the meter reading will be reported using one of 2 resolutions. A resolution of 0.1 will be used for concentrations below 100 ppm, and a resolution of 1 will be used for concentrations above 100 ppm.

The meter display reports PEAK, MAX, STEL or TWA concentration. The update rate is dependent on the reading being reported. See Section 2.5 for a description of these measurements.

2.1.2. Status Display

The status display is a 2 line by 16 character display. The top line is used to display status information and prompts you for information. The bottom line is used for soft key names. Up to 3 names can be

displayed for the three soft keys. If a name does not appear for a soft key, then the soft key has no associated function.

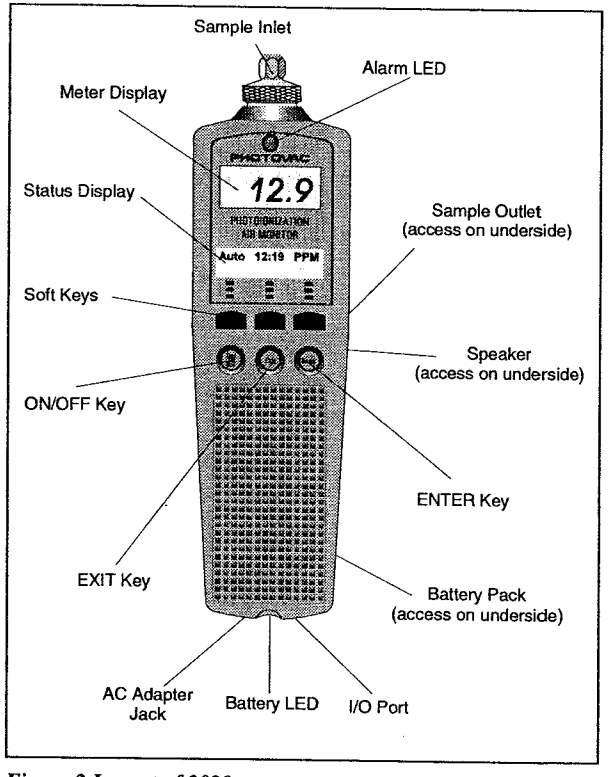

Figure 2 Layout of 2020

2.2. Keys

2.2.1. Fixed Keys

The three round keys below the soft keys each have a fixed function. The first key is the ON/OFF key, the middle key is EXIT and the last key is ENTER.

The ON/OFF key is used to both turn power on to the 2020 as well as turn the power off. To turn on 2020, press the ON/OFF key. To

turn the power off, press the ON/OFF key and hold it down for 2 seconds, and then release it. This is done to prevent accidental power off.

The EXIT key provides a way of returning to the default display. In the functional map, the soft keys allow you to advance and the EXIT key provides a way to go back. See Figure 3. If you are at the root entry of the menu, EXIT will return you to the default display.

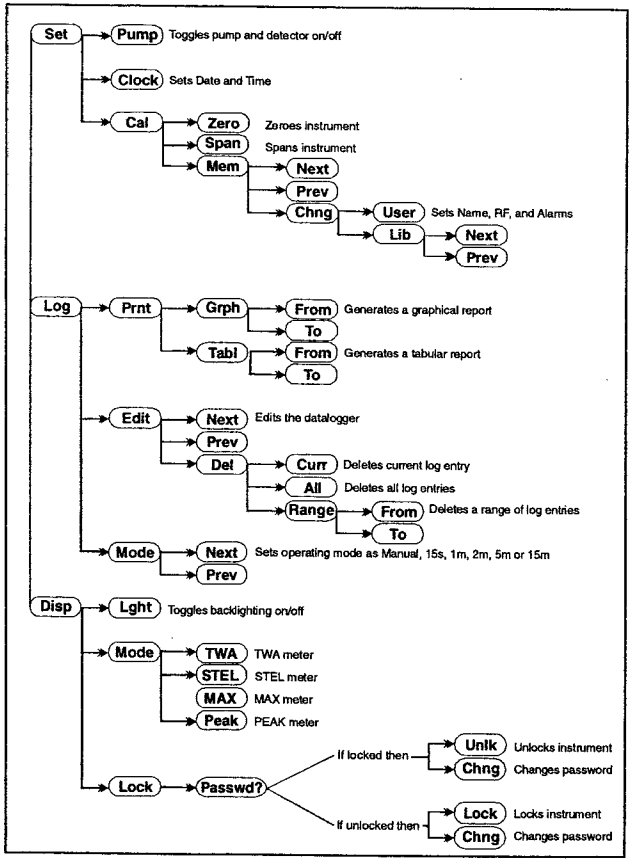

Figure 3 Function Map

The ENTER key has a context sensitive function. When you are operating or navigating through the function map, the ENTER key is used to exit the functions and return you to the default display. When entering data such as a name, number, date or time, ENTER is used to confirm the entry.

2.2.2. Soft Keys

The three soft keys on 2020 are located directly below the status display. Each key has varying functions for configuring 2020, editing the datalogger, and controlling the display. Since only three soft keys are available, each function is broken down into a path. A map, showing each path and the resulting functions, is shown in Figure 3.

2.2.3. Entering Text With the Soft Keys

For all information that you must enter, the left, center and right soft keys correspond to the up, down, and right arrow. See Figure 4.

The up and down arrows are used to change the character highlighted by the cursor. The right arrow is used to advance the cursor to the next character on the right. When the cursor is advanced past the right most character, it wraps around to the first character again. To accept the changes, press the ENTER key. To ignore the changes, press EXIT.

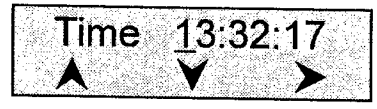

Figure 4 Soft Arrow Keys

Formatting characters, such as the colon (:) in the time, the decimal (.) in a concentration, and the slash (/) in date are skipped when advancing the cursor.

All inputs use an 8 character input, which is displayed on the right side of the top line of the status display. The prompt, describing the input, occupies the left half of the top line. The soft keys are defined on the bottom line of the status display.

2.3. Beginning Operation

2.3.1. Turning 2020 On

1. Turn 2020 on by pressing the ON/OFF key. See Figure 2 for the location of the ON/OFF key.
2. 2020 will display the software version number. Wait for the 2020 to proceed to the default display.
3. Allow 10 minutes for the instrument to warm-up and stabilize.

2.3.2. Default Display

The meter display shows the detected concentration. The resolution of the display changes with the magnitude of the reading. A reading of 0 to 99.9 will be displayed with a resolution of 0.1 ppm or mg/m³. A reading greater than 99.9 will be shown with a resolution of 1 ppm or mg/m³. The meter will display concentrations up to 2000 ppm or 2000 mg/m³.

The status display is used to display the instrument status, date, time, units and active soft keys. Figure 5 shows the status displays.

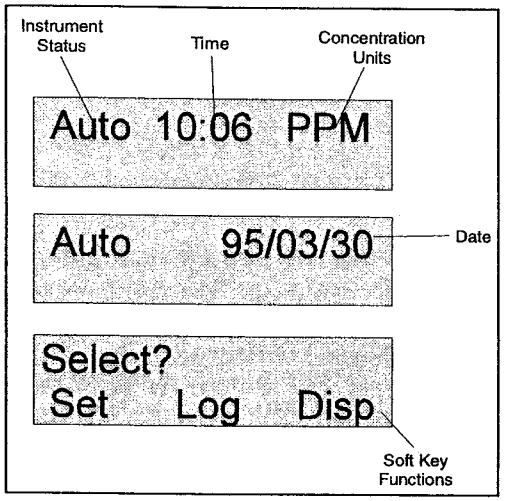

Figure 5 Status Displays

The default display provides the following information: instrument status, current detected concentration, time, date and measurement units. The status display toggles between showing time and units and then the date.

When the display mode is MAX, the date and time correspond to the date and time the MAX concentration was recorded. In TWA mode, the time represents the number of hours and minutes during which the TWA has been accumulating. For PEAK and STEL monitoring, the date and time correspond to the current date and time.

2.4. Monitoring

2.4.1. Instrument Status

The instrument status is shown on the left of the first line of the status display and on the Table and Graph outputs. Each status has a priority assigned to it. If more than one status is in effect, then the status with the highest priority is displayed until the condition is corrected or until the option is turned off. Table 1 is a list of the possible status messages.

Status	Description
Falt1	Zero fault. See Section 6.2.
Falt2	Span fault. See Section 6.2.
Falt3	Lamp fault. See Section 6.2.
Falt4	Pump fault. See Section 6.2.
Cal	Will not be observed on the display during normal operation as various calibration prompt messages are displayed during calibration. If the instrument is turned off during calibration, Cal will be displayed when 2020 is turned on again to indicate the last calibration was incomplete.
Over	Instrument over range. The detector electronics have become saturated. See Section 6.2.
ALPK	Detected concentration exceeds the PEAK alarm level.
ALST	STEL alarm level has been exceeded.
ALTW	TWA alarm level has been exceeded.
LBat	Battery pack power is low.
ELog	The datalogger is full.

Table 1 Instrument Status

Status	Description
TWA	TWA display mode.
MAX	MAX display mode.
STEL	STEL display mode.
Auto	PEAK display mode.
Loc	Locate site. Used for manual operation.
BkGd	Record background reading. Used for manual operation.
Samp	Record sample reading. Used for manual operation.
Off	Pump is off

Table 1 Instrument Status continued

2.4.2. Alarms

While operating the instrument, any one of three alarm conditions can occur. To accurately identify the source of the alarm, each type of alarm has been given a unique status. See Table 1.

In addition to the status, 2020 also has an audio alarm and an alarm LED. To conserve power the 2020 alternates between the LED and audio. Different alarms are identified by the frequency at which the 2020 alternates between the audio and LED; Peak alarm is 5 times per second, STEL alarm is 2.5 times per second, and TWA alarm is 1.25 times per second.

The left soft key is used for acknowledging alarms, and is named "Ack". If no alarm exists, then the "Ack" key is not shown. To clear the alarm, press the "Ack" key. Once acknowledged, the alarm indicators are cleared. The alarm status will remain until the alarm condition clears.

2020 updates the peak concentration once every second. Following every update, the peak concentration is compared to the peak alarm level, and if exceeded, an alarm is triggered.

If a 15 minute average exceeds the STEL, a STEL alarm is generated.

The TWA alarm is generated when the current average of concentration, since the TWA was last cleared, has exceeded the TWA exposure limit.

During calibration, all alarms are disabled. Once the calibration is complete, the alarms are re-enabled.

2.5. STEL, TWA, MAX and PEAK Operation

The 2020's meter display can be configured to show one of 4 values: STEL, TWA, PEAK and MAX.

2.5.1. Short Term Exposure Limit (STEL) Mode

The Short Term Exposure Limit (STEL) mode displays the concentration as a 15 minute moving average. 2020 maintains 15 samples, each representing a one minute averaging interval.

Once every minute, the oldest of the 15 samples is replaced with a new one minute average. This moving average provides a 15 minute average of the last 15 minutes with a one minute update rate. Since the average is calculated using 15 one minute averages, the meter display will only update once every minute.

STEL is set to zero each time the instrument is turned on. Since STEL is a 15 minute moving average, there is no need to clear or reset the STEL.

STEL calculations are always being performed by 2020. You can display the results of the calculations by selecting STEL as the Display mode. See Section 2.8.2 for details of switching between display modes.

2.5.2. Time Weighted Average (TWA) Mode

The TWA accumulator sums concentrations every second until 8 hours of data have been combined. If this value exceeds the TWA alarm setting, a TWA alarm is generated. The TWA is not calculated using a moving average. Once 8 hours of data have been summed, the accumulation stops. In order to reset the TWA accumulator, press the "Clr" key.

This sum will only be complete after 8 hours, so the meter displays the current sum divided by 8 hours. While you are in TWA mode, the time on the status display will show the number of minutes and hours of data that TWA has accumulated. When this reaches 8:00 or 8 hours, 2020 stops accumulating data and the TWA is complete.

TWA calculations are always being performed by 2020. You can display the results of the calculations by selecting TWA as the Display mode. See Section 2.8.2 for details of switching between display modes.

2.5.3. MAX Mode

The MAX mode displays the maximum signal, with the date and time that it was recorded. 2020 continues to log data according to the selected averaging interval, but only the maximum detected concentration is displayed on the meter display.

The right soft key is used to clear the meter when displaying MAX. The "Clr" key only affects the reading that the meter is displaying. For example, if you display the MAX reading, and you press "Clr", only the MAX value is cleared. The TWA is still accumulating in the background.

2.5.4. PEAK Mode

The PEAK mode displays the current detected concentration. The reading is updated once a second. In the background, the 2020 datalogger is sampling the concentration and measuring minimum, maximum, and average concentrations for the selected averaging interval. At the end of every interval, one entry is placed in the datalogger until the datalogger is full. See Section 2.8.2 for details of switching between display modes.

2.6. Set Functions

Set functions are used to setup 2020. There are 3 functions which can be set on the 2020; Calibration, Pump and Clock. Figure 6 shows a map detailing the Set functions and the key presses required for accessing them.

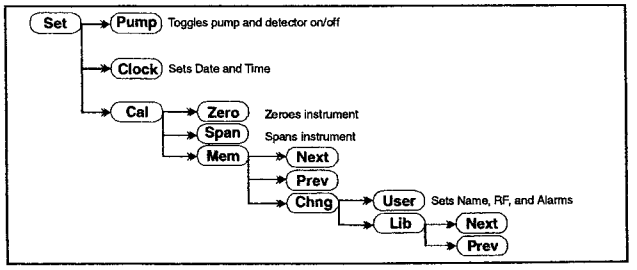

Figure 6 Set Function Map

2.6.1. Pump

The Pump function is used to control the pump. After selecting Set Pump, 2020 responds by displaying the new pump status.

The detector is also turned off when you turn the pump off. This prevents the detector from being damaged when there is no sample flowing through the detector.

When the pump and the detector are off, the meter display will be blank. Turn the pump and detector off when concentration measurements are not necessary, and 2020 will only be used for reviewing data or generating reports. By operating the instrument with the pump and detector off when you do not need them, you will conserve the battery and ultraviolet (UV) lamp.

1. Press the ENTER key. The top line of the status display changes to "Select?". The bottom line displays 3 soft key names; "Set", "Log" and "Disp".
2. Press the soft key below "Set".
3. The names of the soft keys change to reflect the Set options. The display now shows 3 devices which can be set: "Clock", "Pump", and "Cal". Press the "Pump" key.
4. The 2020 turns the pump off. If the pump was off, pressing "Pump" will turn the pump on.
5. A message will be displayed to show you the status of the pump. 2020 reverts back to the previous menu after a few seconds.
6. To return to the default display, press the ENTER key.

2.6.2. Clock

The Clock function is used to set both the current date and time.

1. Press the ENTER key.
2. Press the "Set" key.
3. When the names of the soft keys change, press the "Clock" key.

The up and down arrows are used to change the character underlined by the cursor. The right arrow is used to advance the cursor to the next character on the right. When the cursor is advanced

past the right most character, it wraps around to the first character again.

Formatting characters, such as the colon (:) in the time and the slash (/) in the date are skipped when advancing the cursor.

4. Use the "arrow keys" to enter the correct time. The time is formatted as Hour:Minute:Second.
5. Press the ENTER key to confirm the time and move to the date option.
6. When setting the date, the 2020 prompts you for the current date formatted as Year/Month/Day. Use the "arrow keys" to enter the correct date.
7. Press the ENTER key to confirm the date and return to the Set options. You can wait for the display to timeout or press ENTER to return to the default display.

2.6.3. Cal

Cal allows you to setup and calibrate 2020. You have three options under the Cal function: "Zero", "Span" and "Mem".

A calibration memory consists of a name, a response factor, and PEAK, TWA and STEL alarm levels.

The "Zero" and "Span" keys will be covered in detail in Section 3.1.

To edit the calibration memory , select "Mem" and then "Chng". The 2020 prompts you with two new soft keys; "User" and "Lib".

2.6.4. Library

Library selections simplify Cal Memory programming, and provide standard response factors for approximately 70 applications. "Lib" allows you to select an entry from a pre-programmed Library. The name, response factor and three alarm levels are all set from the library. To select a library entry to program the selected Cal Memory:

1. Select "Set", "Cal", "Mem", "Chng" and "Lib".
2. Use the "Next" and "Prev" keys to scroll through the list. See Appendix 8.8 for a list of the library entries.

3. When the required entry is displayed, press the ENTER key to select it. All the Cal Memory parameters will now be copied from the selected library entry to the current calibration memory.
4. Press the "Set", "Cal", "Mem", "Chng", "User" keys to review the Cal Memory settings.

   The "User" key is used to edit the Cal Memory information manually. Press ENTER to move you through each step of the cal memory: name, response factor, PEAK, STEL and TWA alarms. "User" will be covered in more detail in Chapter 3.

   You can change any of the values entered in the Cal Memory. Changes, made to the library information that has been loaded into a Cal Memory, will have no effect on the original library entry.
5. Press the ENTER key to proceed to the next step.

2.7. Log Functions

The Log functions provide options for reporting, editing and configuring 2020's built in datalogger. Figure 7 shows a map of the Log functions.

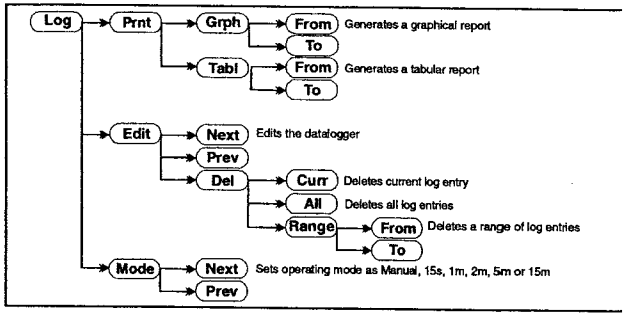

Figure 7 Log Function Map

2.7.1. Mode

2020 has two operating modes; manual and interval. When operating the 2020 in manual mode, each log entry contains a background and sample reading. In interval mode, 2020

automatically records the minimum, maximum and average readings at the preset interval. The 2020 also records date, time and status with each entry in the datalogger.

You can set an averaging interval: 15 seconds, 1 minute, 2 minutes, 5 minutes or 15 minutes. 2020's datalogger can store 1000 entries. The interval you select will determine the period of operation. At the end of the period, the datalogger will be full and you will see an "Elog" status.

Averaging Interval	Hours of Operation to Fill the Datalogger
15 s	4.1
1 m	16
2 m	33
5 m	83
15 m	250

Table 2 Averaging Intervals and Periods

To change the datalogging mode:

1. Press the ENTER key.
2. Press "Log" and select the "Mode" key.
3. Use the "Next" and "Prev" keys to scroll through the list.
4. Press the ENTER key. If you select manual operation, the datalogger will be cleared.

   Before the datalogger is cleared, 2020 will confirm your selection with the prompt "Are you sure?". Press "YES" to confirm your selection and clear the datalogger. If you do not want to lose your previously recorded data, press "NO", then print or save the data to disk before changing to manual operation. See Sections 2.7.3, and 4.2 for printing and saving logged data.

2.7.2. Edit

Edit allows you to review and delete the contents of the datalogger. To review the contents of the datalogger, use the "Next" and "Prev" keys. The average concentration and the time it was recorded are displayed. Hold down the keys to scroll through the data more quickly.

1. To delete entries from the datalogger, press "Del". You can delete the current entry, all entries or a range of entries.

Note: Deleted information cannot be recovered. You should play back and print or download the contents of the datalogger before deleting any information.

2. To delete the current entry, press "Curr". You will be prompte to confirm your selection. Press "YES" to delete the last displayed entry. Press "NO" to return to the Delete options.
3. If you want to delete the entire contents of the datalogger, pres "All". You will be prompted to confirm your selection. Press "YES" to delete all entries. Press "NO" to return to the Delete options.
4. If you want to delete a range of entries you must select a start and stop time. Press "Range" and use the "Next" and "Prev" keys to select the start time.
5. Press the ENTER key, and select the stop time. All entries between, and including, the start and stop entries will be deleted.

Note: Deleting entries from the middle of the datalogger will not free space to store more entries. Deleting entries from the start of the datalogger, or at the end of the datalogger will free usable space.

2.7.3. Print

You can print logged data in tabular or graphical format. You must have a printer connected to 2020 in order to use the print options. See Section 4.1 for instructions on connecting and configuring a printer for use with 2020. See Section 4.3 for instructions on connecting the serial to parallel converter to 2020 and to the printer.

When you are using interval operation, the date, time and instrument status are printed along with the minimum, average and maximum concentration of each averaging interval. See Figure 8.

```
                2020 Report

 Date      Time   Status        Min      Avg      Max
95/03/07 11:24:21 OK            3.5     15.4     62.7
95/03/07 11:24:36 OK            2.7      8.8     46.3
95/03/07 11:24:51 OK           12.2     57.9     98.2
95/03/07 11:25:06 OK            2.9     53.1     98.5
95/03/07 11:25:21 OK            3.5      232      238
95/03/07 11:25:36 OK           40.7      360      496
95/03/07 11:25:51 ALPK         60.3      606      916
95/03/07 11:26:06 ALPK          129      943     1832
95/03/07 11:26:21 ALPK          4.9      705     1702
95/03/07 11:26:36 OK            3.4      3.9      5.7
```

Figure 8 Tabular Report (Averaging Interval)

The graphical report prints a range of entries from the datalogger. 2020 stores one set of readings (Min, Avg and Max) for each averaging interval. In each averaging interval the graphed minimum is the minimum of all the stored readings in that interval. The graphed Avg is the average of all the stored readings for the interval and the Max is the maximum of all the recorded maximum readings. In manual operation, the background, sample and the difference are printed.

A minus sign is used to draw the graph from the minimum to the average. Plus signs are used to graph the area between average and maximum. See Figure 9.

```
                          2020 Report

Date      Time   Status [0                                  2000]

95/03/07 11:24:21 OK     ++
95/03/07 11:24:36 OK     +
95/03/07 11:24:51 OK     -+
95/03/07 11:25:06 OK     -+
95/03/07 11:25:21 OK     ----+
95/03/07 11:25:36 OK     --------+++
95/03/07 11:25:51 ALPK    -----------+++++++
95/03/07 11:26:06 ALPK     ---------------++++++++++++++++++++
95/03/07 11:26:21 ALPK   --------------++++++++++++++++++++
95/03/07 11:26:36 OK     +
```

Figure 9 Graphical Report (Averaging Interval)

In manual operation the date and time are printed. A minus sign is used to draw the graph from the background to the difference. Plus signs are used to graph the area between difference and sample. Difference is calculated by subtracting the background from the sample.

1. Press the ENTER key. Select "Log", "Prnt" and then select "Grph" or "Tabl".
2. Select a start time using the "Next" and "Prev" keys. Hold down the "Next" and "Prev" to scroll through the data quickly.
3. Press the ENTER key, and select the stop time. All entries between, and including, the start and stop entries will be printed.

While printing, the 2020 displays a busy message. Do not try to perform additional functions while 2020 is printing. Pressing EXIT will abort the printout.

Although interval and manual mode generate different reports, the format of the reports is similar. For interval data, the column headings for the results are Min, Avg and Max. For manual data, the column headings are BkGd, Sample and Diff.

2.8. Display Functions

The Display function is used to control and configure 2020's display options. These options control the backlighting, select the display format, and lock the display to prevent access. Figure 10 shows a map of the Display functions.

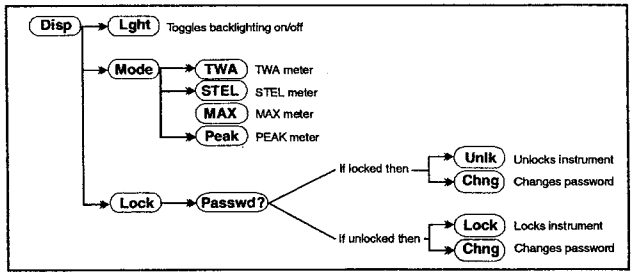

Figure 10 Display Function Map

2.8.1. Light

The Light function is used to switch the backlighting on and off.

1. Press the ENTER key.
2. Select "Disp" and then press "Lght". If the backlighting was off, it will be turned on.
3. Press EXIT to return to the function display.

To extend the operating life of the battery pack, turn the backlighting off when it is not required.

2.8.2. Mode

The Mode function is used to select the display type. You can select TWA, STEL, MAX, and PEAK.

1. Press the ENTER key.
2. Select "Disp" and then press "Mode". Select the mode you want to view. The current mode is not assigned a soft key.

   For example, if the current mode is TWA, then when you press the "Mode" key, "PEAK", "STEL" and "MAX" will be displayed.

When you have selected the new display mode, the meter display and status display will be updated to reflect the new mode. See Section 2.5. for a detailed description of each mode.

2.8.3. Lock

The "Lock" key is used to prevent access to 2020's sensitive options. Sensitive options are those which can affect 2020's readings. These include selecting a calibration memory, zeroing the instrument and spanning the instrument. If any one of these functions are selected when the instrument is locked, 2020 will prompt you to unlock the instrument before you can access the functions.

To lock 2020:

1. Press the ENTER key. Press "Disp" and then select "Lock".

2. You will be prompted for a password. If no password has been entered, then press the ENTER key. If a password has been entered, enter the correct password and then press the ENTER key.
3. If you want to enter a password, press "Chng" and enter a password. The password can be up to 4 numerical characters. Press the ENTER key to accept the password.

> **Note:** If you change the password, make sure you record the setting. Once the instrument is locked, there is no way to unlock it without losing all your data.

4. Press "Lock" to lock 2020. The message "Lock is on" will be displayed. If "Unlk" is displayed, 2020 is already locked.

2.8.4. Unlock

If you try to calibrate 2020 while it is locked you will see the message "Error: LOCKED! See Disp". To gain access:

1. Press EXIT twice and then press "Disp".
2. Press "Lock", enter the password and press ENTER. Once the password has been entered and verified, press "Unlk" to unlock the instrument.
3. Press EXIT twice and continue with calibration.

3. Detailed Operation

3.1. General Information

2020 must be calibrated in order to display concentration in ppm or mg/m³ units equivalent to the calibration gas. First, a supply of zero air which contains no ionizable gases or vapors, is used to set 2020's zero point. Then, calibration gas, containing a known concentration of a photoionizable gas or vapor, is used to set the sensitivity.

Occasionally clean ambient air will be suitable as zero air. Due to 2020's sensitivity, outdoor air is usually unsuitable for calibration. For best results, use a commercial source of zero grade air and a second regulator. Zero air should have not more than 0.1 ppm total hydrocarbons (THC).

If compound threshold limit values (TLVs) are exceeded, you should use a gas bag for sampling and calibration.

To determine the TLV of the compounds contained in the calibration gas, refer to the Material Safety Data Sheet (MSDS) supplied with your calibration gas cylinder.

If you will be using a gas bag for calibration, you should obtain the calibration kit (Part No. 390033). The calibration kit contains a regulator, a gas sampling bag and a gas bag adapter. See 3.3 for details of calibration using a gas bag.

Note: Disconnect 2020 from the AC adapter before beginning calibration.

3.2. Calibration Using the Flow-Match Regulator

3.2.1. Connecting the Flow-Match Regulator to the Cylinder

Warning: Observe proper handling procedure for all gases! See Section 1.2.2.

1. Connect the regulator to the calibration gas cylinder.

   If you are using a portable tank of calibration gas (Part No. 350012), connect the regulator (Part No. 350006) directly to the tank.

2. When the regulator is connected properly, you can read the cylinder contents from the regulator gauge.

3. Connect the adapter tubing to the regulator.

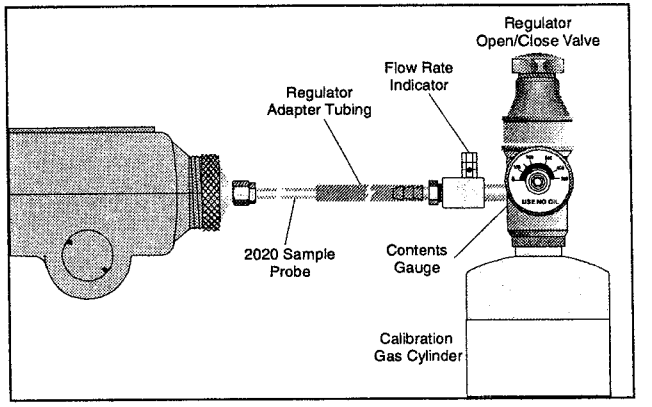

Figure 11 Flow-Match Regulator

3.2.2. Calibrating 2020 with the Flow-Match Regulator

1. Ensure the short sample probe is connected to the 2020 inlet. If you are using the long probe for sampling, then ensure the long probe is connected to 2020.

Note: Ensure the sample probe is free of any contamination as this will effect the calibration

2. Press the ENTER key.
3. Select "Set", "Cal" and then "Mem".
4. Select the desired Cal Memory. 2020 has 15 Cal Memories and can be calibrated with 15 different span gases or response factors if required. Only one Cal Memory can be used at a time. Each Cal Memory stores a different response factor, zero point, sensitivity, and alarm levels.
5. Select "Chng" and then "User". Enter a name for the calibration memory.

Press the ENTER key and enter a response factor (RF). Refer to Appendix 8.7 for a list of Response Factors. If the compound is not listed in Appendix 8.7 or you are measuring gas mixtures, then enter a value of 1.0. The concentration detected by 2020 will be multiplied by the response factor before it is displayed and logged.

6. Press the ENTER key and enter an alarm level for STEL, TWA and PEAK.
7. Press ENTER and expose 2020 to a supply of zero air.
8. Select "Set", "Cal" and "Zero". Allow 2020 to set its zero point.
9. Select "Set", "Cal" and "Span". 2020 asks for the span gas concentration. Enter the known span gas concentration, without pressing the ENTER key to confirm it.
10. Insert the 2020 sample probe into the adapter tubing from the regulator. See Figure 11.
11. Ensure the calibration gas cylinder is upright and open the regulator by turning the valve counterclockwise. Open the regulator until the ball is 1/8" from its rest position.

Note: Do not set the flow rate too high.

12. Press the ENTER key. 2020 sets its sensitivity.
13. When the display reverts to the default display, 2020 is calibrated and ready for use.
14. Remove the adapter tubing from the inlet and close the regulator.

If you turn off 2020 in the middle of zeroing or spanning, the next time you turn it on it will display a Cal status. This indicates that you need to calibrate 2020.

Note: While the Cal status is active, all alarms are deactivated.

3.3. Calibration Using a Gas Bag

3.3.1. Preparing the Calibration Gas Bag and the Zero Air Bag

Use the calibration kit (Part No. 390033) as follows:

Warning: Observe proper handling techniques for all gases! See Section 1.2.2.

1. Connect the regulator to the calibration gas cylinder.

   If you are using a portable tank of calibration gas, connect the regulator (Part No. 600649) directly to the tank.

   If you are using a large cylinder of calibration gas, you must obtain a high purity regulator as specified in Section 1.4. Isobutylene in air is usually supplied with a standard CGA 590 cylinder valve outlet. Obtain a regulator with the matching fitting. Connect the regulator to the tank of calibration gas. Tighten the regulator onto the tank with a wrench. Do not over-tighten.

Note: Do not force the connection.

Do not use Teflon tape with CGA fittings. In general, these fittings are designed for metal to metal sealing.

Do not use adapters to connect one CGA fitting to another type of CGA fitting. If the regulator does not match the outlet on your calibration tank, contact your specialty gas supplier.

2. Attach the knurled nut on the gas bag adapter to the regulator. Finger-tighten the fitting.

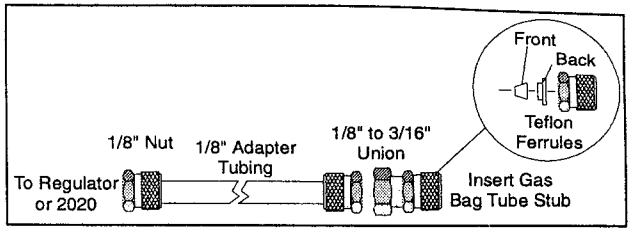

Figure 12 Gas Bag Adapter

3. Loosen the knurled nut on the reducing union of the gas bag adapter.

> **Note:** Do not remove the nut from the union as the Teflon ferrules contained inside the nut may be lost. See Figure 12.

4. Insert the tube stub from the gas bag into the knurled nut. Tighten the knurled nut and ensure the tube stub is secure. If the gas bag is not secure, ensure you have inserted the tube stub far enough into the knurled nut. Do not over-tighten the fitting.

> **Note:** Over-tightening the Teflon ferrules will result in damage to the ferrules!

5. The union should be connected to the gas bag adapter. If it is not, then tighten the nut on the adapter tube to the union.
6. Flush and fill the gas bag. See Appendix 8.6 for instructions.
7. Remove the knurled nut on the adapter tube from the regulator.
8. Repeat this procedure, if necessary, to prepare a bag of zero air.

> **Note:** Do not use the same gas bag or gas bag adapter for the bag of zero air. You will contaminate the bag of zero air.

3.3.2. Calibrating 2020 with a Gas Bag

1. Disconnect the probe from the 2020.
2. Press the ENTER key.
3. Select "Set", "Cal" and then "Mem".

4. Select the desired Cal Memory. 2020 has 15 Cal Memories and can be calibrated with 15 different span gases or response factors if required. Only one Cal Memory can be used at a time. Each Cal Memory stores a different response factor, zero point, sensitivity, and alarm levels.
5. Select "Chng" and then "User". Enter a name for the calibration memory.
6. Press the ENTER key and enter a response factor.
7. Press the ENTER key and enter an alarm level for each mode.
8. Press the ENTER key and enter a response factor. Refer to Appendix 8.7 for a list of Response Factors.

   If the compound is not listed in Appendix 8.7 or you are measuring gas mixtures, then enter a value of 1.0. The concentration detected by 2020 will be multiplied by the response factor before it is displayed and logged.
9. Connect the supply of zero air. If you are using a gas bag with zero air, open the bag and connect the gas bag adapter to the inlet.
10. Select "Set", "Cal" and "Zero". The 2020 sets its zero point.
11. Select "Set", "Cal" and "Span". The 2020 asks for the span gas concentration. Enter the known span gas concentration, without pressing the ENTER key to confirm it.
12. Open the bag and then connect the gas bag adapter to the inlet. Press ENTER. 2020 sets its response factor.

> **Note:** Readings may fluctuate slightly as the gas bag empties. Do not allow 2020 to evacuate the bag completely.

13. When the display reverts to the default display, 2020 is calibrated and ready for use. Remove the span gas bag from the inlet.

If 2020 is powered off in the middle of zeroing or spanning, it will power on displaying a Cal status. This indicates that you need to calibrate 2020. While the Cal status is active, all alarms are inactive.

3.4. Programming the Cal Memories

2020 has 15 Cal Memories and can be calibrated with 15 different span gases or response factors if desired. To program the Cal Memories:

1. If you will be calibrating directly from the portable cylinder, connect a flow-match regulator (Part No. 350006) to each tank. You must use a separate regulator for each compound to prevent cross contamination.

   If you are using gas bags, prepare the bags of calibration gas as outlined in Section 3.3. Use a different gas bag and gas bag adapter for each concentration and for each type of calibration gas. You can use the same gas bag to zero all the Cal Memories, however, you must refill the bag before zeroing each Cal Memory.

2. Select "Set", "Cal" and "Mem".

3. Select the desired Cal Memory (1 to 15) with the "Next" and "Prev" keys.

4. Press "Chng" to change the parameters of the Cal Memory. Select "User" or "Lib".

5. If you selected "User", enter the name, response factor and alarm levels.

6. If you entered "Lib", use the "Next" and "Prev" keys to select the required library. See Appendix 8.8 for a list of Library entries.

> **Note:** It does not matter which Cal Memory is selected or which response factor is entered, 2020's response is not specific to any one compound. The reading displayed represents the total concentration of all ionizable compounds in the sample.

7. Calibrate the instrument as described in Section 3.2.2 or 3.3.2. When the calibration is completed, the calibration information is automatically stored in the selected Cal Memory.

8. Repeat this procedure for each Cal Memory you need.

Whenever the instrument is calibrated, 2020 updates the selected Cal Memory only. Each Cal Memory must be calibrated at least once a day. Frequency of calibration will depend on ambient conditions and instrument response. If ambient conditions change or

the response has drifted, a calibration must be performed for each Cal Memory to ensure reliable operation.

3.5. Response Factors for Gases and Vapors

3.5.1. General Information

In situations where only a single pure compound is present in air, 2020 should be calibrated with a standard of that specific compound as span gas. 2020's 15 Cal Memories can be used to store calibration information for 15 different span gases.

The displayed reading will always be influenced by any other photoionizable compounds present in the air sample.

> **Note:** Even if 2020 has been calibrated with a specific compound, its response is not specific and the presence of another ionizable impurity may render the numerical result invalid.

It is often impractical to carry a range of different standards into the field. Approximate results can be obtained by calibrating 2020 with the recommended span gas and entering the appropriate response factor. The response factor is based on the ratio of the response of the specific compound to the response of the span gas. The response factor multiplies 2020's reading then displays and records it.

Appendix 8.7 provides response factors from which approximations can be made for guidance purposes. Data extrapolated from the use of response factors must be regarded as interim and approximate only. Appendix 8.7 should be used only for concentrations up to 500 ppm of the specific compound, as response factors change with concentration.

3.5.2. Using Response Factors

1. Select "Set", "Cal" and "Mem".

2. Select the desired Cal Memory (1 to 15) with the "Next" and "Prev" keys.

3. Press "Set", "Cal" and "Mem" and "Chng" to change the parameters of the Cal Memory. Select "User" or "Lib".

4. If you selected "User", enter the name, response factor and alarm levels.

5. If you entered "Lib", use the "Next" and "Prev" keys to select the required library. See Appendix 8.8 for a list of Library entries.
6. Calibrate 2020 with zero air and 100 ppm isobutylene as described in Section 3.2.2 or 3.3.2.
7. Expose 2020 to the sample. The displayed reading is the approximate concentration of the specific compound.

The response factors in Appendix 8.7 serve only as a guide to concentrations measured by 2020.

Results are expected to be accurate to within +/-10 ppm or +/-25% of the displayed result, whichever is greater. Accuracy of response factors to other gases and vapors may differ from those listed in Appendix 8.7.

3.6. Manual Operation

As part of manual operation, you setup 2020 to monitor various locations. Since each location may contain different compounds and concentration ranges you can program a Cal Memory and the associated response factor and alarm level for up to 15 different applications. In this way you can sample numerous locations without having to re-calibrate 2020 at each location.

Prepare a monitoring schedule for you application. Your schedule should contain a list of sites that must be monitored and the Cal Memory that must be used when monitoring the site. Also include any reference information that will help you define the site and the monitoring application. If you create your schedule using spreadsheet software, you can later download 2020 data to a computer and then copy it into the spreadsheet for further calculations.

Once you have programmed 2020, and prepared a list of sites to be monitored, you will move around to each location and manually log data at each site.

1. You must determine the number of calibration standards that will be required to perform manual monitoring for your application. Program and calibrate all the calibration memories that you need. See Section 3.2 and 3.4.

Note: It does not matter which Cal Memory is selected or which response factor is entered, 2020's response is not specific to any one compound. The reading displayed always represents the total concentration of all ionizable compounds in the sample.

2. Ensure the 2020 is in PEAK mode. To change the mode, press ENTER and select "Disp". Press "Mode" and select PEAK.
3. Switch to manual operation. Press ENTER and then "Log". Select "Mode". Use the "Next" and "Prev" keys to scroll through the list. When Manual is displayed press ENTER. When you switch between interval and manual operation, the datalogger will be cleared. Press "YES" to confirm your selection and clear the datalogger. If you do not want to lose your previously recorded data, press "NO", then print or save the data to disk before changing to manual operation. See Sections 2.7.3 and 4.2 for printing and saving logged data.
4. The instrument status will change to "Loc".
5. Select the required Cal Memory for this location. Press ENTER and select "Set", "Cal" and then "Mem". Use the "Next" and "Prev" keys to select the desired Cal Memory.
6. Press the ENTER key and locate the first site on your schedule. The middle soft key is used to advance to the next measurement when you are operating in manual mode. Press the "Next" key. If you are not using manual operation, the "Next" key is not shown.
7. The instrument status will change to "BkGd". A background measurement must be made. When you have an accurate background, press "Next". 2020 will record the displayed concentration when you press the "Next" key.
8. The instrument status will now be "Samp". Take a sample measurement. When you have an accurate sample, press "Next". 2020 will record the displayed concentration when you press the "Next" key.
9. The instrument status will again be "Loc". Go to the next site on your schedule.

When you have completed your monitoring you can download the contents of the datalogger to a computer and add the 2020 data to your spreadsheet.

If you change from manual operation to an averaging interval, you will lose the contents of the datalogger. Print or save the data to disk before changing the interval. See Sections 2.7.3 and 4.2 for printing and saving logged data.

3.7. Preparing for Field Operation

3.7.1. Field Check List

When using 2020 for field operation, the following items should be carried into the field to reduce or eliminate down time of the instrument.

If you are going to be in the field for a single 8-10 hour day, then you should include the following accessories:

- ❑ Spare battery pack (Part No. 350009)
- ❑ Spare UV lamp (Part No. 390011)
- ❑ 2020 multi-tool (Part No. 396012)
- ❑ Sample line (Part No. 390006)
- ❑ Calibration kit(s) (Part No. 390033)
- ❑ Calibration regulator (Part No. 350006)
- ❑ Tank(s) of calibration gas (Part No. 350012)
- ❑ Spare gas bag for zero air (Part No. 396017)
- ❑ Gas bag adapter for zero air (Part No. 396010)
- ❑ Supply of commercial zero air
- ❑ Spare inlet filters (Part No. 396015 or 396000)
- ❑ Dilution probe (Part No. 350013)
- ❑ Spare charcoal filters for the dilution probe (Part No. 395064 or 395067)
- ❑ Carrying case (Part No. 350010)
- ❑ User's manual (Part No. 350001)
- ❑ DC power cord (Part No. 350004)

Table 3 Check List for Field Operation

If you will be in the field for more than one day you should include the following additional items:

- ❑ AC adapter (Part No. 350001 or 396013)
- ❑ Printer (Part No. 380120)
- ❑ Cable kit (Part No. 350011)
- ❑ Computer and associated cables
- ❑ Serial to parallel converter (Part No. 380145)

Table 4 Additional Field Items

3.7.2. Operational Check List

Before beginning field work, set up and calibrate 2020 for your particular application. Ensure the instrument is in working order before heading into the field:

1. Press the "Set" and "Clock" keys and ensure the correct time is entered. Press the ENTER key and ensure the correct date has been entered.
2. Ensure the battery pack is fully charged. If you are unsure about the status of the battery, replace the battery pack with one that is fully charged. See Section 1.5.
3. Program and calibrate all the Cal Memories you need. See Section 3.4. After calibration is complete, sample the calibration gas and the bag of zero air to ensure 2020 has been calibrated correctly.
4. Select the correct operating mode. See Section 2.8.2.
5. Reset the TWA accumulator, the STEL moving average and the MAX. See Section 2.5.
6. You may want to delete all entries from the datalogger to avoid confusion between different days' data and to avoid running out of space in the datalogger. See Section 2.7.2.

4. Connecting Accessories

4.1. Printer

The printer must have a printing width of at least 65 characters and must use fixed spaced fonts. The serial communication parameters on 2020 have been fixed at 9600 baud, no parity, 8 data bits and 1 stop bit. Your printer must be able to match these settings.

If you are using a parallel printer, you will need the serial to parallel converter (Part No. 380145). See Section 4.3 for details of connecting and operating 2020 with a serial to parallel converter.

Note: 2020 is not classified for use in hazardous locations with a printer.

1. Turn 2020 off.

Note: You must turn the instrument off before connecting or disconnecting the printer cable.

2. Connect the printer cable (Part No. 350011) to the I/O port on the back of the 2020 and then to the serial port on the printer.
3. Turn 2020 on.
4. The serial communication parameters on 2020 have been fixed. It communicates at 9600 baud, no parity, 8 data bits and 1 stop bit. You must set your printer accordingly.

5. Use the "Grph" and "Tabl" keys as detailed in Sections 2.7.3.

If this arrangement does not produce the desired results, see Section 6.4.

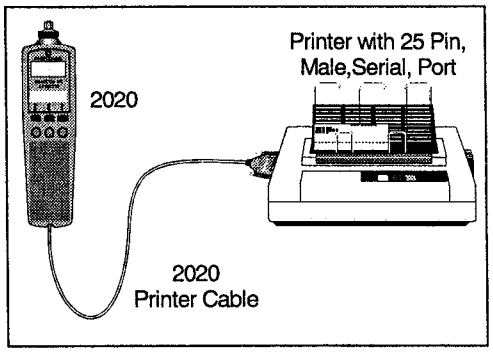

Figure 13 Connecting 2020 to a Serial Printer

4.2. Computer

2020 can send information stored in its datalogger to a computer. This option may be used if you need to prepare reports based on 2020's recorded data. This feature may also be used if you need the recorded data in a format that can be imported into a spreadsheet or database for further calculations.

Note: 2020 is not classified for use in hazardous locations with computers.

You may need to keep more data than can be logged by 2020. If this is the case you have two options: you may print the data before they are deleted from the datalogger and keep the printed reports, or you may store the data on disk for later use. You may not, however, load data that have been stored on disk back into 2020.

In order to establish communication with 2020 and receive data stored in the datalogger, the computer must be set up to emulate a terminal. In order to do this you will need a communications software package that will allow you to transfer data from 2020 to a computer. Software packages such as Crosstalk, and Procomm are

recommended for use with 2020. Crosstalk XVI will be used as an example in the instructions below.

If you are using Microsoft Windows you do not need to purchase any separate software. Instructions for downloading information to Windows' Terminal program are also provided.

If you are already using another type of communication or terminal emulation software package, it is not necessary to purchase a copy of Crosstalk or Procomm. Use your communications package to set up the computer to receive data at 9600 baud, no parity, 8 data bits and 1 stop bit. Refer to the user's manual, provided with your software, for specific details.

Once data have been transferred to Crosstalk, they must be saved to a floppy or hard disk. In order to manipulate the data, you must import the data either as a text file into a spreadsheet, where the data may be parsed and converted to numeric data, or into a text editor or word processor where the data may be viewed and edited.

The instructions below will provide you with the most basic information for using 2020 with communications software. Please refer to the software user's manual for specific details of operation.

4.2.1. Using Crosstalk

The following instructions are for Crosstalk XVI Version 3.71. The commands may vary with the version of Crosstalk you are using. To initiate communications between 2020 and the computer:

1. Start Crosstalk. The Status Screen will appear.
2. At the bottom of the Status Screen there will be a highlighted bar with the word Command?. If the word Command? does not appear press the <Esc> key on the computer keyboard.
3. Type *SP* and press <Enter>. This will allow you to set the baud rate at which the computer will receive data from 2020. Type 9600 and press <Enter>.
4. On 2020 the number of data bits has been fixed at 8, stop bits has been fixed at 1. You must set up Crosstalk accordingly. Type *DA* and press <Enter>. Type in *8* and press <Enter>.
5. Type in *ST* and press <Enter>. Type in *1* and press <Enter>.
6. Type in *PA* and press <Enter>. Type in *None* and press <Enter>. This sets the parity to None

7. Turn 2020 off.

Note: You must turn the instrument off before connecting or disconnecting the printer cable.

8. 2020 must be connected to a serial port. Use the printer cable (Part No. 350011) to connect 2020 to one of the computer's serial ports. Take note of which serial port you are using. Normally you will use Com1 or Com2.
9. If the 2020 printer cable plugs directly into the port on the computer without the gender changer or the 9 to 25 pin adapter (null modem), you are most probably connected to a parallel port. You will need at least one of the adapter cables to connect 2020 to a serial port. See Section 6.6.
10. Type *PO* and press <Enter>. Type in *1* if you connected 2020 to Com1 or type in *2* if you connected 2020 to Com2 and press <Enter>. If you connected 2020 to another serial port enter the corresponding number.
11. Type *MO* and press <Enter>. Type in *A* to change the mode to answer.
12. In order to capture the data and store them on a disk you must turn the Crosstalk capture command on and specify a disk to which the data can be stored. Type *CA* and press <Enter>.
13. Now type in the disk drive and the name of the file where you want the data stored. For example if you want to store the data in a file called 2020 on a floppy disk in drive A, then type *A:\2020.dta* and press <Enter>.
14. If the word Command? does not appear at the bottom of the Crosstalk Capture Screen, press <Esc>.
15. You have now set up Crosstalk to communicate with 2020. Type *GO L* to begin the downloading session. The Status Screen will disappear and the Capture Screen will appear.
16. Press the ENTER key. Select "Log", "Prnt" and then select "Grph" or "Tabl".
17. Select a start time using the "Next" and "Prev" keys. Hold down the "Next" and "Prev" to scroll through the data quickly.

18. Press the ENTER key, and select the stop time. All entries between, and including, the start and stop entries will be sent to the computer.

19. When all the data have been sent, press <Esc>. Type *CA off* and press <Enter>. This will turn the capture option off and write the captured file to the disk drive you specified in step #13.

20. Press <Home> to return to the Status Screen.

21. Type *QU* and press <Enter>. This will end your communications session.

Convert the file to a text file or a print file using the MS-DOS® Copy Command:

22. To convert the file to a text file, at the DOS prompt type: *Copy 2020.dta 2020.txt*

23. To convert the file to a print file, at the DOS prompt type: *Copy 2020.dta 2020.prn*

Once the file has been converted to a text file you can use a text editor to view and edit the contents.

If you are not comfortable with the Crosstalk commands used above, you should familiarize yourself with these commands by reading the Crosstalk user's manual. It is important to understand each of the commands in order to ensure both Crosstalk and 2020 are set up correctly.

4.2.2. Using Microsoft Windows

If you are using Microsoft Windows you do not need to purchase any separate software. The rules for connecting 2020 to the serial port still apply. See steps #7 to 9 in Section 4.2.1.

In order to use these instructions, you must be familiar with Microsoft Windows Version 3.1 and it must be installed and running on your computer.

To initiate communications between 2020 and Windows:

1. Start Windows and then start the Terminal Program. The Terminal Program may be in the Accessories Program Group. Its location will depend on how you have set up Windows.

2. Open the Settings Window and select Communications.

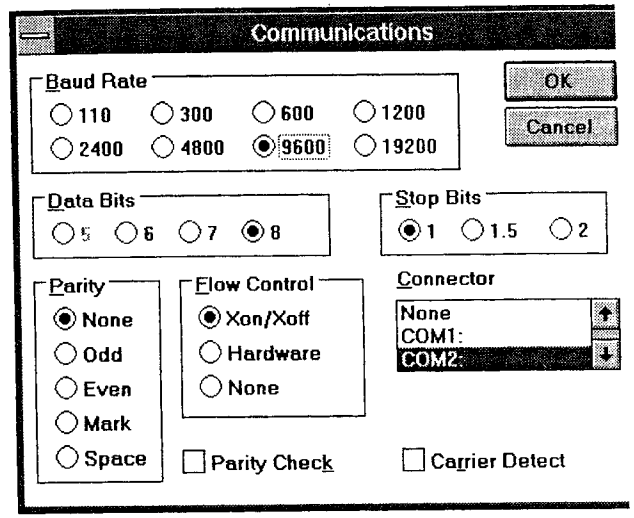

Figure 14 Terminal Program's Communication Dialog Box

3. Select the correct Baud Rate, Data Bits, Stop Bits, Parity and Connector. Select Xon/Xoff for the Flow Control option. Leave the Parity Check and Carrier Detect options off. Select OK to close the dialog box and accept the changes.

4. Open the Transfers Window and select Receive Text File. A Receive Text File dialog box will open. See Figure 15.

5. Type in the desired path and filename for the data that are to be downloaded. Ensure the path is correct.

   Ensure the filename has a .txt extension. The .txt extension will make it easier to use the downloaded data later.

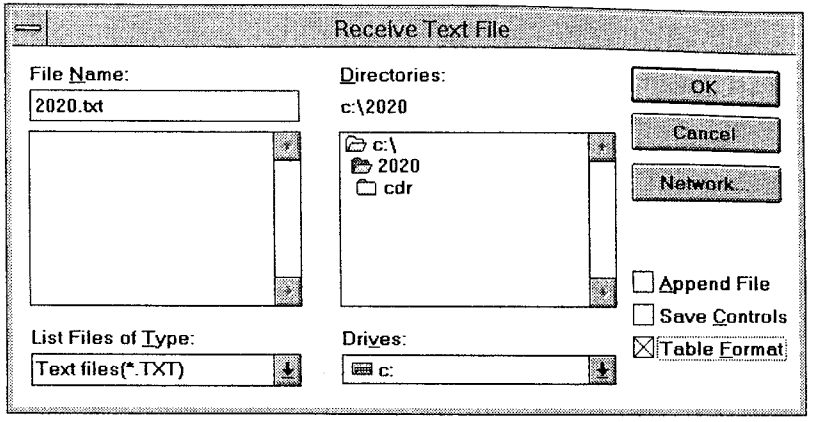

Figure 15 Terminal Program's Transfer Text File Dialog Box

6. Select the Table Format option and then select OK. At the bottom of the screen the message, "Receiving Data" is displayed.
7. Press the ENTER key. Select "Log", "Prnt" and then select "Grph" or "Tabl".
8. Select a start time using the "Next" and "Prev" keys. Hold down the "Next" and "Prev" keys to scroll through the data quickly.
9. Press the ENTER key, and select the stop time. All entries between, and including, the start and stop entries will be sent to the computer.
10. To terminate communications select Stop from the bottom of the screen.

The logged data can now be copied or cut to the Windows Clipboard and pasted into a text editor, such as Windows' Notepad, or a spreadsheet for editing.

Refer to the Microsoft Windows User's Guide for detailed instructions on installation and operation of Microsoft Windows.

4.3. Serial to Parallel Converter

This device allows 2020, which is capable of serial communication, to communicate with a parallel device. This will be most useful for printing, as most printers utilize parallel communications.

The printer must have a printing width of at least 65 characters and must use fixed spaced fonts. The serial communication parameters on 2020 have been fixed at 9600 baud, no parity, 8 data bits and 1 stop bit. Your converter must be set to match these settings.

4.3.1. DIP Switch Settings

The DIP switch settings are very important and must be set correctly in order to correctly communicate with 2020. 2020 will always be the serial device so the data flow direction will be serial to parallel.

To configure the serial port of the converter:

1. Locate the DIP switches located on the side of the converter.

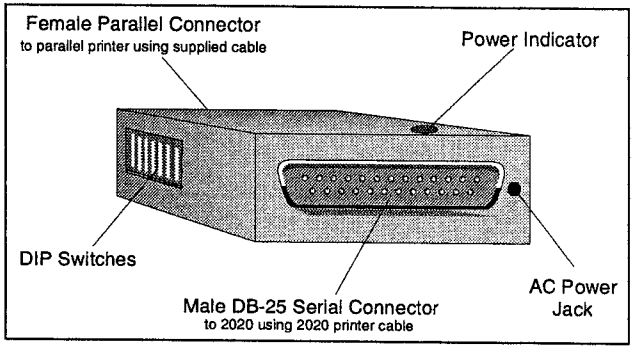

Figure 16 Layout of Serial to Parallel Converter

2. Determine the baud rate at which the converter will be receiving data from the instrument. The value you set here must match 2020.
3. Use the first three DIP switches to set the baud rate to 9600. See Table 5.

Baud Rate	SW1	SW2	SW3
9600	On	Off	On

Table 5 DIP Switch Settings for Baud Rate

4. Switch 4 sets the data bits. Off = 7 Bits. On = 8 Bits. Set the data bits to 8.

5. Use Switches 5 and 6 to set the parity to none.

Parity	SW5	SW6
None	Off	Off

Table 6 DIP Switch Settings for Parity

6. Switch 7 sets the Handshake mode. Off = Xon/Xoff. On = DTR. Set the Handshake mode to Xon/Xoff.

7. Use switch 8 to set the data flow direction to serial to parallel. Off = Serial to Parallel. On = Parallel to Serial.

8. Check your settings. It is imperative that you have the correct settings or you will be unable to establish communications. Your settings should match those in Table 7.

SW1	SW2	SW3	SW4
On	Off	On	On
SW5	**SW6**	**SW7**	**SW8**
Off	Off	Off	Off

Table 7 DIP Switch Settings

4.3.2. Using 2020 with the Serial to Parallel Converter

Note: 2020 is not classified for use in hazardous locations with printers or with the serial to parallel converter.

1. Turn 2020 off

Note: You must turn the instrument off before connecting or disconnecting the printer cable.

2. Unplug the converter from the AC outlet.

3. Use the cable kit (Part No. 350011) to connect the 2020 I/O connector to the converter.

4. Use the parallel cable, supplied with the converter, to connect the converter and the printer. If this cable is not suitable, see Section 6.5 for the cable requirements.

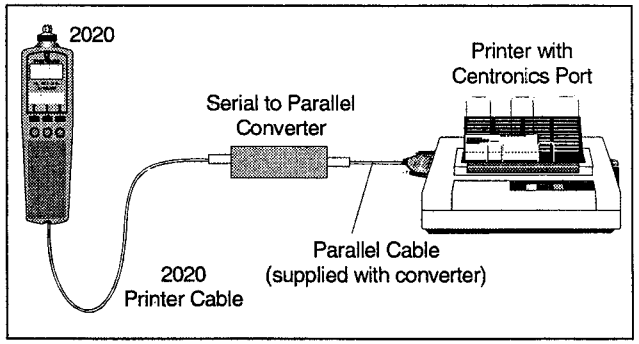

Figure 17 Connecting 2020 to the Serial to Parallel Converter

5. Plug the converter into an AC outlet.

6. Turn 2020 on.

7. Ensure the printer has been setup correctly. It must be on-line. Ensure paper is available and has been aligned properly.

8. Press the ENTER key. Select "Log", "Prnt" and then select "Grph" or "Tabl".

9. Select a start time using the "Next" and "Prev" keys. Hold down the "Next" and "Prev" keys to scroll through the data quickly.

10. Press the ENTER key, and select the stop time. All entries between, and including, the start and stop entries will be sent to the printer.

4.4. Sample Line

A 3 meter (9') sample line (Part No. 390006) may be connected to 2020 for remote sampling. Connect the sample line to the 2020 inlet using the fittings supplied with the sample line.

Note: When using the sample line, be especially careful not to aspirate liquids or solids as they will damage 2020.

4.5. Dilution Probe

4.5.1. Description

Note: 2020 is not classified for use in hazardous locations with the dilution probe.

The dilution probe (Part No. 350013) attaches to the underside of 2020 and allows 2020 to read concentrations up to 20000 ppm isobutylene equivalent units.

A metering valve controls the ratio of sample to zero air. 2020's pump draws air through both the dilution probe inlet and through the charcoal filter. You set the metering valve so that 2020 reads 10% of the actual sample concentration. Zero air is created by drawing room air through a charcoal filter.

2020 is calibrated with 100 ppm isobutylene. The dilution probe is then connected to the 2020 inlet and the dilution probe—2020 system is calibrated with 100 ppm isobutylene. For high accuracy operation, the dilution probe is calibrated with 1000 ppm isobutylene.

Note: Do not use the 11.7 eV lamp in conjunction with the dilution probe.

4.5.2. Assembling the Dilution Probe

1. Slide the charcoal filter tube into the 1/4" compression nut on the zero air inlet of the dilution probe. See Figure 18.

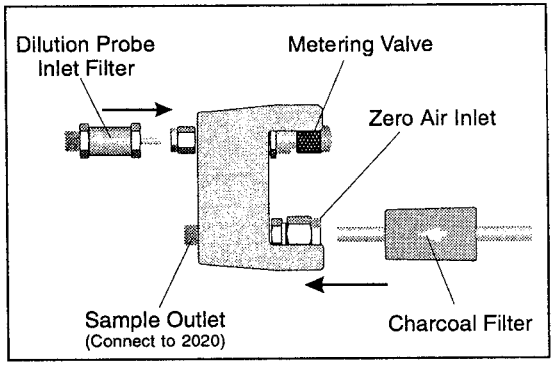

Figure 18 Dilution Probe Layout

2. Finger-tighten the nut. Then use a wrench to tighten the nut 3/4 of a turn further. This will compress the ferrules onto the tube.
3. Slide the inlet filter into the 1/8" compression nut on the sample inlet of the dilution probe. See Figure 18.
4. Finger-tighten the nut and then use a wrench to tighten the nut 3/4 of a turn further. This will compress the ferrules onto the filter tube.

4.5.3. Installing the Dilution Probe

1. Remove the two screws from the bottom of the 2020 control housing.
2. Use the long mounting screws supplied with the dilution probe to connect the mounting bracket to the 2020 bottom housing. See Figure 19.
3. Use the short mounting screws and the washers to connect the dilution probe to the mounting bracket.

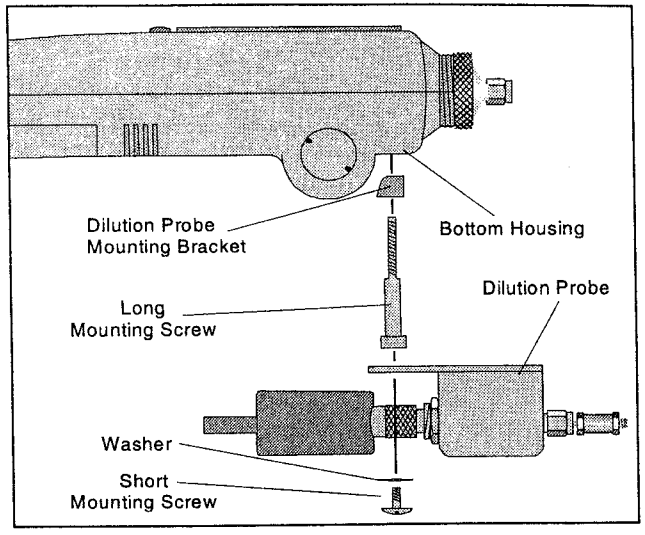

Figure 19 Installing the Dilution Probe

4.5.4. Calibration with the Dilution Probe

2020 must be calibrated in order to display concentration in units equivalent to ppm.

Occasionally clean ambient air will be suitable as zero air. If there is any doubt, use a commercial source of zero grade air and a regulator or second sampling bag. Span gas of the desired compound and concentration is also required and may be obtained from a specialty gas supplier. See Appendix 8.5.

Isobutylene at 100 ppm in air is recommended as span gas (Part No. 350012). If you are using another type of span gas, you must obtain the required gas and concentration. If compound threshold limit values (TLVs) are exceeded, you should use a gas bag for calibration.

Calibrate the instrument as follows:

1. Calibrate 2020 as outlined in Section 3.2.2 or 3.3.2.

2. Remove the 2020 sample probe. Use the tubing supplied with the dilution probe to connect the dilution probe outlet to the 2020 inlet.
3. If you are using gas bags, flush and fill the gas bags with 100 ppm isobutylene.
4. Use the hex wrench to loosen the screw in the metering valve handle. Do not remove the hex screw.
5. Insert the tube from the dilution probe inlet into the adapter tubing from the flow-match regulator. If you are using gas bags connect the gas bag adapter to the dilution probe inlet.
6. Ensure the calibration gas cylinder is upright and open the regulator until the float is 1/8" from its rest position. Do not se the flow rate too high.
7. Adjust the metering valve until the display reads 10% of the actual span gas concentration.
8. Use the hex wrench to tighten the screw and lock the metering valve handle.
9. The dilution probe is now calibrated and ready for use. Disconnect the adapter tubing or the gas bag from the inlet.

Note: When the dilution probe is connected to 2020, the displayed readings are always 10% of the actual reading.

4.5.5. High Accuracy Operation

The 2020–dilution probe system can be calibrated for higher accuracy operation. 2020 is calibrated with 100 ppm isobutylene anc the dilution probe is calibrated with 1000 ppm isobutylene.

1. Calibrate the 2020 as described in Section 3.2.2 or 3.3.2. Use 100 ppm isobutylene as the calibration gas.
2. Connect the dilution probe to the 2020 inlet.
3. If you are calibrating directly from the calibration tank, Insert the 2020 sample probe into the adapter tubing of the regulator.

   Ensure the calibration gas cylinder is upright, and open the regulator by turning the valve counterclockwise. Open the regulator until the ball is 1/8" from its rest position. Do not set the flow rate too high.

4. If you are using gas bags, flush and fill the gas bags with 1000 ppm isobutylene. It is advisable to obtain a second calibration kit (Part No. 390033) for the 1000 ppm isobutylene. See Section 3.3.1 for details of filling the gas bags.
5. Adjust the metering valve until the display reads 10% of the actual isobutylene gas concentration.

4.6. DC Power Cord

2020 can be connected to a car battery through the cigarette lighter with the DC power cord. While 2020 is connected to the car battery the 2020 battery is being charged.

Note: 2020 is not classified for use in hazardous locations with a DC power cord.

1. Turn the instrument off by pressing the ON/OFF key for 2 seconds.
2. Connect the DC power cord (Part No. 390004) to the 2020 AC adapter jack on the rear of the instrument.
3. Connect the other end of the DC power cord to the cigarette lighter in the car.
4. Turn the instrument on again by pressing the ON/OFF key.

If the car is running, ensure the car exhaust does not contaminate your samples.

4.7. Belt Clip Holster

Use the belt clip holster (Part No. 350008) to protect the instrument and to mount the instrument to a belt or personal apparatus.

1. Disconnect the top strap of the holster and insert 2020 into the holster.
2. Reconnect the strap so that 2020 is held securely.

4.8. 11.7 eV UV Lamp

4.8.1. General Information

2020 is equipped with a standard 10.6 eV UV lamp. An 11.7 eV UV lamp (Part No. 390024) available for special applications.

Install this lamp as outlined in Section 5.2.1. When you install a UV lamp other than the standard 10.6 eV lamp, all the response factors become invalid. You must set the response factor for the current cal memory to 1. Contact the Applications Department for further information.

Note: Do not use the 11.7 eV lamp in conjunction with the dilution probe.

4.8.2. Limitations of Lithium Fluoride Lamp Window

This lamp is intended for special applications only. It is not suitable for normal operation, due to limitations of the lamp window material.

The 11.7 eV lamp window material is lithium fluoride (LiF). LiF is composed of two light elements which are easily disrupted within the crystal lattice by the UV light generated by the lamp. Disruption of the lattice causes the crystal to turn a yellowish color, and again performance declines.

Unlike other lamp windows, LiF readily absorbs water from atmospheric humidity. When contaminated by moisture, the window loses its ability to transmit UV light. Clean the lamp window as outlined in Section 5.2.3.

Note: Do not touch the lamp window or handle it near liquid water

4.8.3. Using the 11.7 eV UV Lamp

With an 11.7 eV lamp installed, your instrument functions as a leak detector responding to gases and vapors which ionize at 11.7 eV or less. The 11.7 eV lamp may be useful for detecting leaks of chemicals not ionized by the standard 10.6 eV lamp.

Due to the lamp window limitations, the lifetime of the 11.7 eV lamp is restricted and it must be used sparingly according to the following instructions.

1. Remove the 11.7 eV lamp from the supplied desiccant bottle and install the lamp according to the instructions in the instrument user's manual. Install the lamp as outlined in Section 5.2.1.

Note: Do not remove or replace any detector lamp in a hazardous location.

2. Turn the instrument on and wait for the ready status. If the lamp cannot be started, contact the PE Photovac Service Department.
3. Calibrate 2020 as outlined in Section 3.2. All response factors are invalid when an 11.7 eV lamp is installed. You must set the response factor for the current cal memory to 1.
4. Recalibrate the instrument every 15 minutes of operation.
5. Every hour of operation, switch off the instrument, remove the lamp and examine the window for yellowing. If the window is yellow, then regenerate the window according to the procedure in Section 5.2.3
6. After use, remove the lamp and store it in the supplied desiccant bottle.

Do not leave the 11.7 eV lamp in the instrument when you turn it off. Always remove the 11.7 eV lamp and store it in the supplied desiccant bottle.

.9. Off Line Charger

4.9.1. General Information

The off line charger (Part No. 350015, 350019) allows you to charge a battery pack independently of 2020. To charge a battery pack without removing it from the 2020 see Section 1.5.

The off line charger requires one of the following 2020 accessories for operation:

1. AC Adapter (Part No. 350002 - North America)

2. AC Adapter (Part No. 396013 - Europe)
3. DC Power Cord (Part No. 350004)

Use only the AC adapter specified for use with 2020. Using another AC adapter will result in damage to the battery pack, the off line charger, or the adapter.

4.9.2. Charging from an AC Source

Note: Do not charge the battery pack in a hazardous location.

1. Remove the battery pack as outlined in Section 1.5.
2. Attach the connector from the battery pack to the socket on the off line charger.

Note: The connector is polarized. It will only fit one way. Do not force the connection.

3. Plug the AC adapter into the jack on the opposite face of the off line charger.
4. Plug the AC adapter into an AC outlet. If you are using the European AC adapter, ensure the correct plug is installed on the line cord. If it is not correct for the wall outlet in your area, then it must be replaced.
5. The LED on the upper face of the off line charger indicates the charge state of the battery pack. Red indicates the battery is being charged. Green indicates the battery is fully charged.
6. Charging a fully discharged battery pack will take approximately four hours.
7. It is normal for a fully charged battery pack to indicate it is charging (red light) when first plugged in. The LED will turn green as the battery charges.
8. When the battery pack is fully charged, remove the AC adapter, first from the wall outlet, then from the off line charger.
9. Remove the battery pack connector from the socket on the off line charger.
10. Replace the battery pack in 2020 as outlined in Section 1.5.

You can keep the battery pack fully charged indefinitely, without overcharging it, by leaving it connected to the off line charger while the charger is operating.

4.9.3. Charging from a DC Source

1. Remove the battery pack as outlined in Section 1.5.
2. Attach the connector from the battery pack to the socket on the off line charger.

> **Note:** The connector is polarized. It will only fit one way. Do not force the connection.

3. Plug the DC power cord into the jack on the opposite face of the off line charger.
4. Plug the DC power cord into a vehicle auxiliary 12 VDC or cigarette lighter socket.
5. The LED on the upper face of the off line charger indicates the charge state of the battery pack. Red indicates the battery is being charged. Green indicates the battery is fully charged.
6. Charging a fully discharged battery pack will take approximately 4 hours.
7. It is normal for a fully charged battery pack to indicate it is charging (red light) when first plugged in. The LED will turn green as the battery charges.
8. When the battery pack is fully charged, remove the DC power cord, first from the vehicle auxiliary 12 VDC or cigarette lighter socket, then from the off line charger.
9. Remove the battery pack connector from the socket on the off line charger.
10. Replace the battery pack in 2020 as outlined in Section 1.5.

You can keep the battery pack fully charged indefinitely, without overcharging it, by leaving it connected to the off line charger while the charger is operating.

5. Routine Maintenance

5.1. Battery Charging

A fully charged battery pack powers 2020 for approximately 8 hours. If the instrument is to be used for more than 8 hours, carry a spare battery pack (Part No. 350009). When the first one has been discharged, replace it with the spare.

> **Note:** If you do not turn 2020 off before removing the battery pack, you will reset the instrument and you will lose all logged data and setup parameters.

When the instrument status displays "LBat", the battery pack requires charging. When the "LBat" status is displayed, you have 30 minutes of operation left. 2020 will turn itself off before the battery pack becomes critically low.

> **Warning:** Do not remove or recharge the battery pack in a hazardous location.

Upon return from field work, charge the battery packs as outlined in Section 1.5. Use only the AC adapter specified for use with 2020. Optionally you can use the off line charger to charge the battery pack independently of the instrument. See Section 4.8.

> **Note:** You must use the 220 V battery charger (Part No. 396013) in order to comply with the requirements of the applicable Council Directives.

If you do not require portable operation, you can use 2020 while it is connected to the AC adapter

The AC adapter automatically charges at a high charge rate until the battery pack is fully charged. It then maintains the full charge with a low continuous charge rate indefinitely so there is no danger of over-charging.

When the LED, on the bottom of 2020, is red, the battery is charging. When the LED turns green, the battery is fully charged.

> **Note:** Leaving 2020 for more than 3 months without turning it on may result in the loss of recorded data and setup parameters. If 2020 is not used for long periods, turn the instrument on for a few hours every month to avoid loss of data.

5.2. Maintenance of the UV Lamp

5.2.1. Removing and Replacing the UV Lamp

> **Note:** Do not remove or replace the UV lamp in a hazardous location.

1. Ensure the instrument is turned off.

> **Warning:** You must turn the instrument off before removing the lamp cover!

2. Use the 2020 multi-tool to remove the lamp housing cover.
3. Tilt 2020 slightly and remove the UV lamp.

> **Warning:** Do not touch the wire grid inside the detector cell. Any dust or dirt in the detector cell can be blown out with a gentle jet of compressed air.
>
> Do not insert any object, other than the UV lamp, into the lampholder.

4. Discard the o-ring and spring supplied with the replacement lamp.
5. Without touching the lamp window, place the new lamp into the 2020 lampholder, window first. See Figure 20.

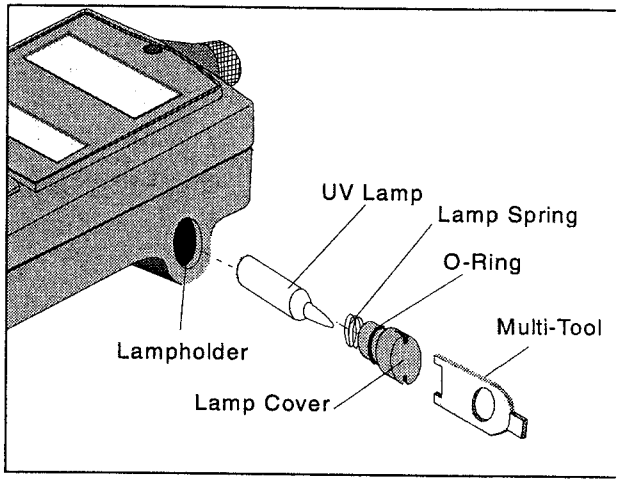

Figure 20 Removing the UV Lamp

> **Note:** If you have a UV lamp with a white serial number label, it is possible that the UV lamp may not fit into the lampholder. Do not force the lamp into the lampholder. See Section 6.3.

6. Replace the lamp housing cover. Tighten the cover down with the multi-tool. Do not overtighten.
7. Calibrate all Cal Memories that you are using and then continue normal operation.

5.2.2. Cleaning the UV Lamp Window

During the course of normal operation, a film builds up on the window of the UV lamp. The rate at which the film develops depends on the type and concentration of the gases and vapors being sampled and results from the UV light interacting with them.

Hot gases and vapors may contribute to a decrease in sensitivity because they may condense on the lamp window. Condensation may eventually evaporate off the window, but it will usually leave a residue that must be removed by cleaning the lamp window.

Since some UV inhibiting deposits are invisible to the eye, regular cleaning of the lamp window is strongly recommended. Clean the lamp frequently to prevent a heavy build-up of deposits that may be difficult to remove. As a guide, clean the window every 24 hours of operation.

Warning: Do not remove the UV lamp in a hazardous location.

The UV lamp cleaning kit (Part No. 380336) includes aluminum oxide powder (3.0 micron powder) and cotton swabs. Additionally, you will require approximately 10 mL of methanol. When ordering methanol, specify purge and trap grade.

The instructions provided below are for 8.4 eV, 9.5 eV, 10.0 eV and 10.6 eV lamps. Refer to Section 5.2.3 for special instruction to clean the 11.7 eV lamp window.

Warning: Never touch the UV lamp window with your fingers.

1. Remove the lamp as outlined in Section 5.2.1.
2. Allow the lamp to cool to room temperature to avoid thermal shock which could crack the window.
3. Dampen a cotton swab in methanol and dab it into the cleaning compound. Allow a small amount of the cleaning compound to adhere to the cotton tip.

Warning: Do not use methanol to clean the 11.7 eV lamp window.

4. Using small circular motions, rub the cleaning compound onto the lamp window. Do not exert excessive force onto the window, since window can be permanently damaged by misuse.
5. Continue cleaning for approximately one minute.
6. Dampen a new cotton swab with methanol and remove any trace amounts of the cleaning compound from the lamp window.

7. Wipe the window and the lamp with a dry, lint free tissue to remove any trace amounts of the cleaning compound and methanol. All traces of cleaning compound must be removed.
8. If you removed an o-ring from the lamp, replace it now. Ensure your hands are clean and dry.
9. Without touching the lamp window, replace the lamp as outlined in Section 5.2.1

5.2.3. Cleaning the Lithium Fluoride Window

To clean the 11.7 eV lamp window:

1. Clean the lamp window with dry aluminum oxide powder on a dry cotton swab. Do not use methanol or water.
2. The lamp window can also be regenerated by storing the lamp in a desiccator for at least 5 days.

Note: You may not be able to fully clean the 11.7 eV lamp window.

5.3. Replacing the Sample Inlet Filter

2020 is equipped with a combined dust and water filter to reduce detector contamination. As the filter collects dust, 2020's inlet flow rate and sensitivity decrease. The filter will not allow water to pass through, but the filter will not stop all solvents.

Note: Do not aspirate liquid samples with 2020!

Replace the filter on a weekly basis, or more frequently if 2020 is used in a dusty or wet environment. You must replace the filter if 2020 has been exposed to liquid water. If you are sampling hot gases or vapors, condensation in the sample line may also affect the filter. The pump will sound labored when the filter requires replacement.

Warning: Do not replace the inlet filter in a hazardous location.

1. Turn the instrument off. Unscrew the filter housing from the detector housing. Be careful not to lose the O-ring seal.

Note: Each filter is protected by a piece of blue plastic. Remove the plastic before installing the filter in 2020.

2. Remove the Teflon/Polypropylene filter and install the new filter (Part No. 396000 or 396015). Place the filter so that the Teflon side is facing down in the filter housing and the mesh side is facing the 2020.

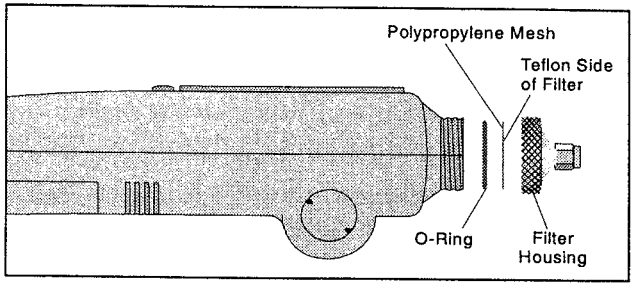

Figure 21 Replacing the Inlet Filter

Handle the filter disk only by the edges. The mesh may be damaged or contaminated by excessive handling. Use forceps if possible.

3. Replace the filter housing.
4. Calibrate all Cal Memories, that you are using, and then continue normal operation.

Warning: Do not operate 2020 without an inlet filter.

5.4. Maintenance of the Dilution Probe

5.4.1. Charcoal Filter

The charcoal filter will remove hydrocarbon contaminants for up to 4000 ppm-hours. This means that the filter will last for 1 hour removing 4000 ppm of hydrocarbon contaminants or will last for 4 hours removing 1000 ppm. The exact time will be determined by the operating environment. You will notice an increased hydrocarbon background when the filter requires replacement.

To replace the charcoal filter:

1. Loosen, but do not remove, the 1/4" compression fitting on the dilution probe zero air inlet and remove the charcoal filter from the dilution probe. See Figure 18.
2. Slide the replacement charcoal filter tube into the compression nut. (Part No. 395067).
3. Finger-tighten the nut. Then use a wrench to tighten the nut 3/4 of a turn further. This will compress the ferrules onto the tube.

When the dilution probe is not in use, place the charcoal filter in its plastic bag and store it in a clean, dry place.

5.4.2. Inlet Filter

The dilution probe is equipped with a dust filter to reduce detector contamination. As the filter collects dust, the inlet flow rate and sensitivity decrease. Replace the filter every 240 hours of operation, or more frequently if the instrument is used in a dusty environment.

Note: Do not operate 2020 or the dilution probe without an inlet filter.

1. Turn 2020 off and remove the dilution probe from the instrument.
2. Hold the filter housing near the housing with a 9/16" wrench. See Figure 22.
3. Unscrew the top of the filter housing with another 9/16" wrench. Be careful not to lose the filter spring.
4. Remove the spring and filter. Install the new filter (Part No. 395000), open end first. Press the filter into place so it will seal at the bottom of the filter housing. Replace the filter spring and the top of the filter housing.

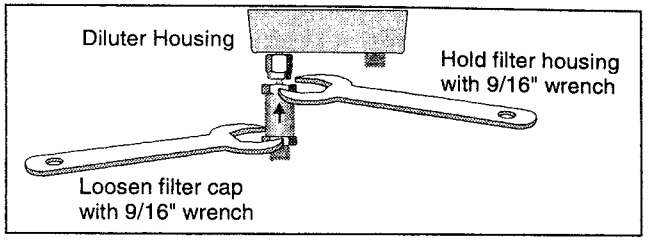

Figure 22 Removing the Dilution Probe Inlet Filter

5. Tighten the top nut while holding the bottom one stationary with the wrench.
6. Calibrate both 2020 and the dilution probe before continuing normal operation. See Section 4.5.4

6. Troubleshooting

6.1. General Information

If you have a service related question about 2020, consult this manual first. If you cannot find the answer in this documentation, contact the PE Photovac Service Department.

When you call, you should have your 2020 in front of you. You should also have this manual at hand. Lastly, please have the following information ready:

1. A description of what happened and what you were doing when the problem occurred.
2. Any corrective action that you have tried.
3. The exact wording of any messages that appeared on the display.

Warning: Do not service 2020 in a hazardous location.

6.2. Fault Messages

When the "Falt" status is displayed, 2020's operation is compromised.

Falt1: Signal from zero gas is too high.

Cause: If another fault occurred while 2020 was setting its zero point, then this fault is displayed.

Action: Ensure no faults are occurring and calibrate 2020 again.

Cause: Contamination of sample line, sample probe, inlet filter or fittings before the detector.

Action: Clean or replace the sample line, sample probe or the inlet filter. See Section 5.3.

Cause: Span gas and zero air are mixed up.

Action: Ensure clean air is used to zero 2020, If you are using gas bags, mark the calibration and zero gas bags clearly.

Cause: Ambient air is contaminated.

Action: If you are unsure about the quality of ambient air, use a supply of commercial zero grade air to zero 2020. See Section 3.1.3.

Falt2: Signal from span gas is too small.

Cause: Span gas and zero air mixed up.

Action: Ensure clean air is used to zero 2020. If you are using gas bags, mark the calibration and zero gas bags clearly.

Action: Ensure the span gas is of a reliable concentration.

Cause: UV lamp window is dirty.

Warning: Do not remove the UV lamp in a hazardous location.

Action: Clean the UV lamp window. See Section 5.2.2

Cause: UV lamp is failing.

Warning: Do not remove or replace the UV lamp in a hazardous location.

Action: Install a new UV lamp. See Section 5.2.1.

Cause: Incompatible application.

Action: The concentration and sample gas are incompatible for use with 2020.

Falt3: UV lamp fault. UV lamp has not started.

Cause: UV lamp has not started immediately.

Action: This fault may be seen momentarily when 2020 is first turned on. Allow 60 seconds for the UV lamp to start and the fault to clear.

Action: Turn 2020 off and then on again. Allow 60 seconds for the UV lamp to start and the fault to clear.

Cause: UV lamp serial number label is blocking the photocell.

Warning: Do not remove or replace the UV lamp in a hazardous location.

Action: If you have a UV lamp with a white serial number label, it is possible that the label is blocking the photocell. Rotate the lamp approximately 90° and then try to start 2020 again. If the fault persists, replace the lamp.

Cause: UV lamp is not installed.

Warning: Do not remove or replace the UV lamp in a hazardous location.

Action: Install a UV lamp. See Section 5.2.1.

Cause: UV lamp has failed.

Warning: Do not remove or replace the UV lamp in a hazardous location.

Action: Install a new UV lamp. See Section 5.2.1.

Cause: Electronic problem.

Action: If a new UV lamp still generates this fault, then contact the PE Photovac Service Department.

Falt4: Pump current too low or too high.

Cause: If the pump sounds labored, then the pump is operating beyond normal operating parameters.

Action: Check for an obstruction in the sample line. Make sure the sample line, the sample probe and the inlet filter are not blocked.

Warning: Do not replace the inlet filter in a hazardous location.

Action: Replace the inlet filter. See Section 5.3.

Action: Ensure the sample outlet, located on the underside of 2020, is not obstructed.

Cause: UV lamp is too wide, causing flow to be restricted.

Warning: Do not remove or replace the UV lamp in a hazardous location.

Action: If you have a UV lamp with a white serial number label, it is possible that the lamp is too wide for the lampholder. Contact the PE Photovac Service Department.

Cause: 2020 has been exposed to a solvent that can pass through the inlet filter and liquid has been aspirated.

Action: Contact the PE Photovac Service Department.

Cause: The pump has failed.

Action: Contact PE Photovac Service Department.

5.3. Troubleshooting

Problem: Very low or no instrument response detected, yet compounds are known to be present.

Cause: 2020 has not been calibrated properly.

Action: Ensure the calibration gas is of a reliable concentration and then calibrate the instrument as outlined in Section 3.2 or 3.3.

After the instrument has been calibrated, sample the bag of calibration gas. A reading equivalent to the calibration gas should be displayed. If not, contact the PE Photovac Service Department.

Warning: Do not remove or recharge the battery pack in a hazardous location

Action: Disconnect the battery charger before calibrating 2020. Section 3.1 or 3.3 for calibration instructions.

Cause: Cal Memories have not been programmed correctly.

Action: Program all the Cal Memories you require for your application. You must use the correct calibration gas and concentration for each Cal Memory. See Section 3.4.

Cause: Response factor has been set to zero.

Action: Enter the correct response factor. Refer to Appendix 8.7 for a list of response factors. If the compound is not listed in Appendix 8.7 or you are measuring gas mixtures, then enter a value of 1.0.

Cause: You are not using the correct Cal Memory.

Action: Select the correct Cal Memory for your application. See Section 3.2.2 or 3.3.2.

Note: It does not matter which Cal Memory is selected or which response factor is entered. 2020's response is not specific to any one compound. The reading displayed represents the total concentration of all ionizable compounds in the sample.

Cause: Detector is leaking. A decrease in sensitivity may be due to a leak in the detector.

Warning: Do not remove or replace the UV lamp in a hazardous location.

Action: Ensure the UV lamp has been installed correctly. See Section 5.2.1.

Action: Ensure the lamp cover has been tightened down. Do not overtighten the cover.

Action: Ensure the o-ring seal on the lamp cover is positioned correctly. See Section 5.2.1.

Cause: UV lamp is too long, causing flow to be restricted.

Warning: Do not remove or replace the UV lamp in a hazardous location.

Action: If you have a UV lamp with a white serial number label, it is possible that the lamp is too long for the lampholder. Replace the lamp and contact the PE Photovac Service Department. See Section 5.2.1.

Cause: UV lamp is too wide, causing flow to be restricted.

Warning: Do not remove or replace the UV lamp in a hazardous location.

Action: If you have a UV lamp with a white serial number label, it is possible that the lamp is too wide for the lampholder. Contact the PE Photovac Service Department.

Cause: Sampling environment is extremely humid.

Action: Water vapor is not ionized by the PID, but it does scatter and absorb the light and results in a lower reading.

The 2020 detector has been designed to operate under high humidity conditions. Under extreme conditions you may notice decreased response due to humidity.

Cause: UV lamp is failing.

Warning: Do not remove or replace the UV lamp in a hazardous location.

Action: Install a new UV lamp. See Section 5.2.1.

Cause: High concentration of non-ionizable compounds.

Action: Chemical compounds, such as methane, with IPs greater than the 10.6 eV scatter and absorb the UV light. Sensitivity may be decreased significantly.

Application with high backgrounds of such materials, may be incompatible with 2020.

Contact the PE Photovac Applications Department for more information.

Problem: Erroneously high readings.

Cause: Sampling environment is extremely humid.

Action: Water vapor may contain mineral salts which carry a charge. The water vapor becomes an electrolytic solution which becomes ionized when it enters the detector.

Atmospheric water in areas around the sea or stagnant water may produce a response in the absence of contaminants. The same effect may be seen when conducting ground water investigations in areas where the water is hard because it contains a significant concentration of minerals.[1]

Cause: 2020 has not been calibrated properly.

Action: Ensure the calibration gas is of a reliable concentration and then calibrate the instrument as outlined in Section 3.1 or 3.3.

After the instrument has been calibrated, sample the bag of calibration gas. A reading equivalent to the calibration gas should be displayed. If not, contact the PE Photovac Service Department.

Cause: Cal Memories have not been programmed correctly.

Action: Program all the Cal Memories you require for your application. You must use the correct calibration gas and concentration for each Cal Memory. See Section 3.4.

Cause: You are not using the correct Cal Memory.

Action: Select the correct Cal Memory for your application. See Section 3.2.2 or 3.3.2.

Note: It does not matter which Cal Memory is selected or which response factor is entered. 2020's response is not specific to any one compound. The reading displayed represents the total concentration of all ionizable compounds in the sample.

Cause: Detector has been short circuited by foreign matter in the detector cell.

Warning: Do not service 2020 in a hazardous location.

Action: Do not touch the wire grid inside the detector cell. Use a gentle jet of compressed air to remove any dust or dirt in the detector cell.

Warning: Do not insert any object, other than the UV lamp, into the lampholder.

Cause: There is an undetermined problem.

Action: Contact the PE Photovac Service Department.

Problem: Date and time settings are not retained.

Cause: The battery pack has been removed before 2020 was turned off.

Warning: Do not remove or recharge the battery pack in a hazardous location

Action: Replace the battery pack and reset the time and date. Ensure 2020 has been turned off before removing the battery pack. See Section 1.5.1.

Cause: 2020 has not been used for 3 months or more and the internal battery (not the external battery pack) has discharged.

Warning: Do not remove or recharge the battery pack in a hazardous location

Action: Connect 2020 to the AC adapter and turn 2020 on. Turn the pump off. See Section 2.6.1. While 2020 is running the internal battery is charging. Leave the instrument running for approximately 24 hours.

Problem: Instrument status shows "Over".

Cause: High concentrations of gases and vapors will cause a rapid change in signal level. The

detector and associated electronics may become temporarily saturated.

Action: Wait a few seconds for the status to return to normal. PIDs are designed to detect relatively low concentrations of gases and vapors. Exposure to very high concentrations may result in a very high or maximum response.

Cause: The detector has become saturated.

Action: Move 2020 to a location where it can sample clean air. Sample clean air until the reading stabilizes around 0.

Cause: Detector has been short circuited by foreign matter in the detector cell.

Warning: Do not service 2020 in a hazardous location.

Action: Do not touch the wire grid inside the detector cell. Use a gentle jet of compressed air to remove any dust or dirt in the detector cell.

Warning: Do not insert any object, other than the UV lamp, into the lampholder.

Cause: There is an undetermined problem.

Action: Contact the PE Photovac Service Department.

Problem: Display is blank.

Cause: Battery pack is critically low.

Warning: Do not remove or recharge the battery pack in a hazardous location

Action: Replace the battery pack or connect 2020 to the AC adapter.

Cause: The battery pack is not connected to the instrument correctly.

Action: Ensure the battery pack connector is securely attached to the connector on 2020. See Section 1.5.

Cause: There is an undetermined problem.

Action: Reset 2020. Turn the instrument on and disconnect the battery pack as outlined in Section 1.5.1. You must leave the instrument on while you disconnect the battery pack. This will reset the instrument. Reconnect the battery pack and close the battery hatch. Turn on 2020, set the time and date and program all the calibration memories that you are using.

Action: Contact the PE Photovac Service Department.

Problem: Sample flow rate is less than 300 ml/min.

Cause: Inlet filter is plugged.

Warning: Do not replace the inlet filter in a hazardous location.

Action: Replace inlet filter. See Section 5.3.

Cause: Inlet filter has not been installed properly.

Action: Ensure that the inlet filter has been installed correctly. See Section 5.3.

Cause: UV lamp is too long, causing flow to be restricted.

Warning: Do not remove or replace the UV lamp in a hazardous location.

Action: If you have a UV lamp with a white serial number label, it is possible that the lamp is too long for the lampholder. Replace the lamp and contact the PE Photovac Service Department. See Section 5.2.1.

Cause: UV lamp is too wide, causing flow to be restricted.

Action: If you have a UV lamp with a white serial number label, it is possible that the lamp is too wide for the lampholder. Contact the PE Photovac Service Department.

Cause: 2020 has been exposed to a solvent that can pass through the inlet filter and liquid has been aspirated.

Action: Contact the PE Photovac Service Department.

Cause: Sample outlet is obstructed.

Action: Ensure the sample outlet in not obstructed in any way.

Cause: Pump has been damaged.

Action: Contact the PE Photovac Service Department.

Problem: Liquid has been aspirated.

Cause: 2020 has been exposed to a solvent that can pass through the inlet filter.

Action: Contact the PE Photovac Service Department.

Problem: Corrosive gases and vapors have been sampled.

Cause: 2020 has been exposed to corrosive gases and vapors.

Action: Corrosive gases and vapors can affect the electrodes within the detector as well as the lamp window. Prolonged exposure to corrosive materials may result in permanent fogging or etching of the window. If 2020 is exposed to corrosive material, contact the PE Photovac Service Department.[1]

6.4. Printer Troubleshooting

Note: 2020 is not classified for use in hazardous locations with a printer.

Problem: Printer will not print.

Cause: Printer is not connected properly.

Action: Ensure that you have the correct cable for your instrument. The printer cable must be properly connected. If you are using the serial to parallel converter, ensure the cables are connected to the converter, to the instrument and to the printer.

Note: Turn the converter and 2020 off before connecting the cables.

Cause: Mechanical problem with the printer.

Action: Make sure that the printer is plugged in and turned on.

Action: Make sure that the printer is on-line, as shown on its control panel.

Action: Check the ribbon, the print wheel or cartridge, and the paper supply.

Cause: Printer cable is not configured correctly.

Action: In order to modify the existing printer cable, the pinout information for the printer connector is required. Refer to the printer user's manual for specific details.

The pinouts for the 2020 printer cable are shown in Figure 23. If modifying the cable is not possible, take the electrical and pinout information to a computer store where a suitable adapter may be obtained.

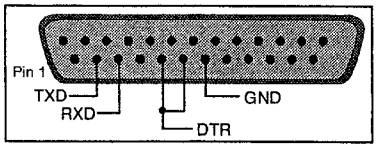

Figure 23 Printer Cable Configuration

Cause: Printer is not configured properly.

Action: Many printers have a set of configuration (DIP) switches. Generally, PE Photovac instruments expect these switches to be set in the factory default settings.

Many printers have switches for enabling automatic line feeds when receiving a carriage return. These switches should be set to carriage returns only, which is normally the factory default setting.

Some printers have switches or control panels that enable you to set the printer for different modes, such as sans serif, letter quality, or compressed text. Do not use these controls. If you do use them, you may cause your tabular or graphed output to be printed incorrectly.

Problem: Data are printed or downloaded correctly at first but become garbled.

Cause: Baud rate may be set too high.

Action: Ensure the baud rate of the printer is set to 9600.

6.5. Serial to Parallel Converter Troubleshooting

Problem: Data are printed correctly at first but become garbled.

Cause: Baud rate may be set too high.

Action: Ensure the baud rate of the printer and the serial to parallel converter are set to 9600 baud.

Cause: Baud rate is not set correctly.

Action: Ensure the baud rate of the printer and the serial to parallel converter are set to the same value.

Problem: Printer will not print.

Cause: Problem with the printer.

Action. Refer to the corrective action in Section 6.4.

Cause: Serial card is installed in the printer.

Action: If a serial card is installed in your printer, you do not need the serial to parallel converter. Disconnect the converter and connect the instrument directly to the printer.

Cause: The serial to parallel converter is not turned on.

Action: Ensure the serial to parallel converter is connected to the AC adapter and the adapter is plugged into an AC outlet. The red LED on the top of the converter will be on. See Figure 16.

Cause: Cables are not configured correctly.

Action: You must use the correct type of cable to ensure trouble free data transmission. The length of the cable at the parallel side must not exceed 15 feet. On the serial side, use only the 2020 printer cable and suitable adapter.

When you are connecting the parallel side of the converter to a Centronics 36 pin, female connector, use a straight wired cable with 36 conductors and a Centronics 36 pin, male connector at each end. This cable is supplied with the converter.

When you are connecting the parallel side of the converter to a Centronics 36 pin, male connector, use a straight wired cable with 36 conductors and a Centronics 36 pin, female connector at one end and a Centronics 36 pin, male connector at the other end.

If you are connecting the parallel side of the converter to a female DB-25 pin connector use a straight wired cable with a DB-25 pin, male connector on one end and a 36 pin, Centronics, male connector on the other end. The pin assignments for all parallel port signals are listed in Table 8.

Pin #	Name	I/O Parallel to Serial	I/O Serial to Parallel
1	/Strobe	In	Out
2-9	Data0-7	In	Out
10	/Acknlg	Out	Not Used
11	Busy	Out	—
12	PE	Pull Low	Pull High
13	Select	Pull High	Pull Low
14	/Auto FF	Not Used	Not Used
15	NC	Not Used	Not Used
16	Ground	—	—
17	NC	Not Used	Not Used
18	NC	Not Used	Not Used
19-30	Ground	—	—
31	/Init	Not Used	Out
32	/Error	Pull High	Pull High
33	Ground	—	—
34	NC	Not Used	Not Used
35	NC	Not Used	Not Used
36	/Slct In	Not Used	Not Used

Table 8 Serial to Parallel Converter Parallel Port Signal

The pin assignments for all serial port signals are listed below.

Pin #	Name	I/O Parallel to Serial	I/O Serial to Parallel
1	Frame Ground	—	—
2	TXD	Out	Out
3	RXD	In	In
6	DSR	In	—
7	GND	—	—
20	DTR	—	Out

Table 9 Serial to Parallel Converter Serial Port Signals

Note: A DB-25, female connector is sometimes a parallel port. Do not connect the serial port of the converter to a parallel port.

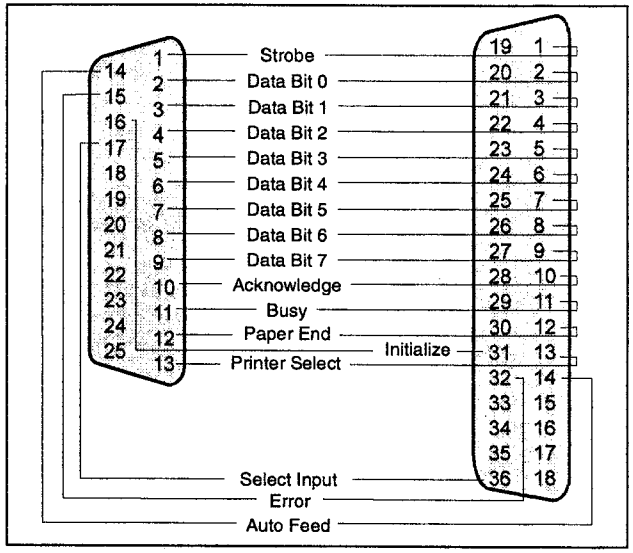

Figure 24 Serial to Parallel Converter Parallel Port Signals

6.6. Establishing Computer Communications

If, after having followed the procedure in Section 4.2, communications cannot be established with a computer, the problem may lie with the hardware connections or the printer cable configuration.

1. Ensure 2020 is connected to the serial port of the computer.

   The serial port will usually be a male connector, typically 9 pins on an IBM-AT® and compatibles and 25 pins on an IBM-XT® and compatibles. The 25 (or more) pin female connector is usually a parallel port. An exception to this rule is Tandy® Computers, which use a female 25 pin connector for the serial port. 2020 cannot be connected to a parallel port unless you are using the serial to parallel converter. (Part No. 380145)

   If you do not have a free serial port on you computer and you want to connect 2020 to the parallel port, you will need the serial to parallel converter. Connect 2020 to the serial port on the converter and then connect the computer to the parallel port. If the port on the computer is anything other than a female, 36 pin Centronics connector you will need an adapter in order to use the cable supplied with the converter. See Section 6.5 for more details.

2. Ensure the cable being used is compatible with the device.

   An IBM-AT and compatibles with a 9 pin serial connector will first require a null modem to switch pins 2 and 3. Next a gender changer that converts the male DB-25 connector on the printer cable from male 25 pins to female 9 pins is required. These two adapters have been combined into one, which is supplied in the 2020 cable kit. See Figure 25.

   An IBM-XT and compatibles should not require a null modem but will require a gender changer. A gender changer will convert the male DB-25 connector on the printer cable to a female connector. A gender changer is supplied with the 2020 printer kit. See Figure 26.

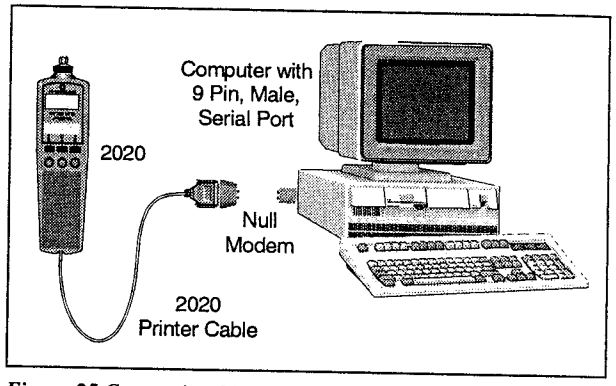

Figure 25 Connecting 2020 Using the Null Modem Cable

The pin definitions of interest are listed in Table 10. Only pins 2 and 3 are shown since these are the problem pins:

Pin #	2020	IBM-AT	IBM-XT
2	RXD	RXD	TXD
3	TXD	TXD	RXD

Table 10 Serial Port Pin Definitions

Pins 2 and 3 should be mismatched between 2020 and the computer. Ensure this is the case. It is also possible that the cable being used may switch pins 2 and 3, even if it is not necessary. The cable may be a null modem. IBM-XT cables are usually null modems, since a null modem is required for connection to a printer.

If you are using an IBM-AT and find that a null modem is not required it is possible that an IBM-XT serial port has been added to an expansion slot and thus does not require a null modem. The opposite may be the case if an IBM-AT serial port was added to an IBM-XT expansion slot, in which case the null modem is required.

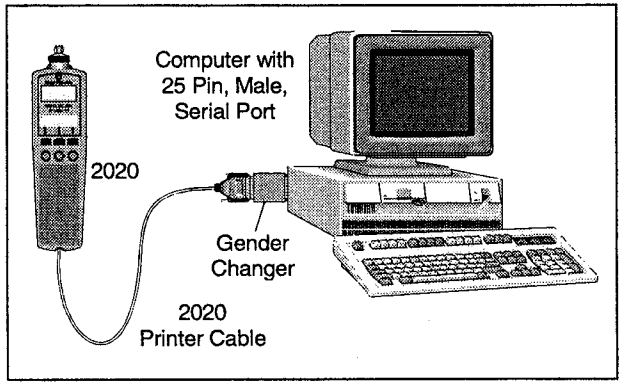

Figure 26 Connecting 2020 Using the Gender Changer

3. Ensure all hardware is working properly.

   Use a printer to test both 2020 and the computer. Connect 2020 to the printer and ensure that this arrangement produces the desired results. If the correct printout is obtained, then the 2020 and the printer cable are okay.

   Now connect the computer to the printer and ensure this works. If the desired printout is obtained this ensures the computer parts are handling data correctly.

7. Technical Description

7.1. General Operation

2020 is a microprocessor controlled air monitor for measuring the presence of photoionizable chemicals in air at parts-per-million levels. The block diagram in Figure 27 shows the main components of 2020.

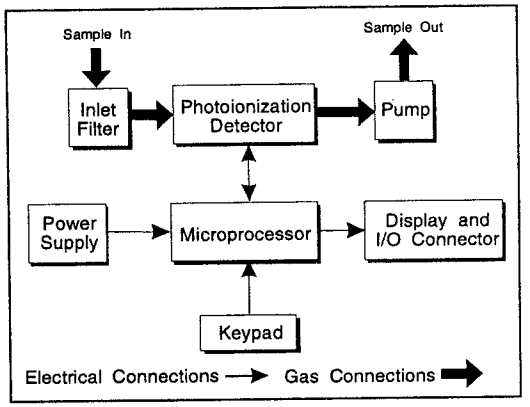

Figure 27 2020 Block Diagram

The microprocessor controls the components of the instrument and interprets and records the signal generated by the photoionization

detector (PID). Recorded data and setup information entered into the microprocessor's memory are retained when 2020 is turned off.

A pump continuously pulls the air under test through 2020's PID. The PID converts the concentration of photoionizable chemicals in the sample into an electrical signal. The microprocessor subtracts any background from the signal and divides this signal by a sensitivity obtained by calibrating with a standard gas of known concentration. This concentration appears on 2020's display and, depending on the values entered through 2020's keypad, an alarm status may be displayed and an audio signal may be heard.

2020 can detect thousands of different types of airborne gases and vapors and its response depends on the type as well as the concentration. 2020 does not distinguish one type of chemical from another, but displays a number indicating the total concentration of all photoionizable compounds in the sample.

A standard of isobutylene at a known concentration may be used for setting the sensitivity. If 2020 is calibrated with isobutylene, it displays concentrations in units equivalent to ppm of isobutylene. If isobutylene were the only photoionizable chemical in the sample, then 2020 would display its concentration directly.

2020 responds more or less readily to other chemicals than it does to isobutylene. Because it has a medium sensitivity to isobutylene, this gas has been chosen as a reliable means of reporting an average concentration of total ionizables present.

For special applications, gases other than isobutylene can be used to calibrate 2020.

7.2. Photoionization Detector

2020's PID is shown in Figure 28. The PID measures the concentration of photoionizable chemicals in the gas stream from the sample inlet and produces an electrical signal for the microprocessor.

A UV lamp generates photons which ionize specific molecules in the gas stream. The permanent air gases (argon, carbon dioxide, nitrogen, oxygen, water vapor etc.) require a relatively high energy for ionization, and are not ionized by the UV photons. Many of the chemicals considered pollutants, including most hydrocarbons, are ionized.

The gas stream is directed into the PID through a small port at the center of the UV lamp window and through a series of larger ports around the perimeter of the lamp window. This arrangement permits a high sample flow rate and short response.

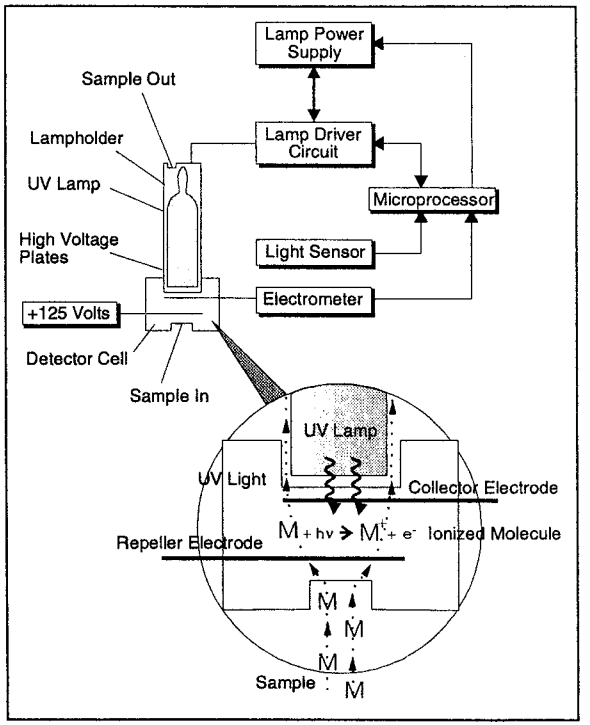

Figure 28 Photoionization Detector

The ionized molecules in the detector cell are subjected to a continuous electric field between the repeller electrode and the collector electrode. The ions move in the electric field, generating a current which is proportional to the concentration of the ionized molecules in the detector cell. An electrometer circuit converts the current to a voltage which is then fed to the microprocessor.

The UV lamp is operated by a high voltage lamp driver circuit which delivers high voltage energy to the lamp through plates in the

lampholder. The lamp driver power supply is controlled by the microprocessor based on a feedback signal from a light sensor on the driver circuit board.

7.3. Calibration

Periodic calibration is required to compensate for 2020 output changes due to inlet filter restriction, ionization chamber cleanliness, pump wear and other factors.

During calibration, 2020 is first exposed to zero air. A small signal is generated. This zero signal is stored by the microprocessor.

2020 is next exposed to span gas. This span gas signal is stored by the microprocessor. The microprocessor subtracts the zero signal from the span gas signal and divides the difference by the user-entered span gas concentration. The resulting sensitivity is stored in the selected Cal Memory with the zero signal and the alarm levels. This number is then multiplied by the response factor and displayed.

2020 readings are always relative to the calibration gas. After calibration with isobutylene, 2020 will respond directly in units equivalent to isobutylene. Most volatile organic compounds will be detected by 2020. It cannot distinguish between isobutylene and other ionizable compounds. A reading of 10 ppm indicates all ionizable compounds that are present have generated an ion current proportional to 10 ppm of isobutylene. The reading is actually 10 ppm isobutylene equivalent units. 2020 readings give an indication of the total ionizables present and their concentration relative to the calibration gas.

7.4. Datalogger

7.4.1. Interval Operation

The microprocessor accumulates all readings in an averaging interval, that you select, and determines the minimum, average and maximum readings. It stores these numbers along with the highest priority instrument status and the most recent time and date. The datalogger can store 1000 of these entries.

These recorded data can now be reviewed and edited. Recorded data can also be printed as either a table or a graph. For each averaging interval, 2020 prints the minimum of all the minima, the average of all the readings for the interval and the maximum of all the maxima.

In PEAK mode, the reading is updated once a second. In the background, the 2020 datalogger is sampling the concentration and measuring min, max, and average concentrations for the selected averaging interval. At the end of every interval, one entry is placed in the datalogger until the datalogger is full.

The MAX mode displays the maximum signal, with the date and time that it was recorded. 2020 continues to log data according to the selected averaging interval, but only the maximum detected concentration is displayed on the meter display.

In STEL mode, 15 samples are combined to form a 15 minute average. Once every minute, the oldest of the 15 samples is replaced with a new one minute average. This moving average provides a 15 minute average with a one minute update rate so the meter display will only update once every minute. STEL is set to zero each time the instrument is turned on.

STEL calculations are always being performed by 2020. You can display the results of the calculations by selecting STEL as the Display mode

TWA mode sums concentrations every second until 8 hours of data have been accumulated. Once 8 hours of data have been summed, the accumulation stops.

This sum will only be complete after 8 hours, so the meter displays the current sum divided by 8 hours. While you are in TWA mode, the time on the status display will show the number of minutes and hours of data that TWA has accumulated. When this reaches 8 hours, 2020 stops accumulating data and the TWA is complete.

TWA calculations are always being performed by 2020. You can display the results of the calculations by selecting TWA as the Display mode.

7.4.2. Manual Mode

In manual operation you are prompted to locate a specific sampling site and then record both a background and a sample entry in the datalogger. 2020 stores these numbers along with the highest priority instrument status and the most recent time and date.

Recorded data can also be printed as either a table or a graph. The difference between the sample and background is calculated and shown on the printed output.

8. Appendices

8.1. Specifications

Size:	25.4 cm (10") long, 7.6 cm (3") wide, 5 cm (2") high
Weight:	0.8 kgs (1.75 lbs)
Detector:	Instant on photoionization detector with standard 10.6 eV UV lamp.
Keypad:	6 silicone keys with tactile feedback
Status Display:	2-line, 16-character dot-matrix, backlit, liquid crystal display for alphanumeric readouts and soft key display.
Meter Display:	4 digit, 7 segment display for real time concentration readout.
Datalogger memory:	16 kilobytes or 1000 entries
Serial output:	RS-232, 9600 baud, 8 data bits with no parity, for tabular and graphic printouts and connection to an IBM compatible computer
Audio output:	95 decibels @ 2048 Hz, on Alarm
Inlet connection:	1/8" compression fitting

Battery type:	Nickel cadmium rechargeable cell with intelligent charger. The battery pack is 24% cadmium (Cd) by weight.
Charge/discharge time:	4 hr/8 hr
Battery charger:	Automatically charges and maintains full charge in battery pack
Materials in sample stream:	Stainless steel, Teflon®, Viton®, polypropylene, nitrile chorobutadiene rubber, nickel
Inlet filter:	Replaceable Teflon/Polypropylene, 1 um
Inlet flow rate:	Greater than 300 mL/min.
Operating temperature range:	0 to 40°C (32 to 105°F)
Operating humidity range:	0 to 100% relative humidity (non-condensing)
Operating concentration range:	0.5 to 2000 ppm, isobutylene
Accuracy:	+/-10% or +/-2 ppm, whichever is greater
Precision:	1% of calibration (calibrated with 100 ppm isobutylene)
Response time:	Less than 3 seconds to 90%
Detection limit:	0.5 ppm isobutylene
Dilution probe:	Normal calibration: concentrations between 100 to 20000 ppm +/- 20% High accuracy calibration: concentrations between 100 to 1000 ppm +/- 15%. Concentrations between 1000 to 20000 ppm +/- 20%

Note: Specifications subject to change without notice.

8.2. Warranty

2020 is warranted for one year against defects in materials and workmanship.

PE Photovac warrants that its manufactured product will be free from defects in materials and workmanship for a period of one (1) year from the date of receipt by the Customer. This may be voided if, in the opinion of PE Photovac, the product has been abused or treated in a negligent manner so as to cause damage or failure. Negligent use includes, but is not limited to, exposure of the internal parts of the equipment to water. Damage caused thereby is expressly excluded from this Warranty.

Consumable supplies and parts routinely replaced are not warranted.

PE Photovac and its vendors disclaim any implied warranty of merchantability or fitness for a particular purpose. PE Photovac and its vendors will not be liable for any indirect, special, incidental, or consequential damages, irrespective of whether PE Photovac or the vendor has advance notice of the possibility of such damages.

PE Photovac's sole liability under this warranty is limited to the repair or replacement of the product at its Service/Repair facility and return to the Customer.

When PE Photovac is made aware of a problem that would be eligible for remedy under Warranty, it will issue a Return Authorization Number to the Customer. No return will be accepted unless such authorization has been obtained. The customer is responsible for insurance and shipping to the designated PE Photovac Service/Repair facility.

8.3. Contacting PE Photovac

To place an order, check the status of an order, obtain current pricing and availability	1-800-231-9918
Service and repair of your instrument	(203)761-5330
Applications Department	Tel.: (203)761-5330 Fax.: (203)761-2677

Table 11 PE Photovac Contact Information

Customer Service	Tel.: (905)477-8088 Fax.: (905)477-8220
In the USA	The Perkin-Elmer Corporation Photovac Monitoring Instruments 761 Main Avenue Norwalk, CT 06859-0211 Tel.: (203)761-5330 Fax.: (203)761-2677
In Canada	PE Photovac 330 Cochrane Drive Markham, Ontario, L3R 8E5 Tel.: (905)477-8088 Fax.: (905)477-8220
In Europe	Photovac Europa Sjaelsoe Allé 7 A P.O. Box 79 DK-3450 Allerod, Denmark Tel.: +45-48-100-400 Fax.: +45-48-100-401
In all other areas contact your PE Photovac representative.	

Table 11 PE Photovac Contact Information - continued

8.4. Installing Alternate AC Plug on the Battery Charger

In most cases 2020 will be shipped with an AC line cord that will fit the AC wall outlet in your area. If this cannot be done, you may need to obtain an AC line cord suitable for the AC receptacle in your area.

The AC line cord, attached plug and receptacle must be marked with your country's certification mark and the cord must have a Harmonization (HAR) mark.

The line cord must be rated for either 100 to 120 VAC at 60 Hz or 220 to 240 VAC at 50 Hz. The voltage rating will depend on the voltage in your area.

Contact your PE Photovac representative to obtain more information.

8.5. Calibration Gas Supplier

The recommended span gas is isobutylene in air. 100 ppm isobutylene in air may be obtained from PE Photovac. (Part No. 350012 for Flow Match regulator, 395066 for gas bag calibration).

The exact concentration will be determined by your application. Other concentrations and other gases may be obtained from Scott Specialty Gases Inc. When ordering, specify a Scotty® V or Mini-Mix™ Cylinder.

Scott Specialty Gases Inc.
1290 Combermere Street
Troy, Michigan 48083

Telephone (within the USA): 1-800-774-9447
Telephone (outside USA): 1-810-589-2950
Fax: 1-810-589-2134

8.6. Using the Gas Bag

1. Turn the knurled plastic knob counterclockwise to unlock it. Use the knurled collar on the valve tube to gently push the valve tube down, toward the bag.
2. Turn the knurled plastic knob clockwise to lock the valve tube in place.
3. Turn the regulator knob counterclockwise about half a turn to start the flow of gas. Fill the gas bag about half full and then close the regulator.
4. Open the syringe port and empty the bag. Flush the bag a few times with the calibration gas and then fill it.
5. To close the gas bag valve, turn the knurled plastic knob counterclockwise to unlock it. Gently pull the valve tube up to close the valve. Turn the knurled plastic knob clockwise to tighten it against the valve tube.

Once the bag has been filled, use the bag and sample as soon as possible.

Note: Do not use gas bags to sample unstable or highly reactive compounds. Do not use Tedlar® bags for storage of hazardous materials.

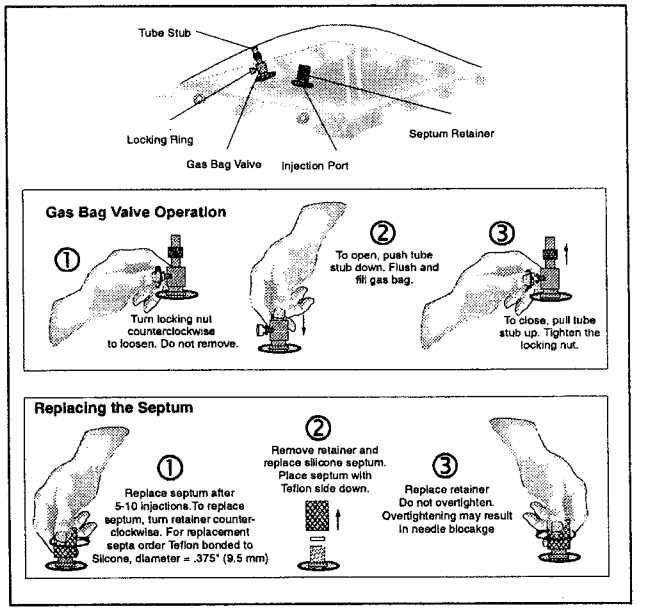

Figure 29 Using the Gas Bag

8.7. Response Factors

The response factors were determined over the range 5 - 500 ppm, based on a 100 ppm isobutylene calibration. Isobutylene RF = 1.0. The following formula was used for calculation of response factors:

$$\text{Response Factor} = \frac{\text{Actual Concentration}}{\text{2020 Response}}$$

A response factor less than 1.0 indicates a compound response better than that of isobutylene. A response factor greater than 1.0 indicates a lower response than that of isobutylene.

Note: It does not matter which Cal Memory is selected or which response factor is entered. 2020's response is not specific to any one compound. The reading displayed represents the total concentration of all ionizable compounds in the sample.

When using response factors, results are expected to be accurate to +/- 10 ppm or +/- 25%, whichever is greater.

Compound	Response Factor
Acetaldehyde	10.5
Acetone	1.2
Acrolein (2-Propenal)	4.0
Allyl Chloride (3-Chloro-1-Propene)	3.9
Benzene	0.5
Bromoform (Tribromomethane)	2.0
1,3-Butadiene	0.7
n-Butanol	3.4
n-Butyl Acetate	2.3
n-Butyl Acrylate	1.8
n-Butyl Mercaptan (Butanethiol)	0.6
Carbon Disulfide	1.3
Chlorobenzene	0.4
Crotonaldehyde (2-Butenal)	1.2
Cumene (Isopropylbenzene)	0.6
Cyclohexane	1.3
Cyclohexanone	0.9
1,2-Dichlorobenzene (ortho-)	0.5
cis-1,2-Dichloroethylene	0.8
trans-1,2-Dichloroethylene	0.4
N,N-Dimethylformamide (DMF)	0.8
1,4-Dioxane	1.3
Epichlorohydrin	6.5
Ethanol	8.8
Ethyl Acetate	3.8
Ethyl Acrylate	2.3
Ethylbenzene	0.5
Ethyl Cellosolve (2-Ethoxyethanol)	1.3
Ethyl Ether (Diethyl Ether)	1.2
Ethyl Mercaptan (Ethanethiol)	0.6
Ethylene	10.1
n-Heptane	2.4
n-Hexane	4.7
Hydrogen Sulfide	3.3
Isoamyl Acetate	1.8
Isobutyl Acetate	2.6

Table 12 Response Factors

Isobutyraldehyde	1.1
Isopentane	8.2
Isoprene (2-Methyl-1,3-Butadiene)	0.6
Isopropanol	4.4
Isopropyl Acetate	2.6
Isopropyl Ether	0.8
Methyl Bromide (Bromomethane)	1.6
Methyl Ethyl Ketone (2-Butanone)	0.8
Methyl Isobutyl Ketone	1.0
Methyl Mercaptan	0.5
Methyl Methacrylate	1.4
Methyl tert-Butyl Ether (MTBE)	0.8
Monomethylamine	1.3
n-Nonane	1.4
iso-Octane (2,2,4-Trimethylpentane)	1.2
n-Pentane	10.4
n-Propanol	5.1
Propionaldehyde (Propanal)	14.8
n-Propyl Acetate	3.1
Propylene	1.2
Propylene Oxide	5.8
Styrene	0.4
Tetrachloroethylene (Perchloroethylene)	0.5
Tetrahydrofuran	1.5
Toluene	0.5
Trichloroethylene (TCE)	0.5
Trimethylamine	0.9
Vinyl Acetate	1.2
Vinyl Bromide	0.4
Vinyl Chloride (Chloroethylene)	1.7
Vinylidene Chloride (1,1-DCE)	0.8
meta -Xylene	0.5
ortho -Xylene	0.5
para-Xylene	0.5

Table 12 Response Factors - continued

8.8. Library Entries

Library selections simplify Cal Memory programming, and provide standard response factors and alarm levels for approximately 70

applications. The name, response factor and three alarm levels are all set from the library.

You can change any of the values entered in the Cal Memory. Changes, made to the library information that has been loaded into a Cal Memory, will have no effect on the original library entry.

Note: It does not matter which library or Cal Memory is selected or which response factor is entered. 2020's response is not specific to any one compound. The displayed reading represents the total concentration of all ionizable compounds in the sample.

See Section 2.6.4 for details on using libraries to program the Cal memories.

Compound	Code	RF
Acetaldehyde	ACETAL	10.5
Acetone	ACETONE	1.2
Acrolein (2-Propenal) 3	ACROLEIN	4.0
Allyl Chloride (3-Chloro-1-Propene) 3	ALLCHLOR	3.9
Benzene	BENZENE	0.5
Bromoform (Tribromomethane) 3	BROMFORM	2.0
1,3-Butadiene	13BUTADI	0.7
n-Butanol	nBUTANOL	3.4
n-Butyl Acetate	nBUTACET	2.3
n-Butyl Acrylate	nBUTACRY	1.8
n-Butyl Mercaptan (Butanethiol) 4	nBUTMERC	0.6
Carbon Disulfide	CS2	1.3
Chlorobenzene	CHLOBENZ	0.4
Crotonaldehyde (2-Butenal)	CROTONAL	1.2
Cumene (Isopropylbenzene)	CUMENE	0.6
Cyclohexane	CYCHEXAN	1.3
Cyclohexanone	CYCHEXON	0.9
1,2-Dichlorobenzene (ortho-)	12DCBENZ	0.5
cis-1,2-Dichloroethylene	cis12DCE	0.8
trans-1,2-Dichloroethylene	trn12DCE	0.4

Table 13 Library Entries

N,N-Dimethylformamide (DMF)	N,N-DMF	0.8
1,4-Dioxane	DIOXANE	1.3
Epichlorohydrin 3	EPICLHYD	6.5
Ethanol	ETHANOL	8.8
Ethyl Acetate	ETHYACET	3.8
Ethyl Acrylate	ETHYACRY	2.3
Ethylbenzene	ETBENZEN	0.5
Ethyl Cellosolve (2-Ethoxyethanol)	ETHCELLO	1.3
Ethyl Ether (Diethyl Ether)	ETHETHER	1.2
Ethyl Mercaptan (Ethanethiol) 4	ETHMERC	0.6
Ethylene 5	ETHYLENE	10.1
n-Heptane	nHEPTANE	2.4
n-Hexane	nHEXANE	4.7
Hydrogen Sulfide	H2S	3.3
Isoamyl Acetate	IAMYACET	1.8
Isobutyl Acetate	IBUTACET	2.6
Isobutyraldehyde 6	IBUTALDE	1.1
Isopentane	IPENTANE	8.2
Isoprene (2-Methyl-1,3-Butadiene) 6	ISOPRENE	0.6
Isopropanol	IPA	4.4
Isopropyl Acetate	IPACETAT	2.6
Isopropyl Ether	IPROPETH	0.8
Methyl Bromide (Bromomethane)	MeBROM	1.6
Methyl Ethyl Ketone	MEK	0.8
Methyl Isobutyl Ketone	MIBK	1.0
Methyl Mercaptan (Methanethiol) 4	METHMERC	0.5
Methyl Methacrylate	MeMeACRY	1.4
Methyl tert-Butyl Ether (MTBE)	MTBE	0.8
Monomethylamine	MMeAMINE	1.3
n-Nonane	nNONANE	1.4
iso-Octane (2,2,4-Trimethylpentane)	IOCTANE	1.2
n-Pentane	nPENTANE	10.4
n-Propanol	nPA	5.1
Propionaldehyde (Propanal) 3	PROPANAL	14.8
n-Propyl Acetate	nPROACET	3.1

Table 13 Library Entries - continued

Propylene 5	PROPYLEN	**1.2**
Propylene Oxide	PROPOXID	**5.8**
Styrene	STYRENE	**0.4**
Tetrachloroethylene (PCE)	PCE	**0.5**
Tetrahydrofuran	THF	**1.5**
Toluene	TOLUENE	**0.5**
Trichloroethylene	TCE	**0.5**
Trimethylamine	TRMeAMIN	**0.9**
Vinyl Acetate	VINACET	**1.2**
Vinyl Bromide	VINBROM	**0.4**
Vinyl Chloride (Chloroethylene)	VINCHLOR	**1.7**
Vinylidene Chloride (1,1-DCE)	1,1-DCE	**0.8**
meta-Xylene	mXYLENE	**0.5**
ortho-Xylene	oXYLENE	**0.5**
para-Xylene	pXYLENE	**0.5**

Table 13 Library Entries - continued

Notes

1 Peak alarm levels have been established as the TLV-Ceiling concentration, or the TLV-STEL concentration in those cases where no TLV-Ceiling value exists.

2 In cases where no STEL exists for a compound, the STEL value has been established as equivalent to the TWA value.

3 In cases where recommended exposure limits are below the detection limit for the compound in question, the estimated lower limit of detection has been substituted for those values.

4 2020 is not suitable for monitoring these compounds at ACGIH recommended levels.

5 A 1000 ppm TWA has been established for those compounds which are "Simple Asphyxiants", and for which no exposure value exists.

6 For those compounds which lack established exposure levels, an arbitrary value of 200 ppm has been established for the TWA, STEL and PEAK alarms.

8.9. References

1. Maslansky, Carol J. and Steven P. Maslansky. *Air Monitoring Instrumentation.* New York: Van Nostrand Reinhold, 1993

2. American Conference of Governmental Industrial Hygienists. *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (1994-1995).* Reprinted with permission

Note: The TLV/BEI™ publication is revised annually.

3. Scott Specialty Gases, Catalog, 1994

4. National Institute for Occupational Safety and Health (NIOSH). *Recommendations for Occupational Safety and Health, Compendium of Policy Documents and Statements*, January 1992.

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ATTACHMENT B
GROUNDWATER MONITORING EQUIPMENT
OPERATOR'S MANUALS

表1

MULTI-PARAMETER WATER QUALITY MONITORING SYSTEM

U-20XD Series

U-22XD

Operation Manual

■

HORIBA

HORIBA's Warranty and Responsibility

Your U-20XD series multi-parameter water quality monitoring system is covered by HORIBA's warranty for a period of one (1) year, under normal use. Although unlikely, if any trouble attributable to HORIBA should occur during this period, necessary exchange or repairs shall be conducted by HORIBA, free of charge.

The warranty does not cover the following:

- Any trouble or damage attributable to actions or conditions specifically mentioned in the operation manuals to be avoided
- Any trouble or damage attributable to use of the multi-parameter water quality monitoring system in ways or for purposes other than those described in the operation manuals
- If any repairs renovations, disassembly, etc. are performed on this multi-parameter water quality monitoring system by any party other than HORIBA or a party authorized by HORIBA
- Any alteration to the external appearance of this multi-parameter water quality monitoring system attributable to scratches, dirt, etc. occurring through normal use
- Wear and tear to parts, the exchange of accessories, or the use of any parts not specified by HORIBA

INSTALLATION ENVIRONMENT

This product is designed for the following environment:

→ Installation Categories II
→ Pollution degree 2

LIMITATION OF LIABILITY FOR DAMAGES

HORIBA will not accept responsibility for damage or malfunction that may occur as a result of operation or situation not recommended in this manual. HORIBA shall not be liable for Customer's incidental, consequential or special damages, or for lost profits or business interruption losses, in connection with the operation of the Manufactured Parts, CPU hardware, disk drives or Software.

CE MARKING

U-20XD Series conforms with the following directive(s) and standard(s):

Directives:

the EMC Directive 89/336/EEC, in accordance with Article 10(1) of the Directive
the Low Voltage Directive 73/23/EEC

Standards:

[the EMC Directive] EN61326:1997+A1:1998
(EMISSION : Class B, IMMUNITY Category : General)
[the Low Voltage Directive] EN61010-1:1993 +A2:1995

FCC Warning

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Unauthorized reprinting or copying of this operation manual

No unauthorized reprinting or copying of all or part of this operation manual is allowed. The utmost care has been used in the preparation of this operation manual. If, however, you have any questions or notice any errors, please contact the HORIBA customer service printed on the back cover of this operation manual.

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Preface

Thank you very much for purchasing HORIBA's “MULTI-PARAMETER WATER QUALITY MONITORING SYSTEM” U-20XD Series.

Compact and one-hand-held, our multi-parameter water quality monitoring system makes measurements about a large number of items simultaneously.

The instrument uses a large-sized LCD display and has a variety of functions through easy operation, being useful for use at sites where measurements are to be made.

The water-proof construction of the instrument is compliant with IP-67 of IEC 529, “Water-proof test on electrical and mechanical equipment and tools and protection grade against entry of solids.” Please use the instrument by following the information in this Operation Manual to maintain the water-proof construction of the instrument.

IP-67 standards

- Keeping dust and grit out of the instrument
- Up to 5 °C difference between water and an instrument employed and no entry of water into. the inside of the instrument at a depth of 1 m for 30 minutes

This Operation Manual contains information on the basic way of handling the instrument, notes, etc. for the user. Be sure to read through the Operation Manual before use.

Symbols employed

The symbols employed herein have the following meanings:

⚠WARNING : Improper use can result in serious injury or even death.

⚠CAUTION : The improper use of the instrument may cause the following dangers:

- Danger of injury
- Danger of damage to the instrument, its peripherals, and data

⊘ : Description of what should never be done, or what is prohibited.

❗ : Description of what should be done, or what should be followed.

Important : Explanation necessary for the proper operation of the instrument

Note : Explanation that is useful and necessary for handling the instrument

☞ : Refer to the item shown.

Symbols employed in screen description

The symbols and used in screen description have the following meanings:

: The letters and numbers in this symbol are blinking on the screen.

: The letters and numbers in this symbol are lighting up on the screen.

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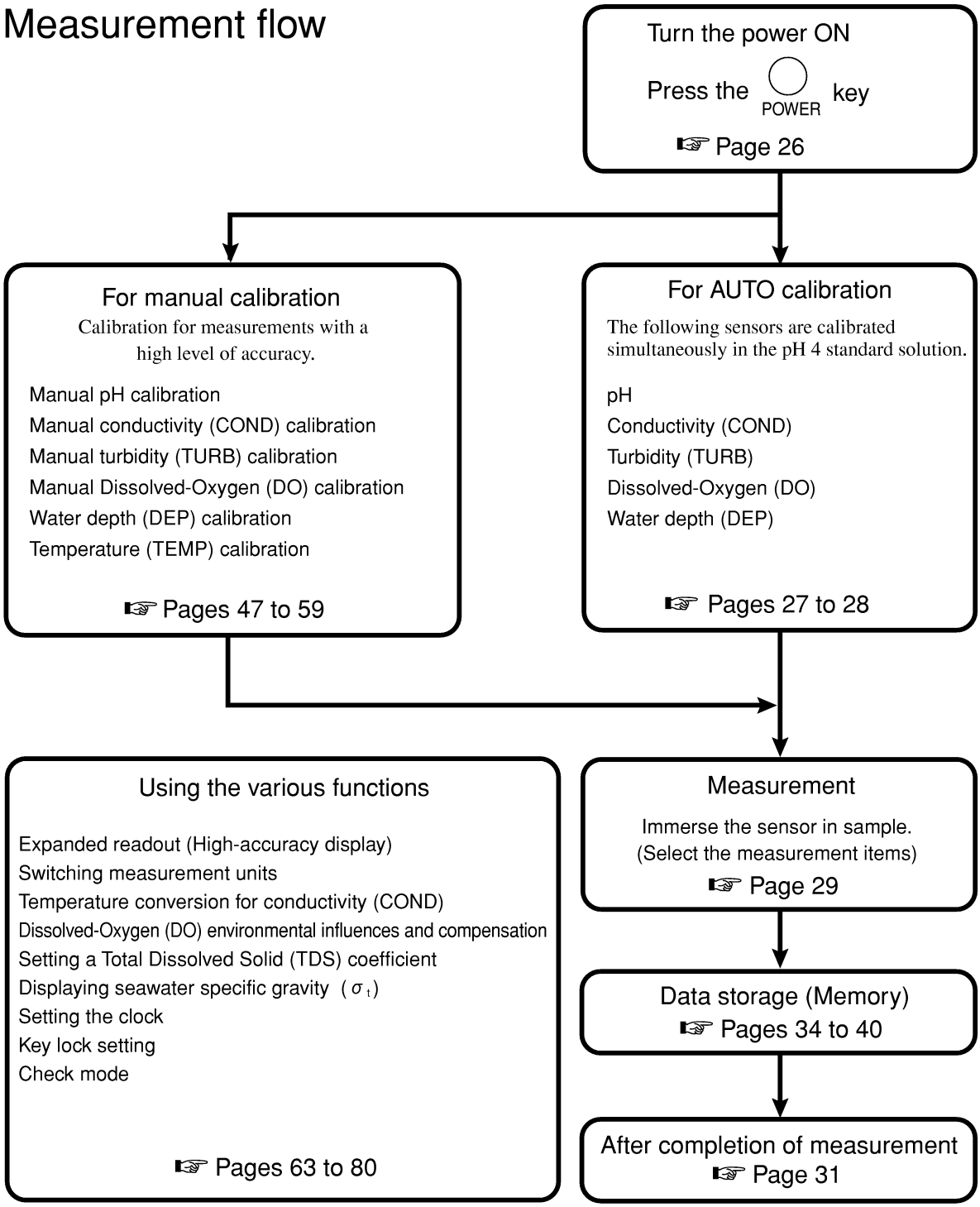
Measurement flow



1. Introduction

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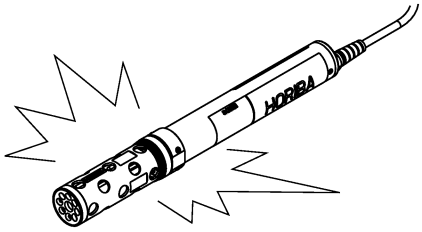
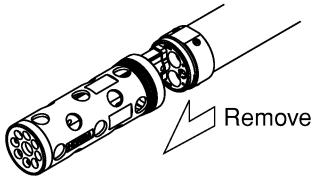
1.1 Notes on handling the instrument

Handling of sensor probe

Do not give a shock to the sensor probe.
The sensor will be damaged.

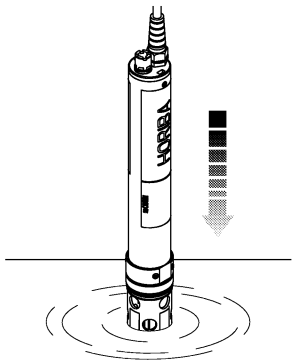


Do not remove the protection cover from the sensor probe to use.
Damage may occur to the sensor.



Slowly lower the sensor probe into the sample.

Dropping it from a height of 1m or more may cause damage to the sensor.
Do not immerse the sensor probe at the depth of exceeding 100 m.
The device can resist the hydraulic pressure at the dept up to 100 m.



- The protection cover may rust due to the environment in which it is used. The damage caused by this usage shall not be warranted by the manufacturer. Solve it with parts which users need to replace periodically.

⚠ WARNING

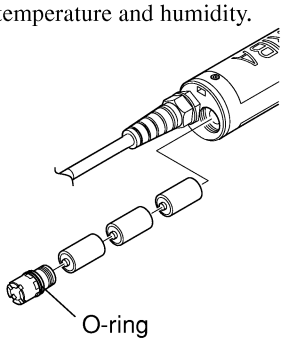
- Fix the sensor probe to the cable or the reel to use.
- In place with a large distance to the water level or with a rapid water flow, fix the sensor probe hook to a point except your body before use for safety purposes.
  Be careful not to let go off the sensor probe by mistake. Otherwise, the sensor probe together with the instrument will fall into the water or a sharp shock will occur to yourself while you are holding the instrument.

Replacing batteries and sensor of the sensor probe

Do not replace the sensor probe batteries and sensor in the atmosphere of high temperature and humidity.

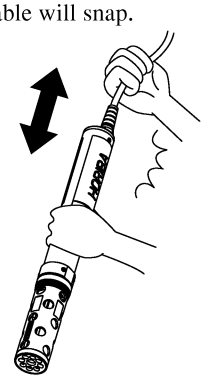
Put connector plugs into the sensor probe connectors with sensors off.

The sensor probe's battery cover is kept waterproof by the use of an O-ring. After checking that there are no foreign bodies adhering to the O-ring, apply silicon grease (included) to the face of the O-ring and close. Be sure to close it all the way to the indicated level. Do not close with the O-ring twisted or warped.

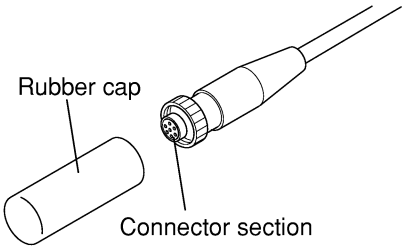


Handling of cable

Do not store the cable with its connector being greatly tensed or bent.
Do not submit the connector to strong shocks or the cable will snap.

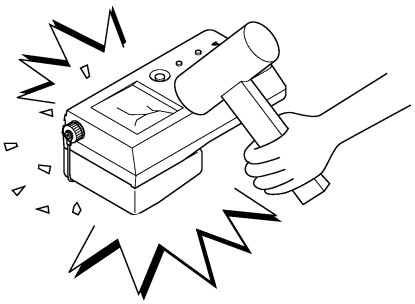


If sample waterdrops remain onto the connector section, metal part of the connector is likely to rust. When storing, wipe the area around the connector well and cover it with the rubber cap.

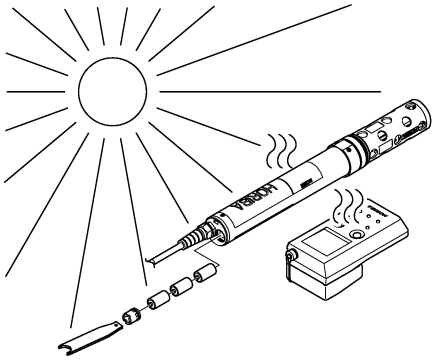


Handling of the instrument

Do not give a shock to or drop the sensor or instrument. The sensor or instrument will be damaged.

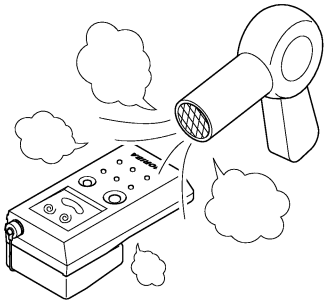


The display part includes LCD. Do not expose the instrument to ultraviolet rays for a long time. Otherwise, the LCD may deteriorate.

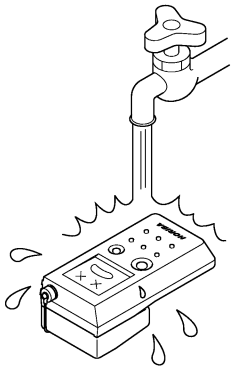


The instrument will be water-proof in construction (IP-67) when the sensor connector is connected to the instrument. However, if the instrument has been dropped into water or become wet, use a soft cloth to dry up the instrument.

Do not use a hair dryer to dry up the instrument.

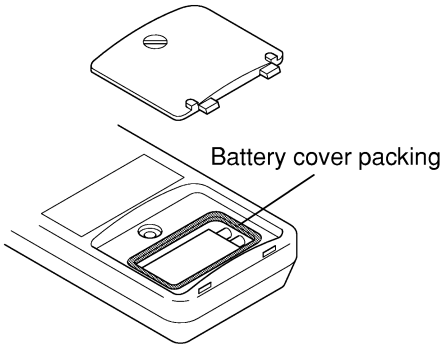


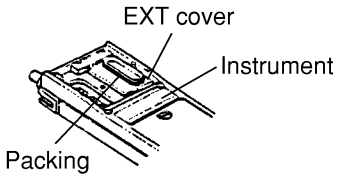
Do not wash directly the instrument using tap water from the faucet.



Note on replacing battery of the instrument and the section to which the EXT unit is attached

Waterproof function of the main unit is maintained by the packing of battery cover and EXT unit cover. Foreign matter on the packing can cause water to enter the instrument. Check for foreign matter on the packing before closing the battery cover and the EXT cover.
If the packing is twisted, do not close the battery cover and the EXT cover.





For a long use

We recommend that the packing be replaced once a year.
For battery cover packing replacement, contact your sales agent.

Note on place for use

- Avoid continuous measurement in water containing alcohol, organic solvent, strong acid, strong alkali or neutral detergent; otherwise the sensor surface will deteriorate.
- Do not use the instrument in the atmosphere with ambient temperatures below 0 °C (incl.) or above 55 °C (incl.).
- Avoid using the instrument in the condition exposed to strong vibrations or corrosive gases.
- Do not use the instrument near a source of strong electromagnetic field such as high-voltage cables and motors.

Batteries

The improper use of batteries may cause leaks and explosion.
Observe the followings:

- Set the batteries in place properly while paying attention to the plus (+) and minus (-) poles.
- Do not use both an old and new batteries or batteries of different types.
- Batteries for use in the instrument are not of the rechargeable type.
- Remove the batteries when not in use for a long time.
  In case of leaks, wipe off the solution in the battery case thoroughly and place new batteries in position.

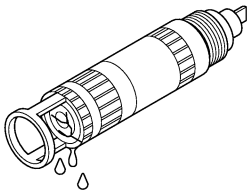
Handling the DO sensor

- In case of breakage of DO sensor diaphragm, replace DO sensor or replace just the diaphragm by using diaphragm replacement unit, without directly touching the internal solution.
- When removing the DO sensor from the sensor probe, make sure to install the short socket (included).

- Do not give a shock to the DO sensor. The sensor will be damaged.

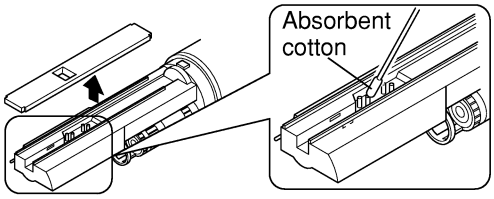
CAUTION

- The DO sensor holds a strong-alkaline solution. Protect the eye and skin from the solution. If there is any solution in the eye or on the skin, immediately use sufficient water to wash off the solution. Consult a doctor as required.



Handling the COND/TURB unit

When cleaning the COND/TURB unit, use an absorbent cotton to avoid damage to the TURB cell.

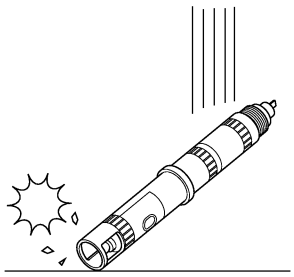


Handling the pH/ORP sensor

The pH/ORP sensor has a glass electrode at the end. Handle the sensor carefully to avoid a break in the glass electrode.

CAUTION

- Be careful not to break the glass on the top of the sensor. Otherwise you may get hurt with a piece of glass.



Disposal

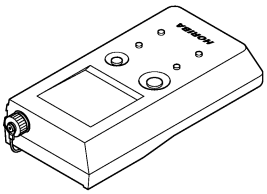
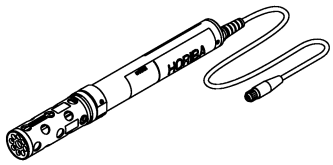
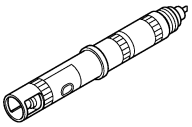
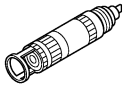
Dispose of this product as special waste, otherwise this may affect the environment.

Handling in transportation

- When transporting this product as freight, use the carrying case to prevent damage.
- Remove the flow cell from the sensor probe in transportation.

1.2 Packing list

The U-20XD series is comprised of the following items.

Model	U-22XD
Meter (U-2000)	
Sensor probe	
Sensor	pH/ORP sensor 
	DO (Dissolved-Oxygen) Sensor 
Accessories	pH 4 standard solution (500 mL)
	pH internal solution (250 mL)
	pH syringe with needle
	Sensor spanner
	Calibration beaker
	Probe cap
	Grip holder
	Carrying case
	Manganese battery 6F22 (006P) (1 piece)
	Alkaline batteries LR03 (AAA) (3 pieces)
	Silicon grease
	Sensor O-ring (S8) (10 pieces)
	Sponge for probe cap (5pieces)
	Operation manual

- The included battery is for the monitor. Its life is not guaranteed.

2. Before Use

2.1 Introduction to the instrument 8
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2.1.2 Introduction to functions of the instrument 9
2.1.3 Functions of expansion units 9
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2.1 Introduction to the instrument

2.1.1 Measurement items

Components that can be measured with the U-20XD series models are as follows:

Model	U-22XD
Measurement items	
pH	○
Dissolved Oxygen (DO)	○
Conductivity (COND)	○
Salinity (SAL) [Conductivity conversion]	○
Total dissolved solids (TDS) [Conductivity conversion]	○
Specific gravity of seawater [Conductivity conversion]	○
Temperature (TEMP)	○
Turbidity (TURB)	○
Water depth (DEP)	○
Oxidation-Reduction Potential (ORP)	○

○ ..... Measurable

2.1.2 Introduction to functions of the instrument

Outline of the functions of the instrument is described below.

Feature	Function name	Page
Data obtained during measurement can be saved in the memory.	Manual data storage	Page 34
Data can be automatically saved in the memory at constant time intervals.	Auto data storage	Page 36
Saved data can be called.	DATA OUT	Page 41
The latest date of calibration and its details can be called.	Calibration history	Page 43
Enlarged display is available.	Expand readout	Page 63
Measurement units can be switched.	Switching measurement unit	Page 64

* Other functions possible in the check mode are available. (☞ Page 73)

2.1.3 Functions of expansion units

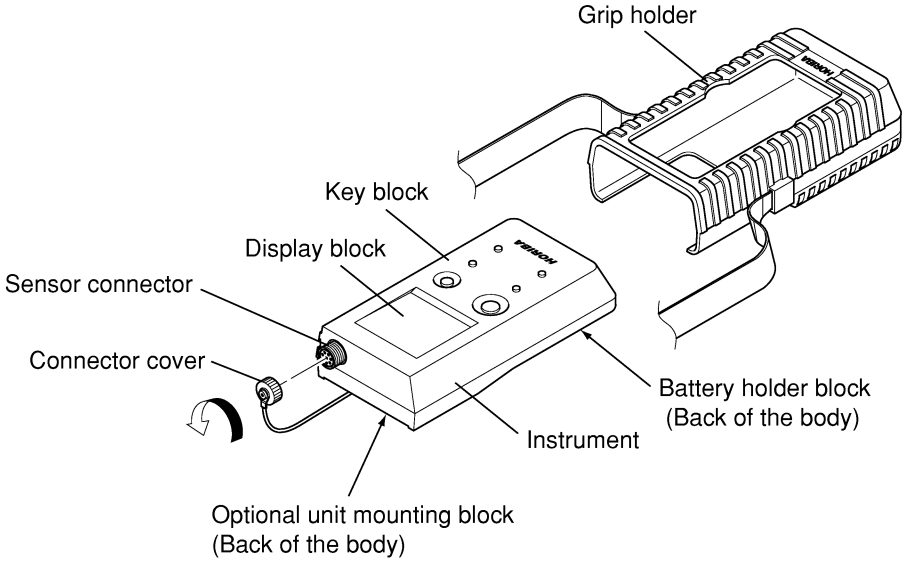
For the U-20XD series, use of expansion units allows communications with personal computers through RS-232C, the storage of G.P.S. data in the memory, and printer output, and commercial power supply.
Expansion units are available in the following two types:

Unit/name	Contents	Functions
U-2001 Expansion adaptor	• Expansion adaptor • Software for PC	<RS-232C communications, G.P.S connection, and printer output> The above functions cannot be used at the same time. One of the connectors for these three functions needs to be used.
U-2002 System unit	• System unit contain case • Software for PC • G.P.S. unit • Printer set	<RS-232C communications, G.P.S connection, printer output, battery power supply*> The above functions can be used at the same time. * A battery power supply can be used for measurements outdoors for 30 consecutive days.

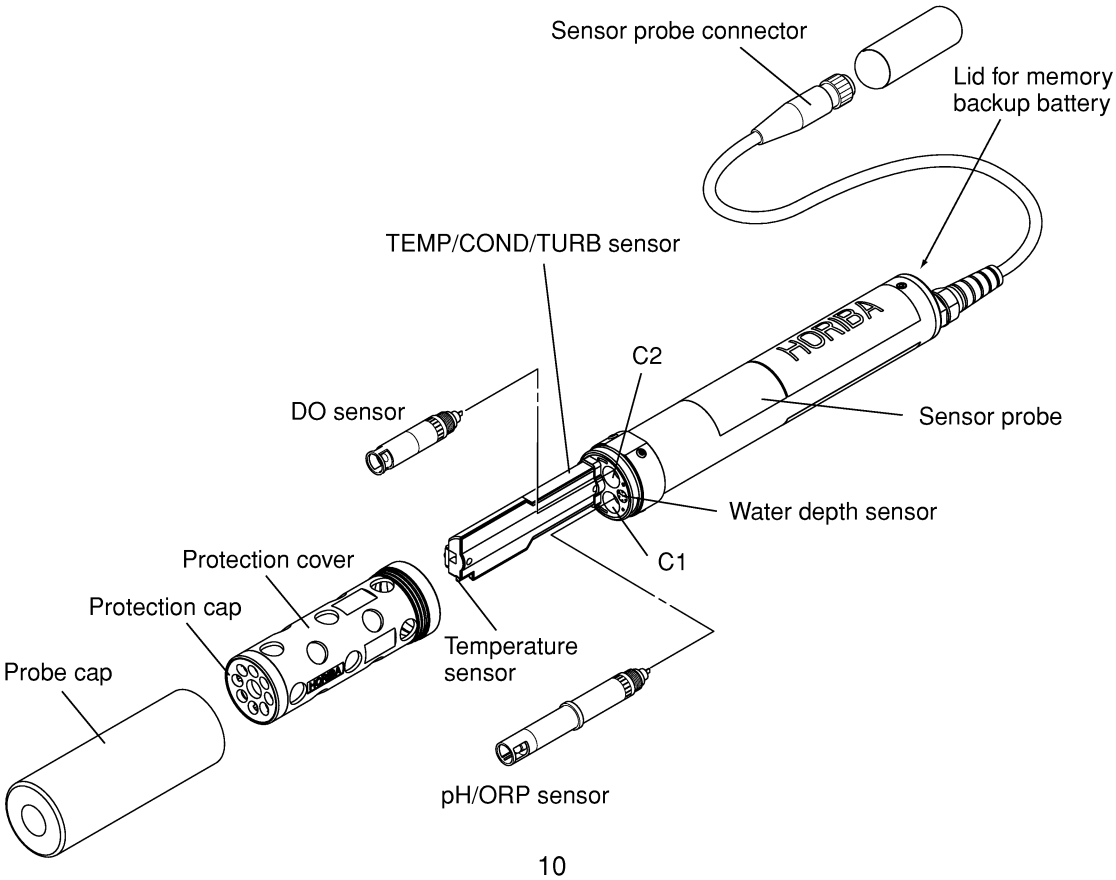
* U-2001 and U-2002 can operate on a commercial power supply through the use of an AC adapter (optional). However, the AC adapter cannot be used for the G.P.S. unit or printer set.

2.2 Names of the parts

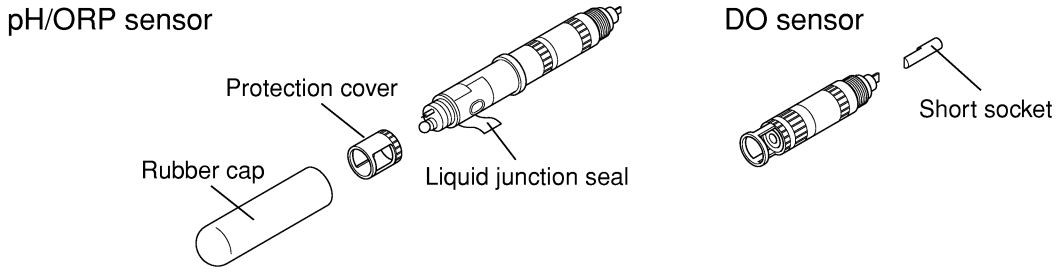
2.2.1 Instrument name



2.2.2 Sensor probe names



2.2.3 Sensor names



2.2.4 Use of carrying case

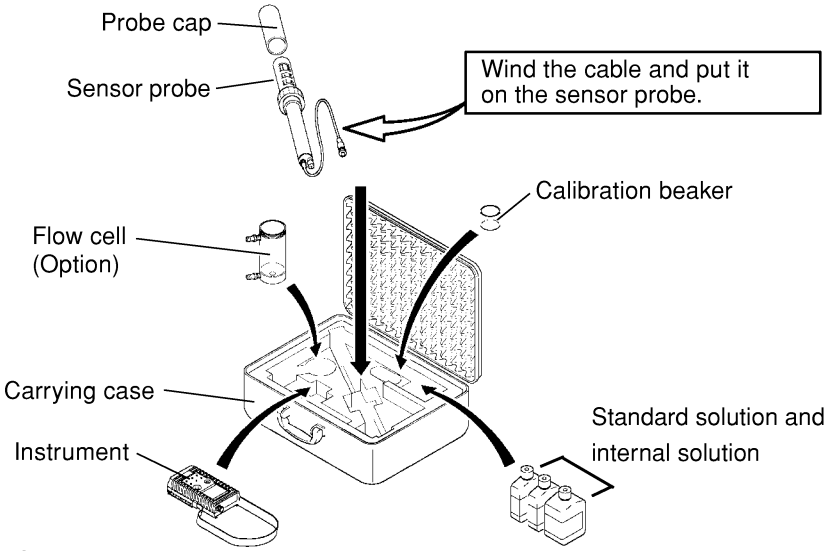
The carring case models W-2010 and W-2030 are applicable to store or transport U-22XD series.

Model	Applied to	Storage temperature	Material
W-2010	Cable length 10 m or less	-5 to 60℃	PP, ABS
W-2030	Cable length 30 m or more		

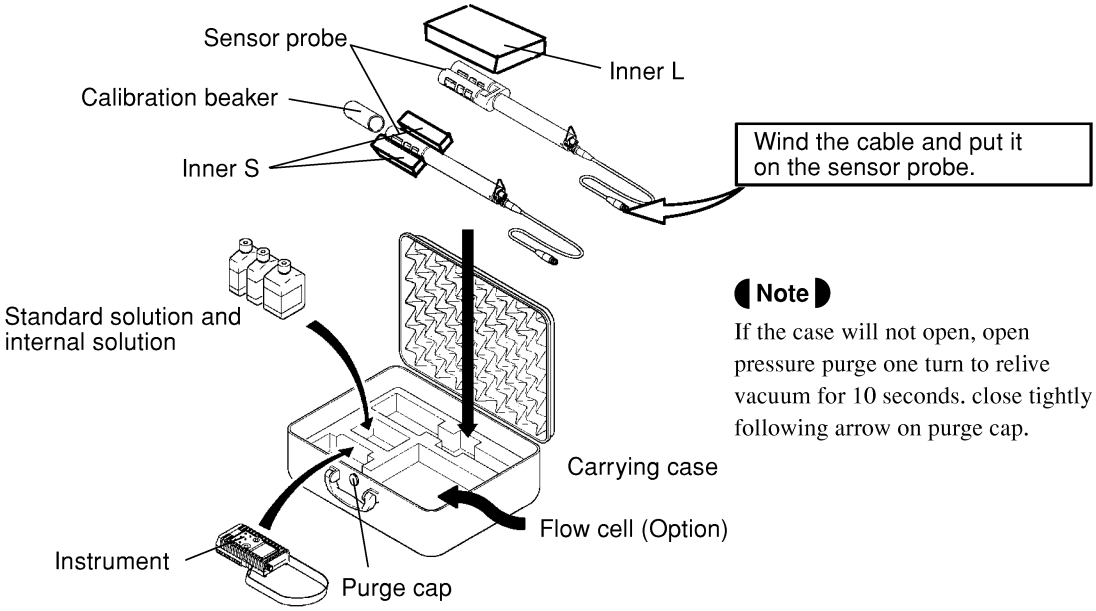
⚠ CAUTION

- Do not drop or hit the carring case to protect the units against damage.
- When using the sensor probe with flow cell, separate them for strage.
- Be careful not to catch your finger, when fastening or releasing the laches.

• W-2010



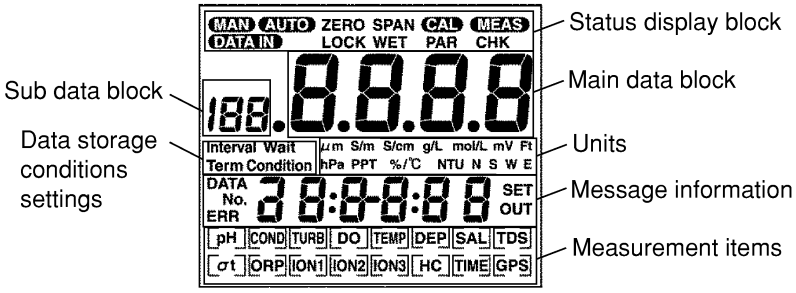
• W-2030



Note

If the case will not open, open pressure purge one turn to relive vacuum for 10 seconds. close tightly following arrow on purge cap.

2.2.5 Display



Status display block

MAN ..... On when the data memory and calibration settings are set to manual.
AUTO ..... On when the data memory and calibration settings are set to automatic.
DATA IN ..... On when the data memory operation and the data memorys operation settings are being performed. Blinking during calibration.
ZERO ..... On in the Zero calibration mode.
SPAN ..... On in the Span calibration mode.
CAL ..... On in the Calibration mode.
MEAS ..... On in the Measurement mode. (Measurements are being made when light up.)
LOCK ..... On when the keys are locked.
CHK ..... On when the instrument is in the check mode.

Sub data block

Display of the pH, Latitude (degree), Longitude (degree), Year and Check No.

Main data block

Display of Measurement data, Latitude (minute, 〔second〕), Longitude (minute, 〔second〕), and month and day.

Data storage conditions setting

Interval ..... On when a time interval is set for storage of data.
Wait ..... On when a time is set for waiting from the automatic data storage instruction until the start and during data processing through individual operations.
Term ..... On when a period is set for automatic data storage.

Units

Displays the units for measurement items.

Message information

Displays the stored data (data mode) and the data No. when the data is stored.
SET ..... Indicates that the instrument is in Set mode.

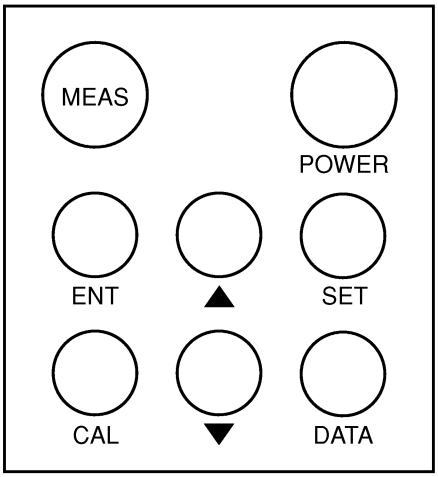
Measurement items

Displays the measurement items for the data in the main data block display. The display is read as follows.
Items without brackets ([ ]) ..... Items with the highlighted text will be stored in the data memory.
(☞ *Measurement item setting*, page 76)
Items with brackets ([ ]) ..... Displays the measurement items with data display.
(☞ *Measurement item setting*, page 76)

Note

- Because of the instrument's automatic power off function, the indication will disappear if the unit is not used for about 30 minutes. For operation of the unit and display of the indication, turn ON the instrument again.

2.2.6 Key names



POWER: Power key

Turns the instrument On and Off. Immediately after the power is switched on, the initial screen is displayed to indicate the status of the instrument.

MEAS: Measurement key

In the Measurement mode (MEAS is on), this key switches the measurement item. In addition, pressing the MEAS key returns you from the Setting, Calibration and Memory Call Up modes to the Measurement mode.

Note

- Regardless of which mode the instrument is in, it is always possible to return to the Measurement mode by pressing the MEAS key.

ENT: Enter key

In the Measurement mode (MEAS is on), pressing the ENT key stores the data in memory.
In the Calibration mode (CAL is on), pressing the ENT key performs calibration.
In the Setting mode, pressing the ENT key switches the setting and registers entered setting values.

CAL: Calibration key

Pressing the CAL key switches the instrument to the Calibration mode. If automatic data storage is in progress, it is aborted.

SET: Set key

Pressing the SET key switches the instrument from the Measurement mode to the Set mode. If the SET key is pressed on the “year, month, day, time” display screen, it switches the instrument to the Check mode.

DATA: DATA key

Pressing the DATA key switches the instrument to the Data mode.

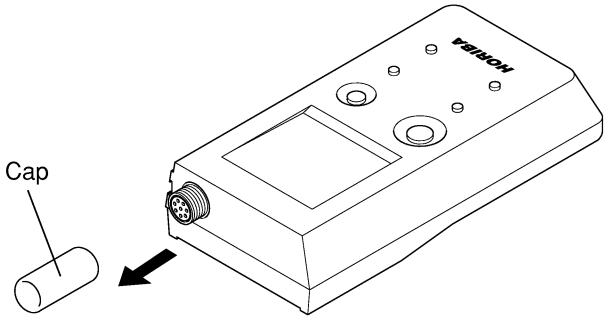
▲▼ : UP/DOWN keys

Use the UP/DOWN (▲▼) keys to set the calibration value in the Manual mode.

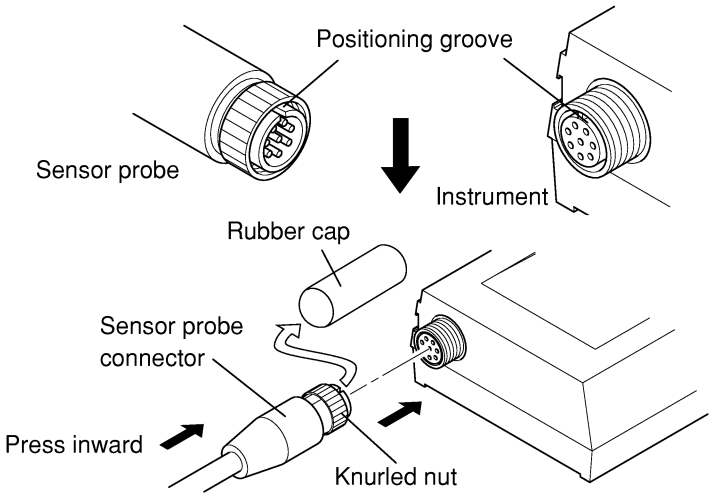
2.3 Setting up the U-20XD series models

2.3.1 Instrument and sensor probe connection

1. Remove the cap from the instrument's connector.



2. Align the positioning grooves of the instrument's connector and sensor probe connectors, and fit the connector of the sensor probe into the this other.



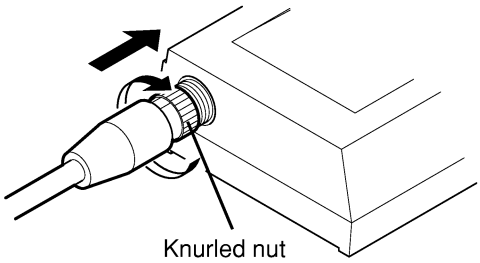
3. Press the sensor probe connector inward and turn. Tighten the connector until it will not turn any more.

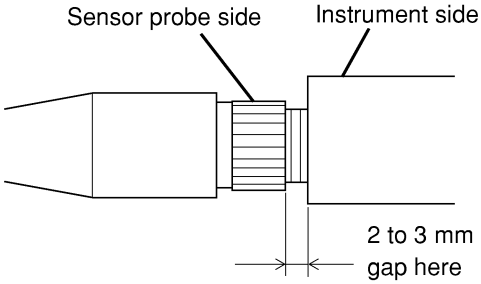
⚠ CAUTION

- Turn the knurled nut with holding the knurled part. Otherwise, it will cause breaking of wire.

Important

- The connector cover or sensor probe connector should be connected to the instrument. Otherwise, the instrument will not be waterproof.
- Unless snugly attached, the instrument is not fully waterproof. When the sensor probe connector is tightened as far as it can go, a 2 to 3 mm gap is left between the instrument's connector and sensor probe connector.





Note

- Tighten the sensor probe connector until it will not turn any more.

2.3.2 Sensor installation

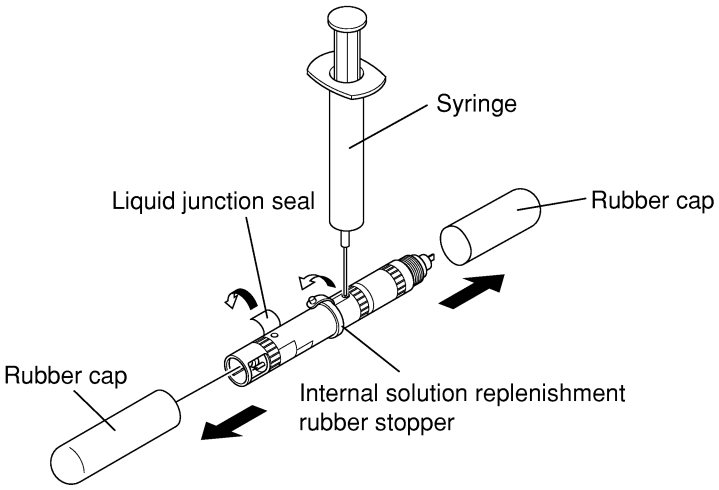
Connect the Dissolved Oxygen (DO) and pH/ORP sensors to the sensor probe.

Preparing pH/ORP sensor

1. Remove the liquid junction seal and rubber caps.

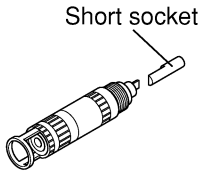
2. Open the internal solution replenishment rubber stopper. Then use a syringe to take internal solution (#330).

Air bubbles in the internal solution may impair the pressure compensation of the sensor. Allow as few air bubbles as possible to enter the inside solution.



Preparing DO sensor

1. Remove the short socket.



Important

- Provide the DO sensor with a short socket or connect the sensor to the sensor probe for storage. Otherwise, the sensor may have a shorter life or stable instructions may not be obtained.
- The short socket is used when storing. Do not throw it away.

Resetting the DO sensor when storing without having installed the short socket.

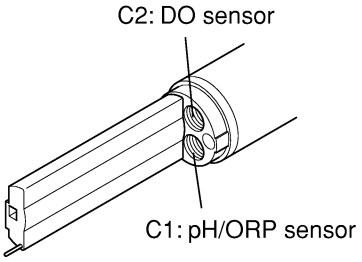
When leaving the DO sensor unattended for a brief period (1 or 2 days) without the short socket, the DO sensor can be reset by connecting it to the short socket or the probe. However, an amount of time corresponding to the period it was left unattended is necessary. If left unattended without being connected to the short socket or the probe for a long period (1 month), it cannot be reset.

Where to attach

1. The hole on the sensor probe in which each sensor is attached is determined by the type of sensor. Check the type of sensor and the assigned hole before attaching anything.

Important

- Installing the sensor in the wrong hole will damage both the sensor and sensor probe.

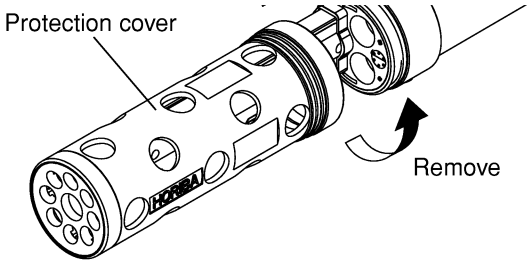


Installation procedure

Important

- With the U-22XD sensor probe install the DO sensor first and then the pH/ORP sensor.
- We recommend that the O-ring of the sensor be replaced with a new one each time the sensor is removed.

1. Remove the probe cap and remove the protection cover from the sensor probe.



When the protection cover's screws are firmly fixed in place and cannot be removed by hand, place a spanner on the protection cover and the surface of the cover guide and remove.

Do not try to remove the protection cover by hitting it or submitting it to shocks.

2. Apply silicon grease to the DO sensor's O-ring.

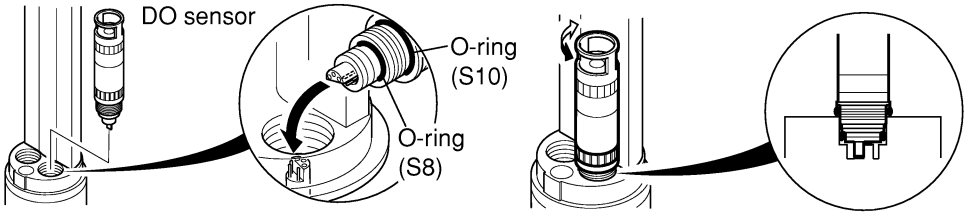
Make sure that no silicon grease gets on the connector.

3. Fit the DO sensor inside the sensor probe hole, being careful to align the shape of the connectors.

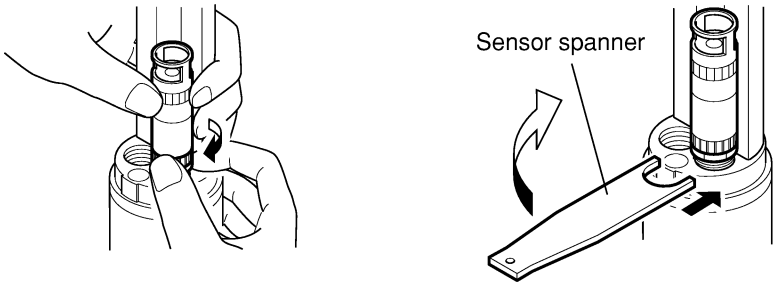
- Make sure that the O-ring is not scratched or twisted. Leakage will cause failures.
- Remove the DO sensor connected to the probe and, when reconnecting them, replace the O-ring (S8) on the smaller end of the DO sensor with a new O-ring.

Important

- Press the sensor slightly inward and try turning to check the fit. The sensor cannot be turned if inserted properly.



4. Turn the screw 2 or 3 turns by hand and then fully tighten with the sensor spanner.

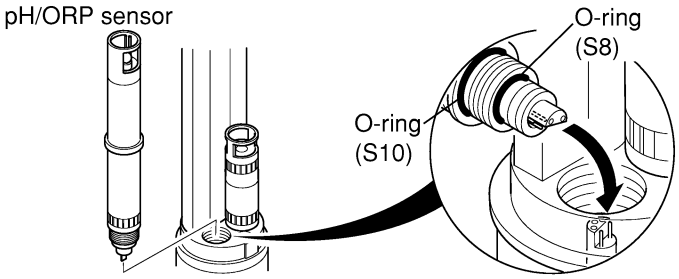


5. Apply silicon grease to the pH/ORP sensor's O-ring.

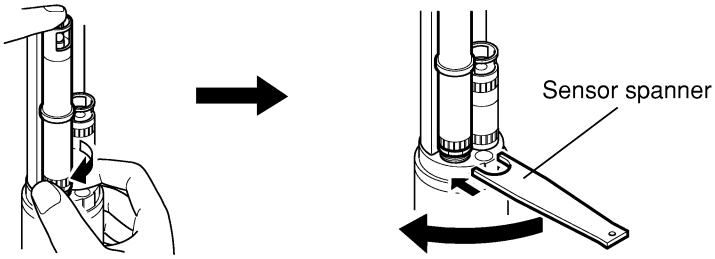
Make sure not to get silicon grease on the connector.

6. Fit the pH/ORP sensor inside the sensor probe hole, being careful to align the shape of connectors.

- Make sure that the O-ring is not scratched or twisted. Leakage will cause failures.
- Remove the pH/ORP sensor connected to the probe and, when reconnecting them, replace the O-ring (S8) on the smaller end of the pH/ORP sensor with a new O-ring.



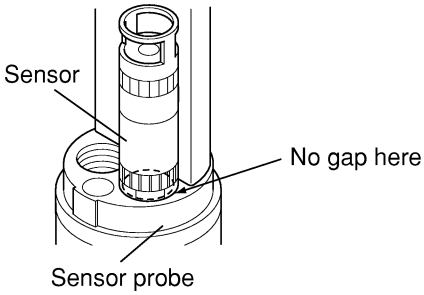
7. Holding the top of the pH/ORP sensor with your finger, turn the screw 2 or 3 turns by hand and then fully tighten with the sensor spanner.



⚠ CAUTION

- Unless snugly attached, the sensor is not fully waterproof. The sensor is snugly fit inside the sensor probe when tightened as far as it will go.

Example for DO sensor



8. Attach the removed protection cover to the sensor probe as it was.

Important

- Before attaching each sensor to the sensor probe, do not soak the connector block in water.
- Be careful not to contaminate or wet the sensor probe or sensor connector.

Fasten the guard cover with your hand until it touches the end surface. If improperly fastened, it will slacken and, when storing the instrument, there will be a lack of humidity control. Fastening by hand is enough, do not use a spanner or other tool to fasten or the screws may break.

2.3.3 Installation and replacement of the battery

The U-20XD series is shipped from the factory with the battery packed separately.
When using the instrument for the first time or replacing the battery, perform the following procedure:

Type of battery:

Instrument (U-2000) ..... Alkaline battery 6LR61 (Manganese battery 6F22 [006P])
1 piece. (Battery for instrument operation)
Sensor probe ..... Alkaline batteries LR03 [AAA] (Manganese battery [R03])
3 pieces. (Battery for memory backup)

Notes on handling the battery

The improper use of battteries may cause leaks and explosion.
Observe the followings:

- Set the batteries in place properly while paying attention to the plus (+) and minus (-) poles.
- Do not use both an old and new batteries at a time or batteries of different types.
- Battteries for use in the instrument are not of the rechargeable type.
- Remove the batteries when not in use for a long.
  In case of leaks, wipe off the solution in the battery case thoroughly and place new battteries in position.

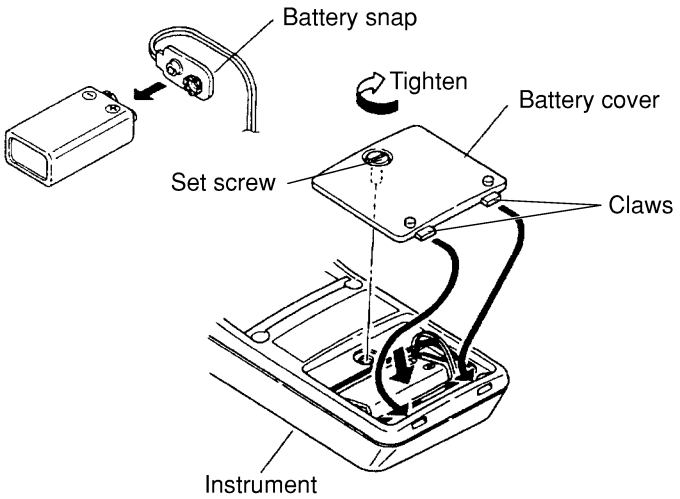
Note

- The battery originally attached to your unit is for monitor and the service life of the battery cannot be guaranteed.

Instrument (U-2000)

1. Loosen the set-screw on the battery cover and remove the cover.
2. Remove any old battery.
3. Fit the battery snaps to a new battery and insert the battery assembly into the instrument.
4. Insert the claws on the battery cover into the grooves in the instrument. Then tighten the set screw.

   The battery snap may be loose for some batteries. In such a case use radio pliers and tighten the metal snap fittings.

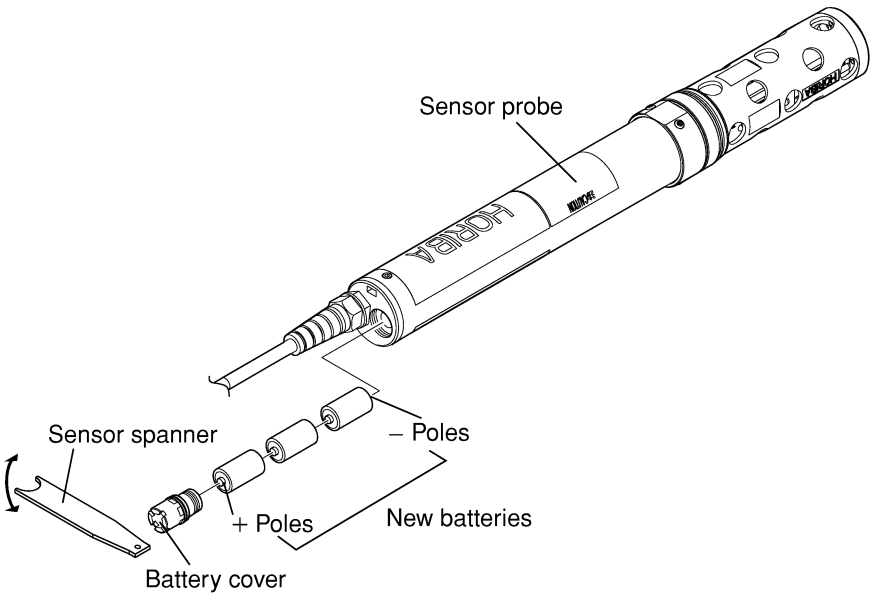


Important

- When removing the battery snap, do not pull it too strongly.

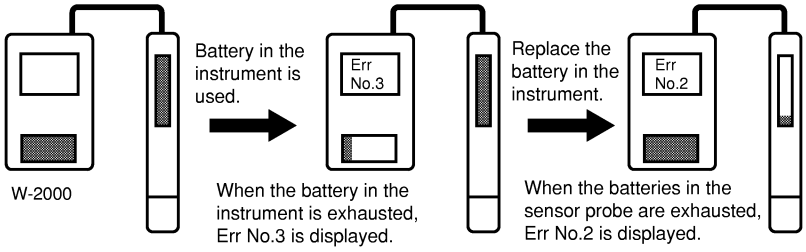
Sensor probe (for memory back up)

1. Remove the battery cover using a sensor spanner or a suitable object.
2. Remove any old batteries.
3. Insert new batteries making sure that the plus (+) and minus (-) poles match the terminals correctly.
4. To keep the sensor probe water-resistant, use a chip spanner as illustrated below and tighten the battery cover until the cover does not turn any more.



⚠ CAUTION

- When replacing the batteries of the sensor probe, be sure to connect the sensor probe to the instrument. Otherwise, the memory will be reset and all the data saved in the memory will disappear.
- When the sensor probe is connected to the instrument, battery in the instrument is consumed.



Note

- The battery on the main unit is used up first allowing up to 30 hours use at room temperature. (When using alkaline batteries.)
- Life is reduced by approximately one half when manganese batteries are used.

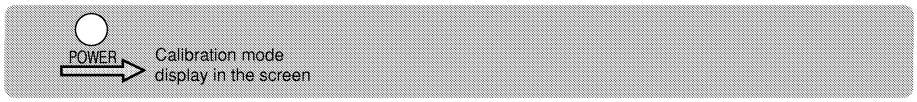
3. Basic operation

The pH, conductivity (COND), turbidity (TURB), dissolved-oxygen (DO) and water depth (DEP) sensors can be calibrated automatically. Upon completion of this chapter, even beginners should be able to make measurements easily.

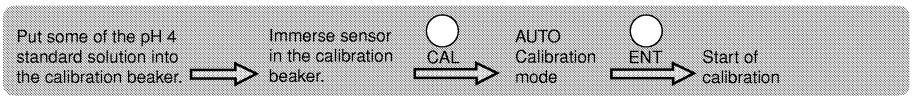
3.1 Key operations and mode switching 24

3.2 Operation procedure 26

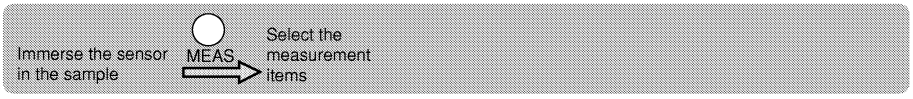
3.2.1 Power ON 26



3.2.2 AUTO calibration method 27



3.2.3 Measurement 29



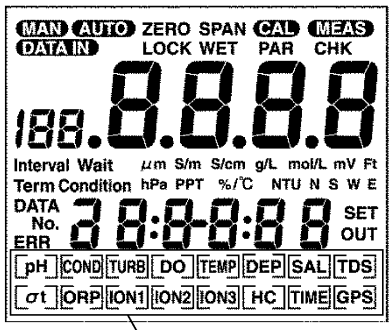
3.2.4 After completion of measurement 31

3.1 Key operations and mode switching

Measuring items and displays which are switched with the MEAS key

The items measurable with individual models are displayed. The items selected with the MEAS key will be indicated with [ ].

Example: In the pH Measurement mode: [pH]



Display block

The symbols displayed and their meanings are as follows:

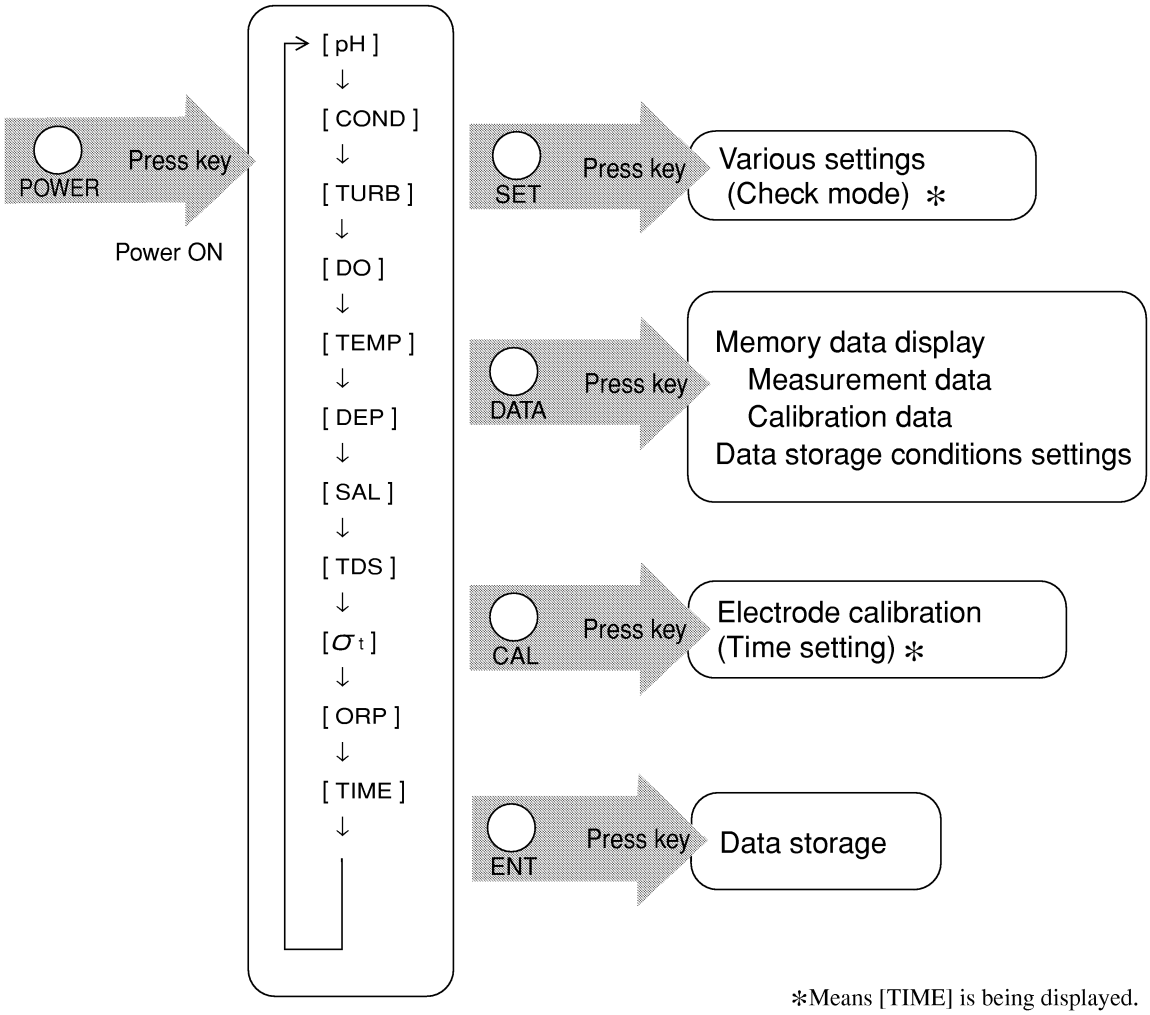
pH ..... pH
COND ..... Conductivity
TURB ..... Turbidity
DO ..... Dissolved-Oxygen
TEMP ..... Temperature
DEP ..... Depth
SAL ..... Salinity
TDS ..... Total dissolved solids
σ_t ..... Specific gravity of seawater
ORP ..... Oxidation-reduction potential
TIME ..... Display of date and time
GPS ..... G.P.S. (Global Positioning System) for imformation of position

Note

- [GPS] lights up when the optional G.P.S. sensor has been connected to the instrument and position information is received from the G.P.S. sensor during the measurement. For more information, refer to the instruction manual for the expansion units.

Measurement mode

MEAS When the MEAS key is pressed, the next measurement item appears.



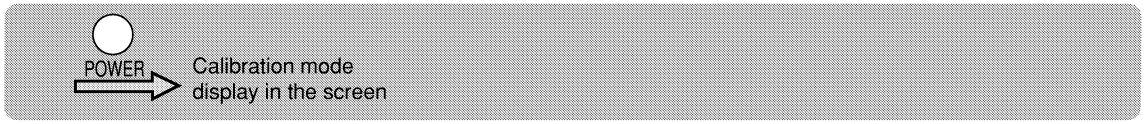
∗Means [TIME] is being displayed.

Note

- "*Measurement item setting*" on page 76 explains how to set the display so items are not displayed.

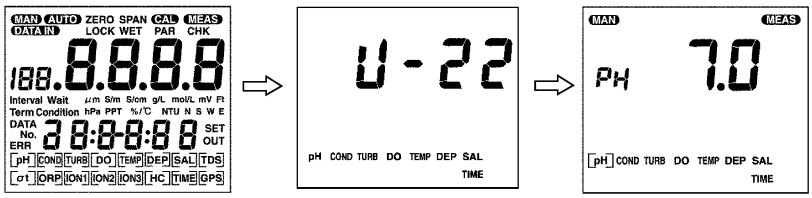
3.2 Operation procedure

3.2.1 Power ON

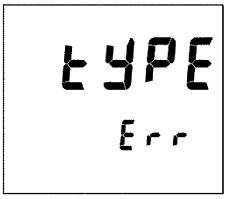


1. Press the **POWER** key.

The display will change in the order of All segment display → Sensor detector display → pH Measurement mode.



With the sensor probe is not connected,



is displayed.

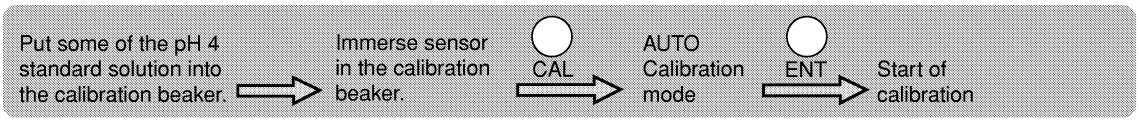
Before turning ON the instrument, connect the sensor probe properly.

3.2.2 AUTO calibration method

To obtain correct measurement, it is necessary to calibrate the sensor using the standard solution before performing measurement. Previous calibration records shown in calibration log.
(☞ 4.3.2 *Calling up The calibration log*, page 43.)

Note

- In the AUTO calibration mode, the pH, COND, and TURB sensors are calibrated in the pH 4 standard solution, and the DO and DEP sensors in the atmosphere simultaneously.
  Calibrate contents at 25°C are as follows:
  pH: set at 4.01 (zero calibration) and the Span is the adjustment value at the factory when shipping.
  COND: 0.449 S/m (Span calibration), the Zero is the adjustment value at the factory when shipping.
  TURB: 0 NTU (zero calibration), the Span is the adjustment value at the factory when shipping.
  DO: 8.52 mg/L (Span calibration), the Zero is the adjustment value at the factory when shipping.
  DEP: 0 m (Zero calibration), the Span is the adjustment value at the factory when shipping.
- Values may be unstable if there is temperature fluctuation. Calibrate after waiting for about an hour.

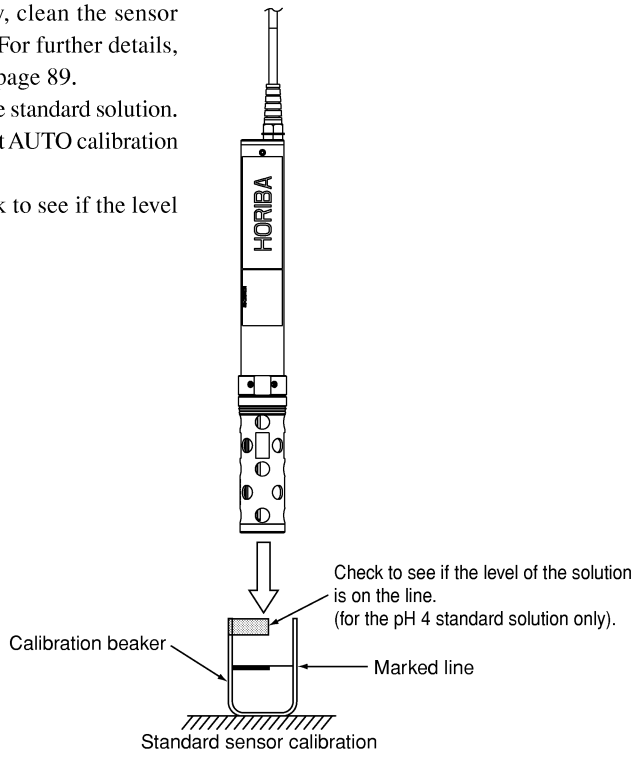


Calibrate using the following procedure.

1. Wash the sensor in distilled water a few times and put some of the pH 4 standard solution into the calibration beaker to the marked line. Then immerse the sensor in it.

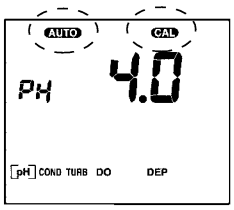
Important

- To carry out calibration for turbidity accurately, clean the sensor surface that will be soaked in standard solution. For further details, see "Troubleshooting for the TURB sensor" on page 89.
- Use the "100-4" manufactured by HORIBA for the standard solution. With other standard solutions, you cannot carry out AUTO calibration correctly.
- Use the label on the calibration beaker and check to see if the level of the calibration solution is on the label line.



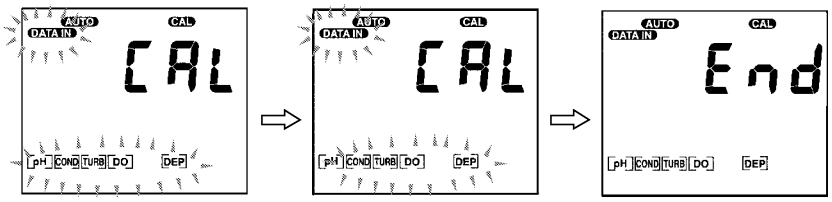
2. Press the **CAL** key in one of the Measurement modes pH, COND, TURB, DO and DEP.

AUTO and **CAL** appear and the instrument enters the AUTO Calibration mode.



3. Press the **ENT** key to start AUTO Calibration.

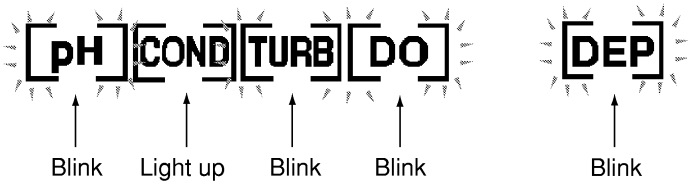
Upon completion of all of the pH, COND, TURB, DO, and DEP modes, End will be displayed.
During calibration, **DATA IN** and [ ] for the selected measurement item blink. [ ] light up for the item of which calibration is finished.



End of calibration

With DATA IN is blinking
To stop calibrating the sensor .... press the CAL key.
To establish the calibration ..... press the ENT key.

Example: When COND calibration is finished:
[ ] for [COND] stops blinking and light up steadily.



Note

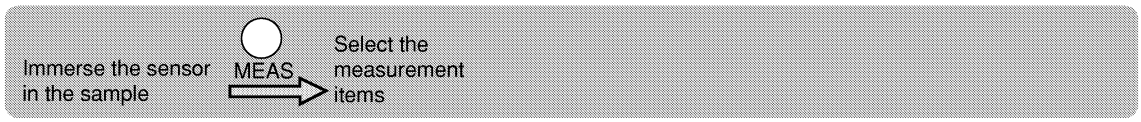
- [ ] continues to blink because calibration is not performed for the item for which an error has happened. If two or more errors happen, an error with a smaller number appears. (See pages 85 to 88 for these errors and ways to solve them.) These calibration errors disappear when the sensor is calibrated properly again, or when the instrument is turned ON again.
- Calibration should be performed for maximum three minutes. When the indications become stable, calibration should be finished.

4. Press the **MEAS** key to return to the Measurement mode.

Important

- Neutralize any basic pH 4 fluids before disposal.

3.2.3 Measurement



1. Immerse the sensor in the sample.

2. Select the measurement item.

Use the MEAS key to switch measurement items in the following order:

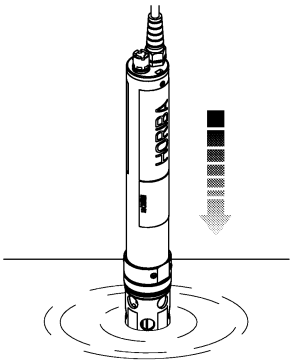
pH → COND → TURB → DO → TEMP → DEP → SAL → TDS → σ_t → ORP → TIME → then back to pH.

Note

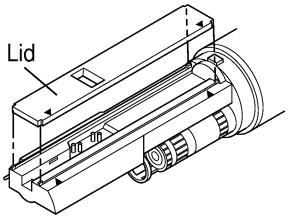
- [GPS] lights up when the optional G.P.S. sensor is connected to the instrument and position information is received from the G.P.S. sensor.
- The above measurement items can be changed by setting “”*Measurement item setting*” described on page 76.

Important

- When immersing the sensor probe in the sample, slowly lower the sensor probe into the sample.
- Dropping it from a height of 1m or more may cause damage to the sensor.



- Don't remove the COND/TURB lid during calibration or measurement.
- Attach the lid to the cell with fitting four corners and facing ▲ marks each other.



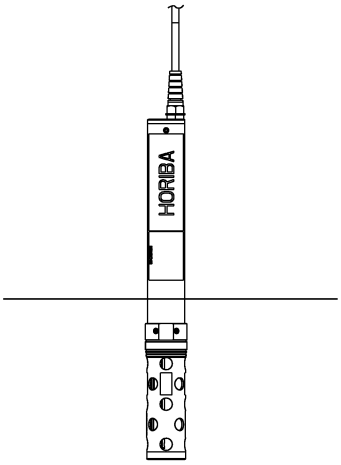
- Perform AUTO calibration after attaching the lid again, when the lid has been removed for the cleaning. A slight difference of the fitting position of the lid causes the difference of the indicated value for turbidity.
- Contacting with a different kind of metal, protection cover of the sensor probe may cause an error in measurement. Be careful not to let protection cover touch with any metal in measurement.

Two useful uses of the U-20XD Series models

Making measurements

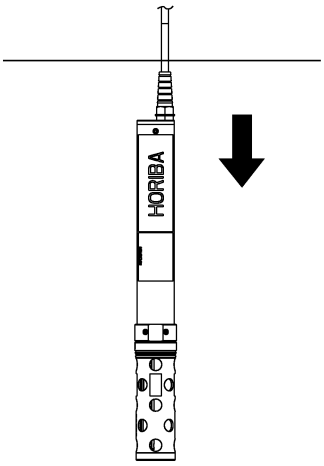
1. Manually storing the measurement data after checking the indication becomes stable

Example: After switching measurement items with the MEAS key, you can then store the measurement data after checking the indication becomes stable.
(☞ 4.1 *Manual storage of data while monitoring the measurement data*, page 34.)



2. Storing data

Example: Data can be stored continuously at constant intervals from the start of the automatic data storage. This function is useful in obtaining data in depth direction and in storing data continuously.
(☞ 4.2 *Automatic data storage*, page 36.)



Notes in obtaining data on depth

- When the instrument is placed at a depth of 100 m or more, the instrument may be broken.

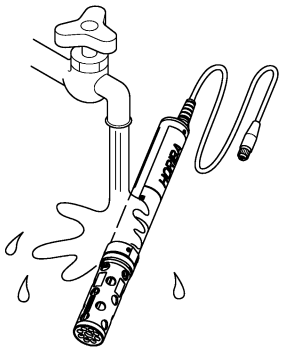
Notes for reliable measurements

- Any sensor contamination may affect measurements. Use the AUTO calibration mode to check for contamination on sensors about once a week for measurements.

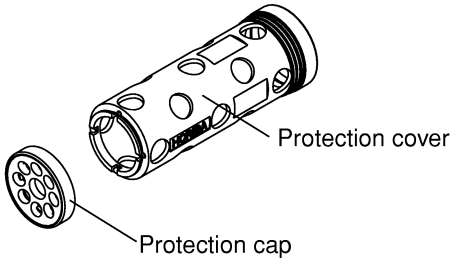
3.2.4 After completion of measurement

1. Turn the power to the instrument off.

2. Use tap water to completely wash off the sample on the sensor and then wipe waterdrops.



Remove the protection cover once and completely wash out with tap water the left over sample on the screws. Reinstall the cover after having wiped off the drops of water. If there is any sample (especially sea water) left over on the screws, rust may form which may prevent the protection cover from being removed. (☞ Installation procedure, page 18.)
Depending on the level of contamination, remove the rubber protection cap from the tip of the protection cover and wash out with tap water. Reinstall it after wiping off the drops of water.



3. Pour about 20 mL (about 2 cm from the bottom)of pure water in the probe cap and install it on the sensor probe. Place the rubber cap on the connector and store the instrument in the carrying case. (☞ 2.2.2 Sensor probe names, page 10.)

When storing with the ph/ORP and DO sensors attached to the probe, make sure to install the probe cap after having poured pure water into it.
Letting the ph/ORP and DO sensors get dry may cause deterioration of the instrument's performance. Should the sponge inside the probe cap be contaminated, replace it with a clean sponge (included).

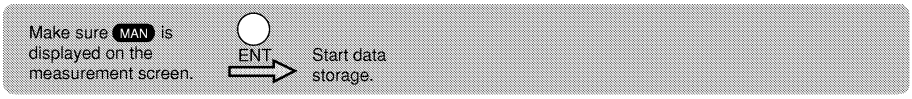
Now you have read the description for performing measurements. For further information on how to use the instrument, refer to the chapters hereafter.

MEMO

4. Using the data memory function

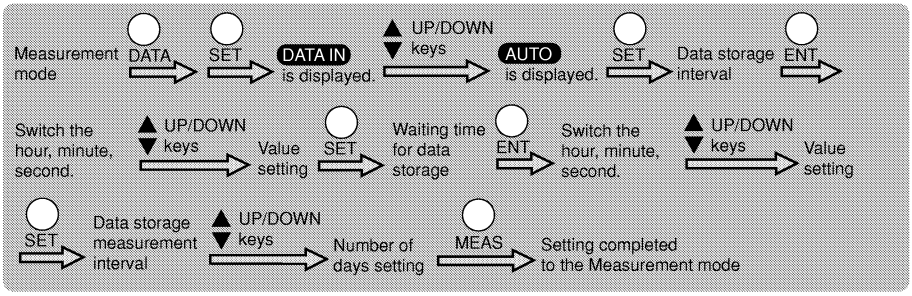
The data memory function can be used to store manualy measurement values with associated data numbers and to store automatically measurement values at fixed intervals (data logger).

4.1 Manual storage of data while monitoring the measurement data 34

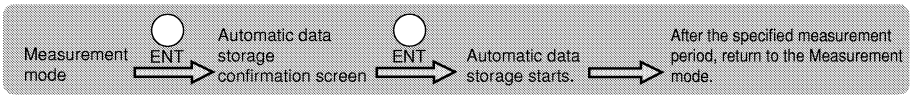


4.2 Automatic data storage 36

4.2.1 Data memory conditions settings 36

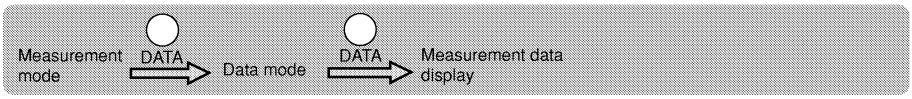


4.2.2 Start of automatic data storage 39

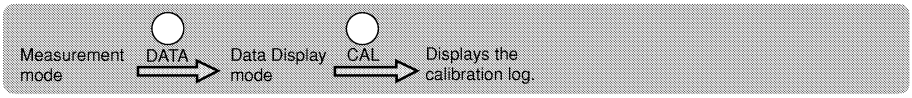


4.3 Calling up data from the memory 41

4.3.1 Calling up measurement data 41



4.3.2 Calling up the calibration log 43

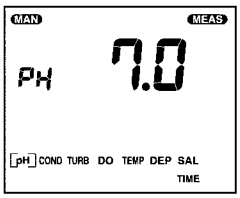


4.1 Manual storage of data while monitoring the measurement data

Make sure MAN is displayed on the measurement screen. → ENT → Start data storage.

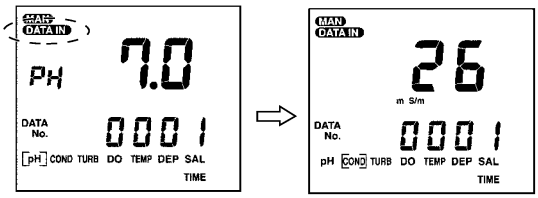
1. Make sure that MAN is displayed on the Measurement mode.

If AUTO is displayed, switch to MAN display.
(☞ page 35, Switch to MAN display on the measurement mode)



2. Press the ENT key.

Data storage starts, DATA IN and the data No. are displayed on the screen, and the measured value to be stored and the measurement item are displayed in order at approximately 0.5 second intervals.



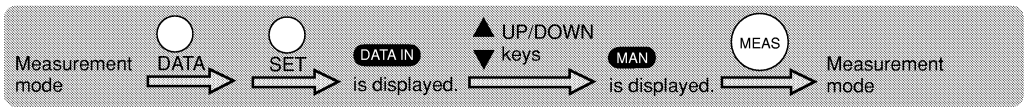
All measurement items and times are stored in sequence.

After the data is stored in memory, the screen returns to the original Measurement mode.

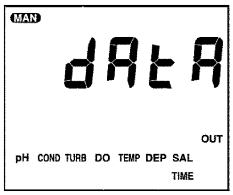
Note

- Up to 2880 sets of data can be stored in the memory.
  When 2880 sets of data have been stored in the memory, ERR 9 appears and no more data can be stored. In this case, "*Data memory clear*" while referring to page 78, and you can store new data in the memory.

When AUTO is displayed
Switch to MAN display on the measurement mode

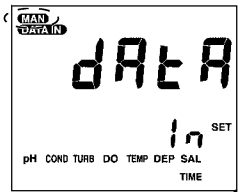


1. Press the **DATA** key in the Measurement mode.



2. Press the **SET** key.
DATA IN is displayed.

3. Press the **UP/DOWN** (▲ ▼) keys to display MAN.

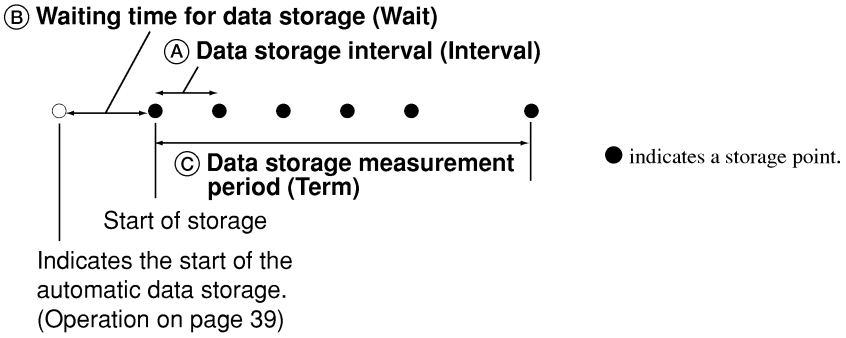


4. Press the **MEAS** key to return to the Measurement mode.

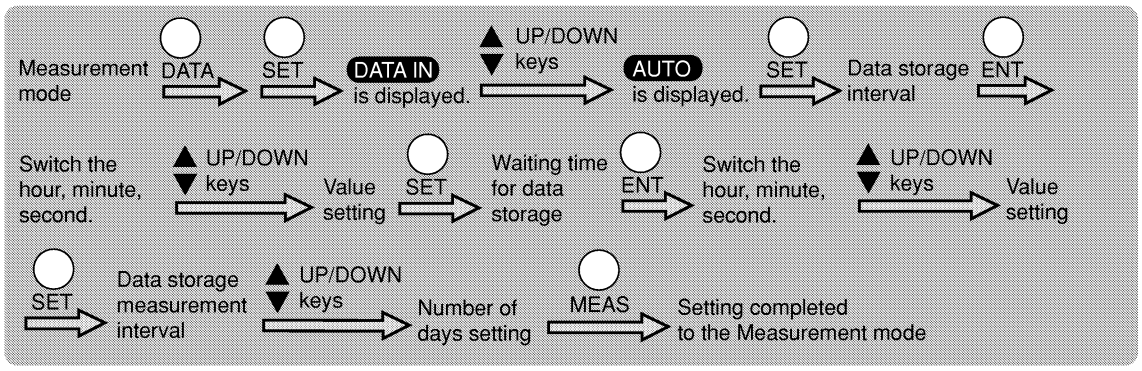
4.2 Automatic data storage

Measured values are stored automatically at constant time intervals. Before using the automatic storage, the following condition settings are required:

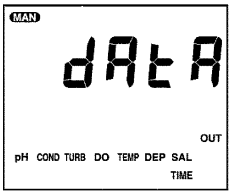
- Setting of data storage interval (4.2.1, step 4)
- Setting of waiting time for data storage (4.2.1, step 6)
- Setting of the data storage measurement period (4.2.1, step 8)



4.2.1 Data memory conditions settings



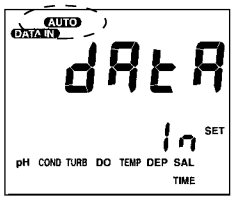
1. Press the **DATA** key in the Measurement mode.



2. Press the **SET** key.

DATA IN is displayed.

3. Press the **UP/DOWN** (▲ ▼) keys to display **AUTO**.



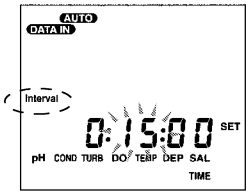
4. Press the **SET** key to display the screen for setting the data storage interval Ⓐ.

"**Interval** " is displayed.

5. Press the **ENT** key to switch the among "hour", "minute" and "second" and set the value using the **UP/DOWN** (▲ ▼) keys.

(Data storage intervals can be set to 2 seconds to 24 hours.)

The current setting location will blink.



6. Press the **SET** key to display the screen for setting the waiting time for data storage Ⓑ.

"**Wait** " is displayed.

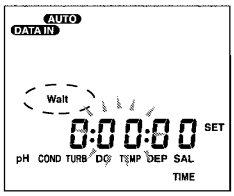
7. Press the **ENT** key to switch among "hour", "minute" and "second" and set the value using the **UP/DOWN** (▲ ▼) keys.

(The waiting time for data storage can be set to 2 seconds to 24 hours.)

The current setting location will blink.

Important

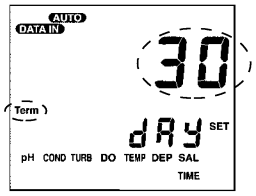
- If wait time is set to "0", note that data is not stored in a memory the first time.



8. Press the **SET** key to display the screen for setting the data storage measurement period Ⓒ (number of days).

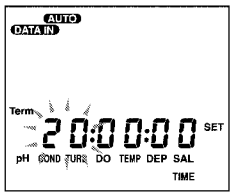
"**Term** " is displayed.

9. Use the **UP/DOWN** (▲ ▼) keys to set the value (number of days).



Setting of less than 24 hours

First set the number of days to 00 then press ENT key to select the "hour/minute/second" setting. Use the UP/DOWN (▲ ▼) keys to set the hour, the minute and second. During setting, the number to be set blinks.

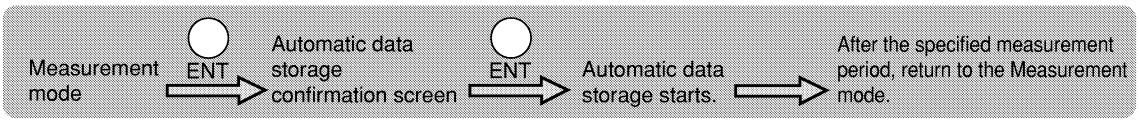


Note

- Press the SET key to return to step 4.

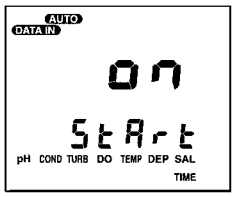
10. When the **MEAS** key is pressed, setting will be completed and the instrument will return to the Measurement mode.

4.2.2 Start of automatic data storage



1. Make sure that **AUTO** is displayed on the Measurement mode.

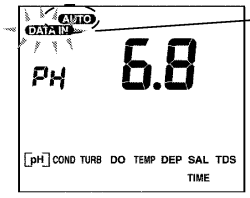
2. Press the **ENT** key. A confirmation screen will be displayed asking if you wish to start automatic data storage.



Note

- If you do not wish to proceed with automatic data storage, press the CAL key to return to the Masurement mode.

3. Press the **ENT** key to start automatic data storage.



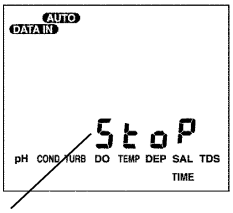
While **DATA IN** is blinking, the automatic data storage is being executed.

Note

- During the automatic data storage, measurement items can be switched by pressing the MEAS key.

Important

- During the automatic data storage, the ENT, SET, and DATA keys do not function and therefore calibration, setting change and stored data display cannot be performed.
- To stop automatic data storage, press the CAL key.



Confirmation display for canceling automatic data storage appears.
To stop the automatic data storage ..... Press the ENT key.
To return to the screen for the automatic data storage ... Press the DATA key.

4. After the specified measurement period, DATA IN disappears and the instrument returns to the normal Measurement mode.

Note

- When the instrument is turned on, AUTO lights up and DATA IN blink if automatic data storage is being performed with the sensor probe.

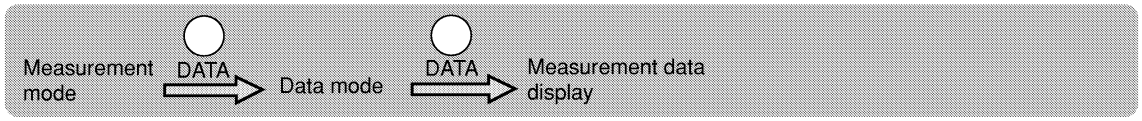
Notes for automatic data storage

- For long-term data storage, replace the sensor probe battery with a new one.
- You can remove the connector from the main unit. It can still be used for up to 60 hours at room temperature with the battery in the sensor probe (alkaline battery). Life is reduced by approximately one half when manganese batteries are used.
- If the sensor probe is connected to the instrument for monitoring, the instrument battery is first consumed to protect the memory of the sensor.
- When 2880 sets of data have been stored in the memory, ERR 9 appears and no more data can be stored. The automatic data storage is automatically ended and the instrument returns to the normal Measurement mode.

4.3 Calling up data from the memory

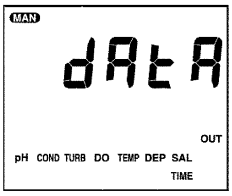
4.3.1 Calling up measurement data

Reading out data that has been stored manually or automatically.



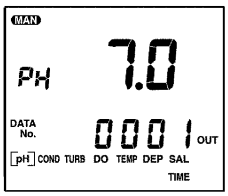
1. Press the **DATA** key in the Measurement mode.

The instrument goes to the DATA mode.



2. Press the **DATA** key.

The measurement data is displayed.
Data you want to call can be displayed by selecting a measurement item and data No.



DATA key ..... Selects switching of measurement item or memory data No.

When switching measurement items: Measurement item blinks.
When switching data No. : Data No. blinks.

UP/DOWN (▲▼) keys .... Switch measurement item or No. which has been selected with the DATA key.

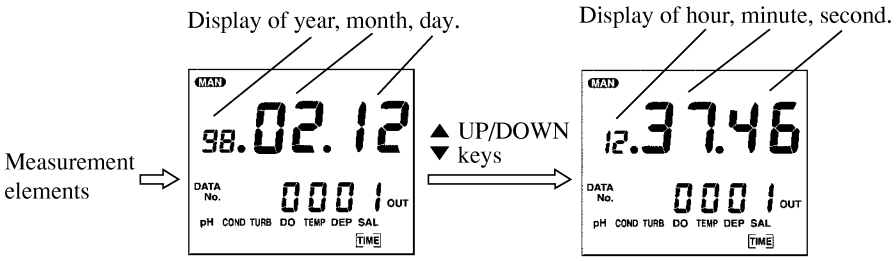
Note

- If you push the CAL key, only the data numbers will be displayed, allowing rapid changing of the numbers. Push the UP/DOWN (▲▼)keys to find the number, then press the SET key to display the data.

3. Press the **DATA** key.

TIME data

Use the UP/DOWN (▲▼) keys to switch between "Yer, Month, Day" and "Hour, Minute, Second".

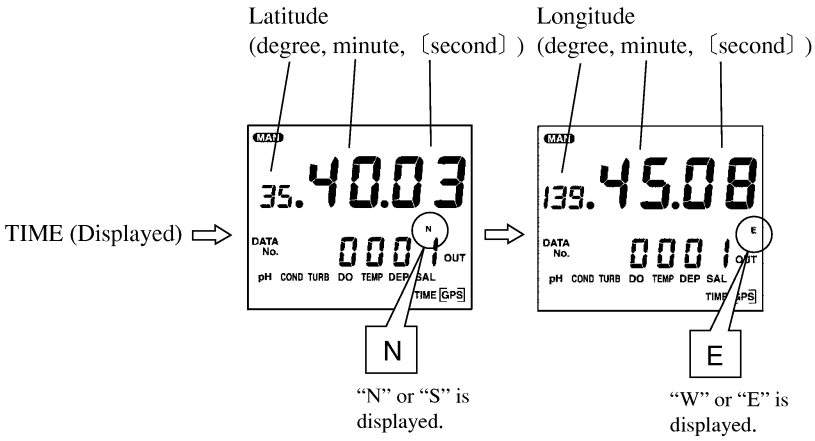


Note

- The time in the automatic memory can be out by about 2 seconds.

G.P.S. data (only when G.P.S. data is present)

Use the UP/DOWN (▲ ▼) keys to switch between "Latitude" and "Longitude".



Latitude N → The North latitude S → The South latitude
Longitude E → The East longitude W → The West longitude

ENT key ..... Prints all measurement data for the displayed memory data item.
(when the printer is connected to the instrument)

Useful uses of keys in automatic storage

SET + UP (▲) key ..... Displays the first part of the next data automatically stored.
SET + DOWN (▼) key ..... Displays the first part of the previous data automatically stored.
If there is manual data, then the previous or next manual data is shown.

Display for automatic storage

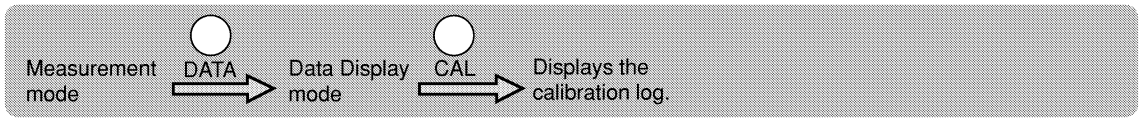
For the first and last data in one session of automatic storage the following identification marks are displayed in front of the values representing the data Nos.:
[: displayed for the first data in automatic storage.
] : displayed for the last data in automatic storage.

Note

- When the MEAS key is pressed, data calling is stopped and the instrument returns to the Measurement mode.
- Data is called from the sensor probe so to get one piece of data takes about one second.

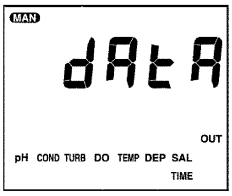
4.3.2 Calling up the calibration log

A calibration log is a record containing the "year, month, day" and "hour and minute" of the last calibration of individual measurement items and their calibration method. The instrument automatically stores the calibration log.



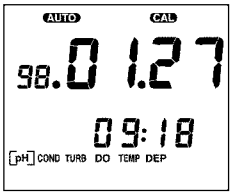
1. Press the **DATA** key in the Measurement mode.

The instrument goes to the DATA Display mode.



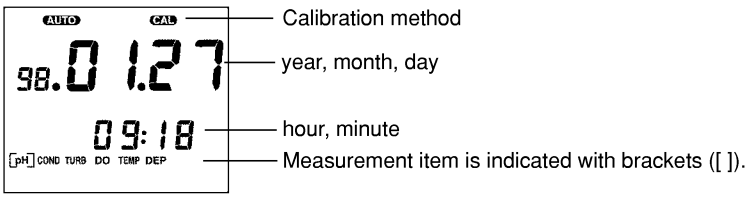
2. Press the **CAL** key.

The calibration log is displayed.



UP/DOWN (▲▼) keys: Switch the measurement item.
ENT key: Prints the entire calibration log. (when the printer is connected to the instrument)

Calibration log.



Calibration method

AUTO CAL	: AUTO calibration
MAN ZERO CAL	: Manual zero calibration
MAN SPAN CAL	: Manual span calibration
MAN ZERO SPAN CAL	: Manual zero calibration and span calibration

Note

- Press the MEAS key to abort the data calling and return to the Measurement mode.

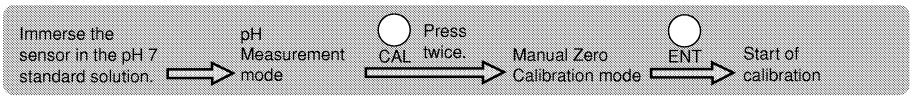
MEMO

5. Techniques for more accurate measurement

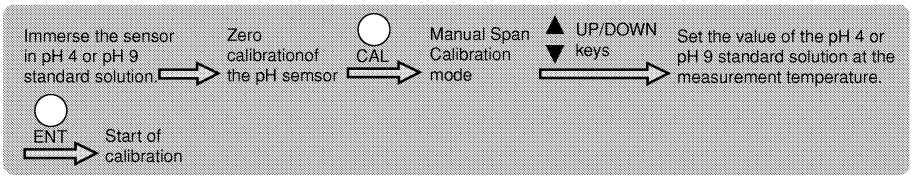
In normal operation, calibration using the AUTO Calibration mode described earlier in the basic operation section provides sufficient accuracy. However, for more accurate measurement, manual calibration is effective. When measurement with high-accuracy extended display is needed, be sure to perform manual calibration.
Attention: The extended display mode is entered automatically when manual calibration is selected.

5.1 Manual pH calibration 47

5.1.1 Zero calibration 47

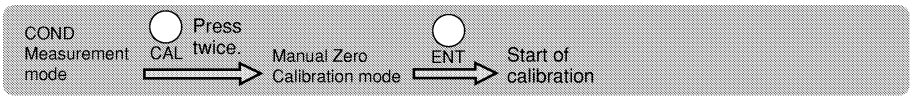


5.1.2 Span calibration 48

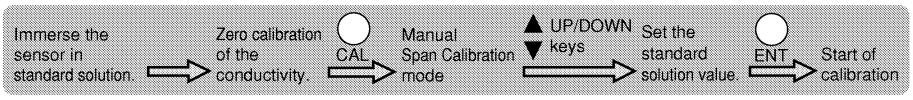


5.2 Manual conductivity (COND) calibration 49

5.2.1 Zero calibration 49

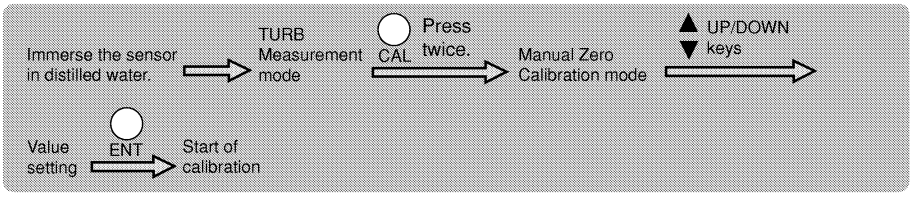


5.2.2 Span calibration 50

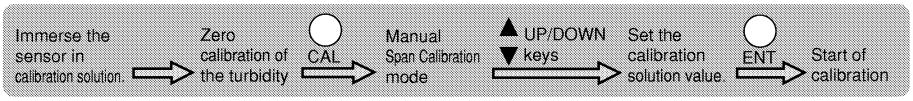


5.3 Manual turbidity (TURB) calibration 52

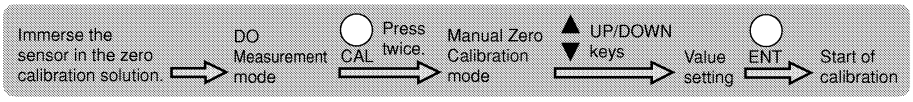
5.3.1 Zero calibration 52



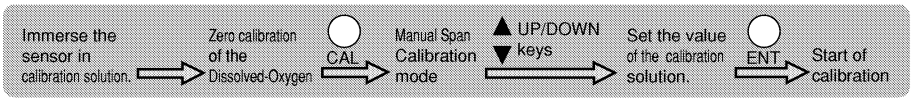
5.3.2 Span calibration 53



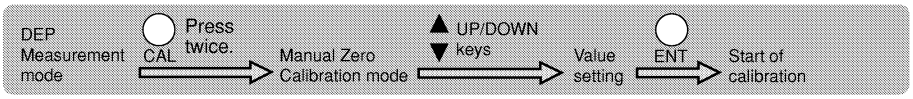
5.4 Manual Dissolved-Oxygen (DO) calibration 54
5.4.1 Zero calibration 54



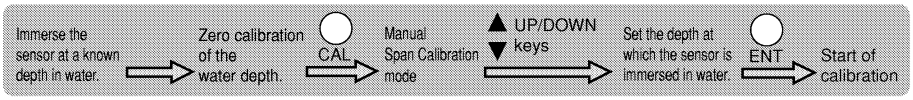
5.4.2 Span calibration 55



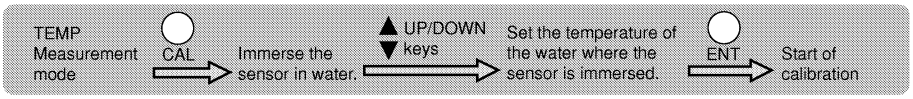
5.5 Water depth (DEP) calibration 57
5.5.1 Zero calibration 57



5.5.2 Span calibration 58



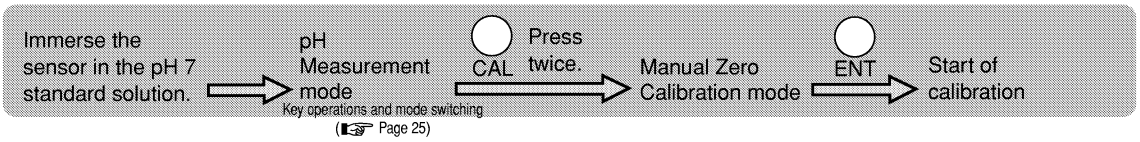
5.6 Temperature (TEMP) calibration 59



5.7 Operation check using ORP standard solution 60

5.1 Manual pH calibration

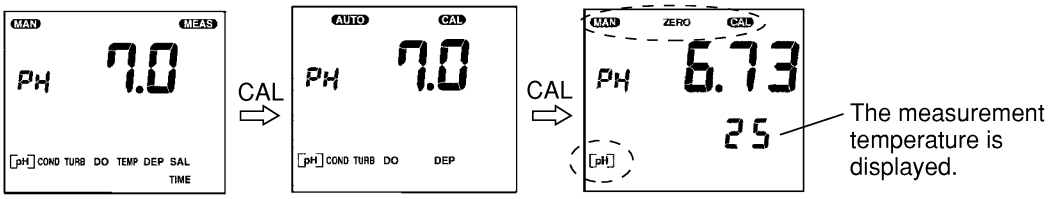
5.1.1 Zero calibration



1. Wash the sensor two or three times using distilled water, then pour some pH 7 standard solution into the calibration beaker, and immerse the sensor in it.

2. Press the **CAL** key twice in the pH Measurement mode.

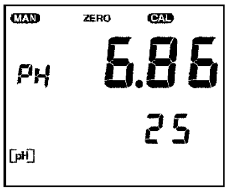
When the instrument enters the Manual Zero Calibration mode, **MAN**, **ZERO** and **CAL** light up.



Manual Zero Calibration mode

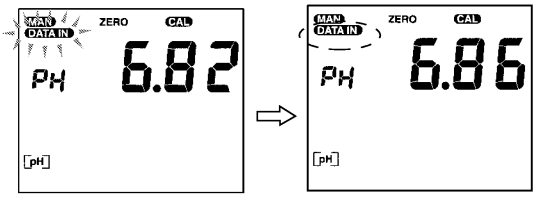
3. Use the **UP/DOWN** (▲ ▼) keys to input the value for the pH 7 standard solution at the measurement temperature.

(☞ *8. Reference data*, page 96.)



4. Press the **ENT** key.

The manual zero calibration starts.



End of calibration

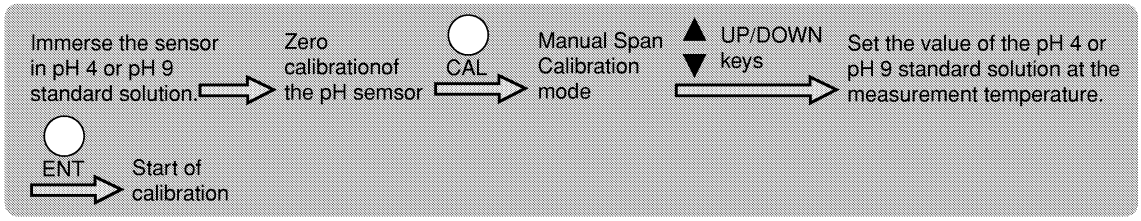
The measured value is displayed during calibration, and **DATA IN** blinks until the indicated value stabilizes. When the indicated value has stabilized, **DATA IN** lights up and the calibration finishes.

With DATA IN is blinking

To stop calibrating the sensor .... Press the CAL key.

To establish the calibration ..... Press the ENT key.

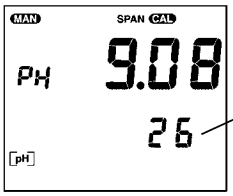
5.1.2 Span calibration



1. Wash the sensor two or three times using distilled water, then pour some pH 4 or pH 9 standard solution into the calibration beaker, and immerse the sensor in it.

2. After the zero calibration of the pH sensor, press the **CAL** key to make sure that the instrument is in the Manual Span Calibration mode.
MAN, **SPAN** and **CAL** light up.

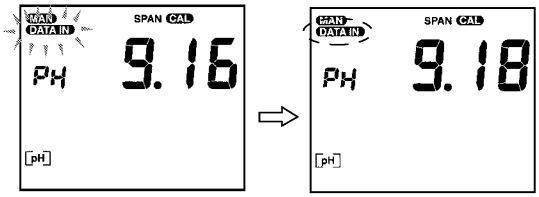
3. Use the **UP/DOWN** (▲ ▼) keys to set the value for the pH 4 or pH 9 standard solution at the measurement temperature.



The measurement temperature is displayed.

4. Press the **ENT** key.

The manual span calibration starts.



End of calibration

The measured value is displayed during calibration, and **DATA IN** blinks until the indicated value stabilizes. When the indicated value has stabilized, **DATA IN** lights up and the calibration finishes.

With DATA IN is blinking
To stop calibrating the sensor .... Press the CAL key.
To establish the calibration ..... Press the ENT key.

5. Press the **MEAS** key to return to the Measurement mode.

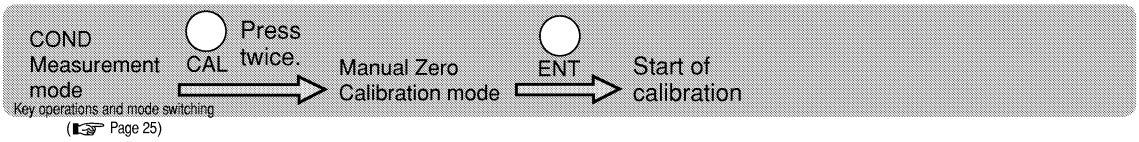
Note

- When the SET and CAL keys are pressed during the manual pH calibration mode, the calibration data for the pH sensor can be deleted.

5.2 Manual conductivity (COND) calibration

The U-20XD series models can measure conductivity (COND) in the range from 0.90 to 9.99 S/m. Depending on the concentration of the sample, these models automatically select the most suitable measuring range from three ranges: 0.0 to 99.9 mS/m, 0.090 to 0.999 S/m, and 0.90 to 9.99 S/m. The zero point is common to the three measuring ranges.

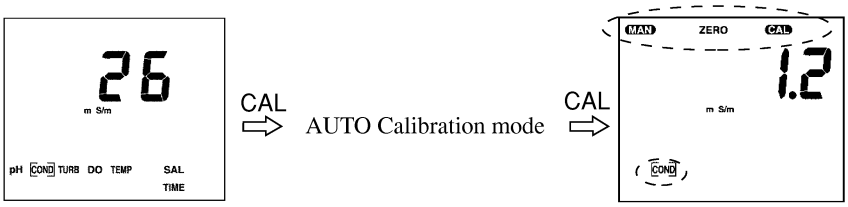
5.2.1 Zero calibration



1. Wash the conductivity (COND) sensor two or three times using distilled water. Completely remove the water on the sensor and calibrate the instrument in the atmosphere.

2. Press the **CAL** key twice in the Conductivity (COND) Measurement mode.

When the instrument enters the Manual Zero Calibration mode, **MAN**, **ZERO** and **CAL** light up.

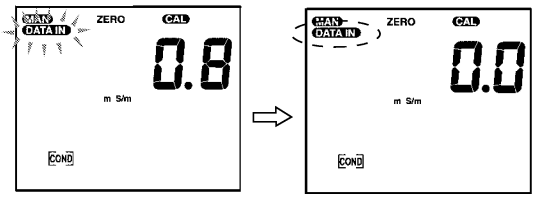


Manual Zero Calibration mode

3. Use the **UP/DOWN** (▲ ▼) keys to set the value to 0.0.

4. Press the **ENT** key.

The manual zero calibration is starts.



End of calibration

The measured value is displayed during calibration, and **DATA IN** blinks until the indicated value stabilizes. When the indicated value has stabilized, **DATA IN** lights up and the calibration finishes.

With DATA IN is blinking

To stop calibrating the sensor .... Press the CAL key.

To establish the calibration ..... Press the ENT key.

5.2.2 Span calibration

Preparation of calibration solution (Potassium chloride (KCl) standard solution)

Dry Potassium chloride (KCl) powder (high-grade commercially available) at 105 °C for two hours, and leave it to cool in a desiccator.
Consult the following table and measure a portion of potassium chloride (KC1), then prepare standard potassium chloride (KC1) solution following the procedure below.

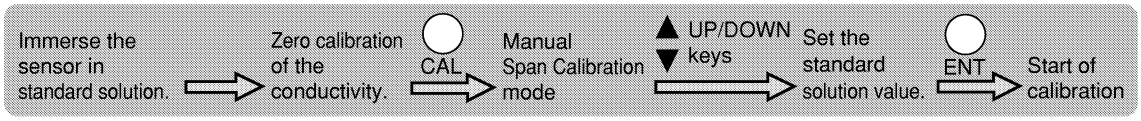
Potassium chloride (KCL) standard solution	Conductivity (COND) value	Potassium chloride (KCl) mass (g) at solution temperature of 25 °C	Calibration range
0.005 mol/L	71.8 mS/m	0.373	0.0 to 99.9 mS/m
0.050 mol/L	0.667 S/m	3.73	0.090 to 0.999 S/m
0.500 mol/L	5.87 S/m	37.2	0.90 to 9.99 S/m

1. Dissolve the weighed Potassium Chloride (KCl) in distilled water.

2. Put the dissolved Potassium Chloride (KCl) into a 1 L measuring flask, and fill to the 1 L mark with distilled water.

Calibration procedure

Perform the span calibration using the three types of standard solution as follows.



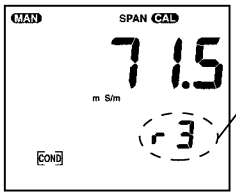
Important

- Set the temperature of the span standard solution to 25 ± 5 °C.
- The sensor should be calibrated in the three standard solutions in the order of increasing concentration.

1. Wash the sensor two or three times using distilled water, then pour some standard solution into the calibration beaker, and immerse the sensor in it.

2. After the zero calibration of the conductivity (COND) sensor, press the **CAL** key to make sure that the instrument is in the Manual Span Calibration mode.
MAN, **SPAN** and **CAL** light up.

3. Use the **UP/DOWN** (▲ ▼) keys to set the standard solution value.



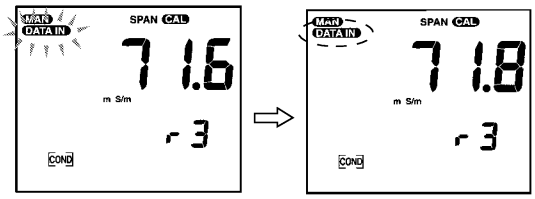
The calibration range is displayed.

Note

- The sensor automatically identifies the calibration solution and the relevant calibration range is displayed.
  r 1 : 0.90 to 9.99 S/m
  r 2 : 0.090 to 0.999 S/m
  r 3 : 0.0 to 99.9 mS/m

4. Press the **ENT** key.

The manual span calibration is starts.



End of calibration

The measured value is displayed during calibration, and DATA IN blinks until the indicated value stabilizes. When the indicated value has stabilized, DATA IN lights up and the calibration finishes.

With DATA IN is blinking
To stop calibrating the sensor .... Press the CAL key.
To establish the calibration ..... Press the ENT key.

5. Press the **CAL** key and use each standard solution and perform steps 1 to 4 above for calibration.

6. Press the **MEAS** key to return to the Measurement mode.

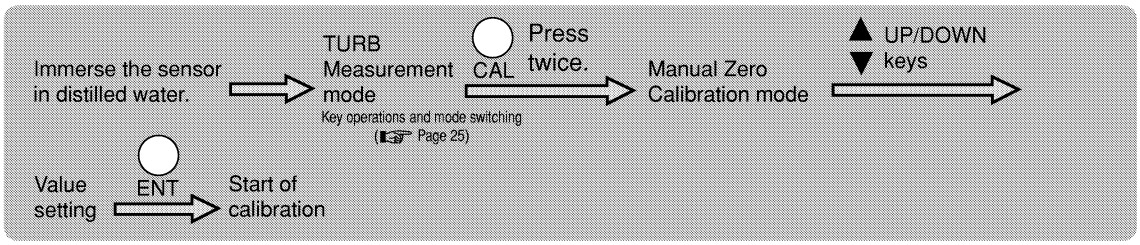
Note

- When the SET and CAL keys are pressed during the manual Conductivity (COND) Calibration mode, the calibration data for the conductivity (COND) sensor can be deleted.
- Perform the calibration again after deleting the present calibration data when calibration error occurs and the calibration cannot be performed.
- Perform the calibration again after deleting the present calibration data when the value cannot be read off because of unsettled digit of the measurement value.

5.3 Manual turbidity (TURB) calibration

5.3.1 Zero calibration

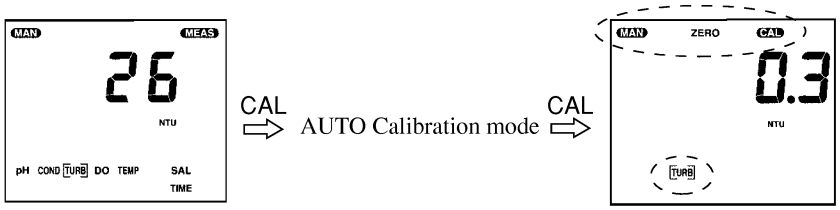
In zero calibration, distilled water is used as a calibration solution. If you cannot obtain distilled water, you may use ion exchange water, which can be considered to have a turbidity of zero.
When the turbidity (TURB) sensor is calibrated, it is particularly important that the probe is completely contamination-free. Do not use a contaminated probe. Otherwise unreliable calibration will result.



1. Wash the sensor two or three times using distilled water, then place some distilled water into the calibration beaker, and immerse the sensor in it.

2. Press the **CAL** key twice in the Turbidity (TURB) Measurement mode.

When the instrument enters the Manual Zero Calibration mode, **MAN**, **ZERO** and **CAL** light up.

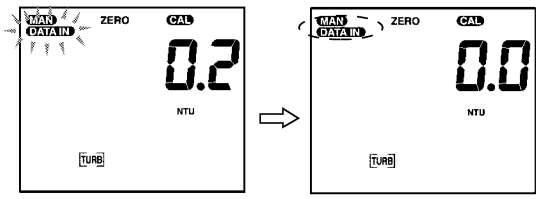


Manual Zero Calibration mode

3. Use the **UP/DOWN** (▲ ▼) keys to set the value to 0.0.

4. Press the **ENT** key.

The manual zero calibration is started.



End of calibration

The measured value is displayed during calibration, and **DATA IN** blinks until the indicated value stabilizes. When the indicated value has stabilized, **DATA IN** lights up and the calibration finishes.

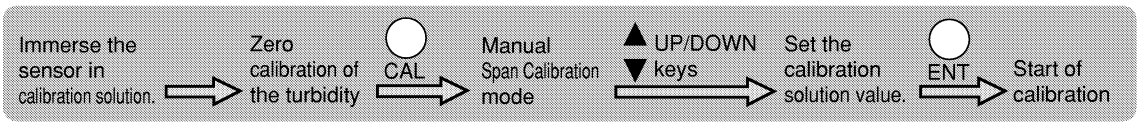
With DATA IN is blinking
To stop calibrating the sensor .... Press the CAL key.
To establish the calibration ..... Press the ENT key.

5.3.2 Span calibration

Preparation of calibration solution

Weigh out 5.0 g of hydrazine sulfate, and dissolve it in 400 mL of distilled water. Next dissolve 50 g of hexamethylene tetramine in 400 mL of distilled water, and mix the two solutions together. Finally add distilled water until the total solution volume is 1000 mL, and mix well. Store this solution at a temperature of 25 ± 3 °C for 48 hours. The turbidity value (TURB) of this solution is equivalent to 4000 NTU.
Use the solution as span calibration solution for turbidity (TURB) of 800 NTU by diluting this solution by a factor of 5 (use a pipette to measure 50 mL of the 4000 NTU solution and pour it into a 250 mL measuring flask, and add 200 mL of distilled water).

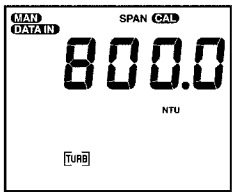
Calibration procedure



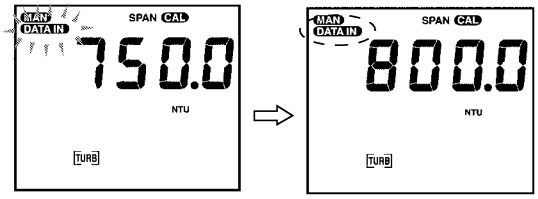
1. Wash the sensor two or three times using distilled water, then pour standard solution into a calibration beaker, and immerse the sensor in it.

2. After the zero calibration of the turbidity (TURB) sensor, press the **CAL** key to make sure that the instrument is in the Manual Span Calibration mode.
MAN, **SPAN** and **CAL** light up.

3. Use the **UP/DOWN** (▲ ▼) keys to set the value to 800.0.



4. Press the **ENT** key.
The manual span calibration is starts.



End of calibration

The measured value is displayed during calibration, and **DATA IN** blinks until the indicated value stabilizes. When the indicated value has stabilized, **DATA IN** lights up and the calibration finishes.

With DATA IN is blinking
To stop calibrating the sensor .... Press the CAL key.
To establish the calibration ..... Press the ENT key.

5. Press the **MEAS** key to return to the Measurement mode.

Important

- When it is known beforehand that the solution for measurement has a low turbidity (0 to 100 NTU), calibrate the sensor in the span calibration solution of 80 NTU. To prepare an 80 NTU calibration solution, dilute the 4,000 NTU calibration solution with distilled water by a factor of 50.

Note

- When the SET and CAL keys are pressed during the manual Turbidity (TURB) Calibration mode, the calibration data for the turbidity (TURB) sensor can be deleted.

5.4 Manual Dissolved-Oxygen (DO) calibration

It is necessary to prepare a new calibration solution each time directly before calibration of the Dissolved-Oxygen (DO) sensor.

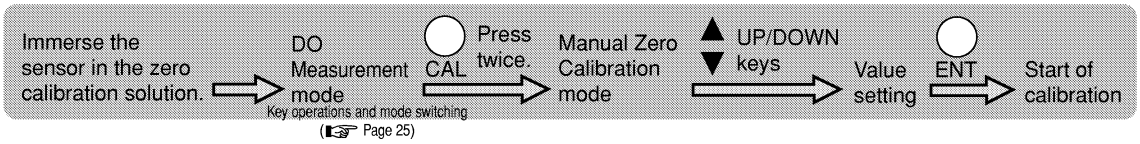
5.4.1 Zero calibration

Use ion exchange water or tap water with sodium sulfite dissolved in it.

Preparation of calibration solution

Add approximately 50 g of sodium sulfite to 1,000 mL of water (either ion exchange water or tap water) and stir the mixture to dissolve the sodium sulfite in it.
The calibration beaker (included) cannot be used to manually calibrate the DO sensor.
Use a container that can immerse the DO sensor.

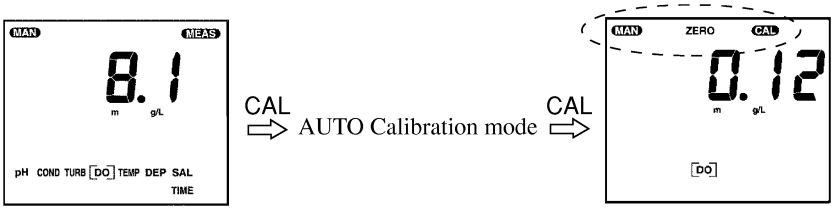
Calibration procedure



1. Wash the sensors 2 to 3 times with pure water and immerse the DO sensor completely in zero calibrated liquid.

2. Press the **CAL** key twice in the Dissolved-Oxygen (DO) Measurement mode.

When the instrument enters the Manual Zero Calibration mode, **MAN**, **ZERO** and **CAL** light up.

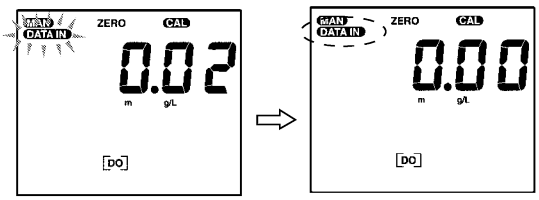


Manual Zero Caliburation mode

3. After the display has stabilized, use the **UP/DOWN** (▲ ▼) keys to set the value to 0.0.

4. Press the **ENT** key.

The manual zero calibration is starts.



End of calibration

The measured value is displayed during calibration, and **DATA IN** blinks until the indicated value stabilizes. When the indicated value has stabilized, **DATA IN** lights up and the calibration finishes.

With DATA IN is blinking
To stop calibrating the sensor .... Press the CAL key.
To establish the calibration ..... Press the ENT key.

Important

- After calibration, use tap water to clean the sensor.

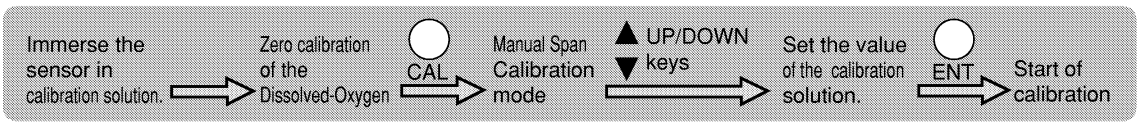
5.4.2 Span calibration

Use ion exchange water or tap water with saturated dissolved oxygen as the span calibration liquid.

Preparation of standard solution for span calibration

Pour 1 to 2 liters of water into a container (either ion exchange water or tap water).
Using a pneumatic pump, feed air into the water and froth up the solution until oxygen is saturated.
The calibration beaker (included) cannot be used to manually calibrate the DO sensor.
Use a container that can immerse the DO sensor.

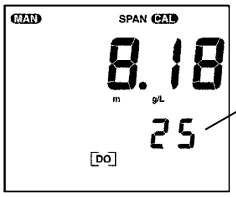
Calibration procedure



1. Wash the sensors 2 to 3 times with pure water and immerse the DO sensor completely in span calibrated liquid.

2. After the zero calibration of the Dissolved-Oxygen (DO) sensor, press the **CAL** key to make sure that the instrument is in the Manual Span Calibration mode.
MAN, **SPAN** and **CAL** light up.

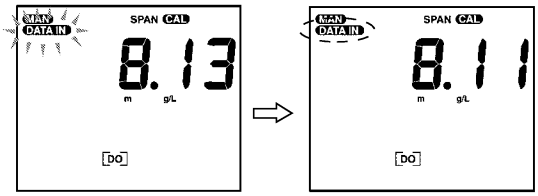
3. After the display has stabilized, use the **UP/DOWN** (▲ ▼) keys to set the amount of saturated dissolved oxygen in water at the temperature.



The temperature setting is displayed.
Refer to the table given on page 56 and set a value equivalent to the amount of saturated dissolved oxygen at the temperature.

4. Press the **ENT** key.

The manual span calibration is starts.



End of calibration

The measured value is displayed during calibration, and **DATA IN** blinks until the indicated value stabilizes. When the indicated value has stabilized, **DATA IN** lights up and the calibration finishes.

With DATA IN is blinking
To stop calibrating the sensor .... Press the CAL key.
To establish the calibration ..... Press the ENT key.

5. Press the **MEAS** key to return to the Measurement mode.

Note

- When the SET and CAL keys are pressed during the manual Dissolved-Oxygen (DO) calibration mode, the calibration data for the dissolved-oxygen (DO) sensor can be deleted.

Amounts of saturated dissolved oxygen in water at various temperatures (salinity=0.0%)

JIS K0101

Temp. (˚C)	DO (mg/L)	Temp. (˚C)	DO (mg/L)	Temp. (˚C)	DO (mg/L)	Temp. (˚C)	DO (mg/L)
0	14.16						
1	13.77	11	10.67	21	8.68	31	7.42
2	13.40	12	10.43	22	8.53	32	7.32
3	13.04	13	10.20	23	8.39	33	7.22
4	12.70	14	9.97	24	8.25	34	7.13
5	12.37	15	9.76	25	8.11	35	7.04
6	12.06	16	9.56	26	7.99	36	6.94
7	11.75	17	9.37	27	7.87	37	6.86
8	11.47	18	9.18	28	7.75	38	6.76
9	11.19	19	9.01	29	7.64	39	6.68
10	10.92	20	8.84	30	7.53	40	6.59

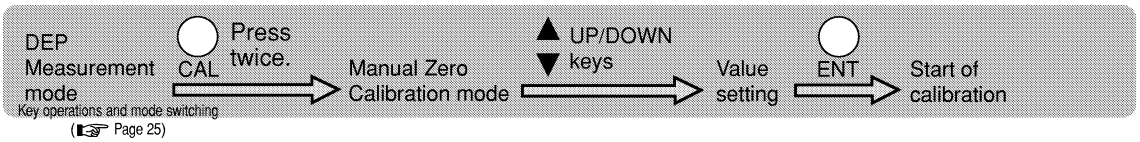
ISO5814

Temp. (˚C)	DO (mg/L)	Temp. (˚C)	DO (mg/L)	Temp. (˚C)	DO (mg/L)
0	14.62				
1	14.22	11	11.03	21	8.91
2	13.83	12	10.78	22	8.74
3	13.46	13	10.54	23	8.58
4	13.11	14	10.31	24	8.42
5	12.77	15	10.08	25	8.26
6	12.45	16	9.87	26	8.11
7	12.45	17	9.66	27	7.97
8	11.84	18	9.47	28	7.83
9	11.56	19	9.28	29	7.69
10	11.29	20	9.09	30	7.56

AUTO calibration is based on the JIS tables. When you need the measured data based on ISO, calibration should be done according to the procedure of span calibration.

5.5 Water depth (DEP) calibration

5.5.1 Zero calibration

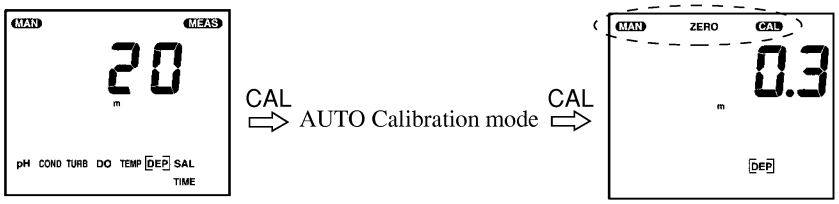


Key operations and mode switching (☞ Page 25)

1. Immerse the sensor in the sample water for approximately 30 minutes so that sensor probe and sample temperatures become the same.

2. Press the **CAL** key twice in the Water Depth (DEP) Measurement mode.

When the instrument enters the Manual Zero Calibration mode, **MAN**, **ZERO** and **CAL** light up.



Manual Zero Calibration mode

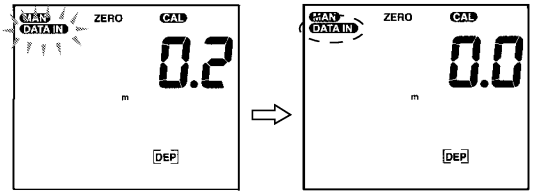
Important

- Sensor probe should be immersed to the depth where the battery cover comes level with the surface. And the level is uses as 0 m in depth.

3. Use the **UP/DOWN** (▲ ▼) keys to set the value to 0.0.

4. Press the **ENT** key.

The manual zero calibration is starts.



End of calibration

The measured value is displayed during calibration, and **DATA IN** blinks until the indicated value stabilizes. When the indicated value has stabilized, **DATA IN** lights up and the calibration finishes.

With DATA IN is blinking

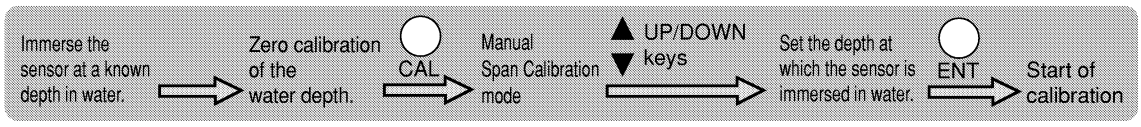
To stop calibrating the sensor .... Press the CAL key.

To establish the calibration ..... Press the ENT key.

Important

- Since the water depth (DEP) sensor depends greatly on temperature, calibrate the sensor at the same temperature as the sample for more accurate measurement.
- Use the AUTO Calibration mode because calibration error becomes large when using in a place with flow velocity or where it is shallow.

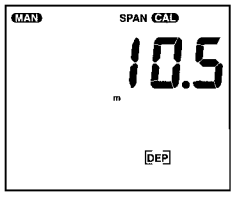
5.5.2 Span calibration



1. Immerse the sensor at a known depth in water. (Set the depth of the lid for memory backup battery as the depth setting.)

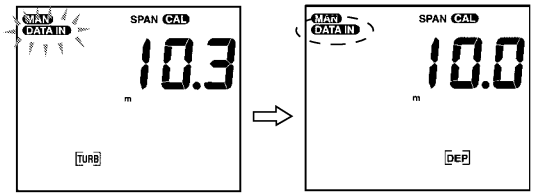
2. After the zero calibration of the water depth (DEP) sensor, press the **CAL** key to make sure that the instrument is in the Manual Span Calibration mode.
MAN, **SPAN** and **CAL** light up.

3. Use the **UP/DOWN** (▲ ▼) keys to set the depth at which the sensor is immersed in water.



4. Press the **ENT** key.

The manual span calibration is starts.



End of calibration

The measured value is displayed during calibration, and **DATA IN** blinks until the indicated value stabilizes. When the indicated value has stabilized, **DATA IN** lights up and the calibration finishes.

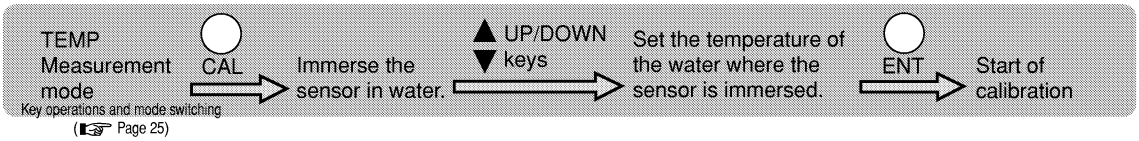
With DATA IN is blinking
To stop calibrating the sensor .... Press the CAL key.
To establish the calibration ..... Press the ENT key.

5. Press the **MEAS** key to return to the Measurement mode.

Note

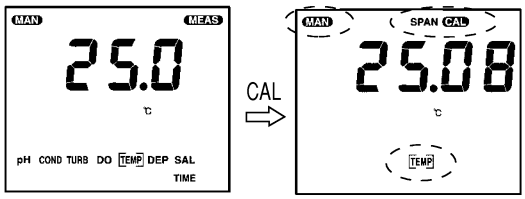
- When the SET and CAL keys are pressed during the manual Water depth (DEP) Calibration mode, the calibration data for the water depth (DEP) sensor can be deleted.

5.6 Temperature (TEMP) calibration



1. Press the **CAL** key in the Temperature (TEMP) Measurement mode.

Select the manual calibration mode.

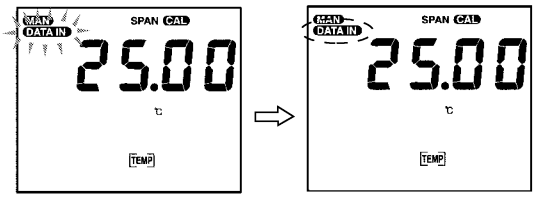


2. Immerse the sensor in water at a known temperature.

3. Use the **UP/DOWN** (▲ ▼) keys to set the temperature of the water where the sensor is immersed as a calibration value.

4. Press the **ENT** key.

The manual calibration is starts.



End of calibration

The measured value is displayed during calibration, and **DATA IN** blinks until the indicated value stabilizes. When the indicated value has stabilized, **DATA IN** lights up and the calibration finishes.

With DATA IN is blinking

To stop calibrating the sensor .... Press the CAL key.

To establish the calibration ..... Press the ENT key.

5. Press the **MEAS** key to return to the Measurement mode.

Note

- When the SET and CAL keys are pressed during the manual Temperature (TEMP) calibration mode, the calibration data for the temperature (TEMP) sensor can be deleted.

5.7 Operation check using ORP standard solution

Note

- Standard solution is not used only for calibration of the meter, but to confirm whether or not the condition of electrodes is good.

1. Add 250 mL pure (ion exchange) water to one packet of any of the below listed standard solutions and mix well.
When mixing, the excess quinhydrone (a black powder) will float to the surface of the solution.

2. Immerse a washed and dried ORP electrode in the ORP standard solution and measure the mV value.

3. If the electrode and the meter, itself, are working correctly, numerical values within 15 mV or less of those listed in Table 1 should be obtained.

4. If measurements that fall within 15 mV of the values listed above are not obtained using this method, measure the solution again after replacing the reference electrode internal solution and removing the dirt from the surface of the metal electrode by moistening a cotton swab with alcohol or a neutral cleaning agent and lightly rubbing the electrode or by soaking the electrode in diluted nitric acid (1:1 nitric acid).

5. If measurements within 15 mV of the values listed above are still not obtained after re-measuring, the reference electrode or the meter may be faulty. Either replace the electrode or have the meter inspected.

Important

- If the prepared ORP standard solution is allowed to stand in open air for one hour or more, it may undergo transformation. For this reasons ORP standard solution that has finished being prepared cannot be stored.
- When measuring a solution that has low concentrations of oxidants and reductants after conducting an operational check using a standard substance, the measured values may not stabilize or the results of measurement might not be repeatable.
  If this is the case, use the meter after immersing the electrodes in the solution again and mixing it thoroughly.

Precautions when measuring actual samples

- Note that when measuring the ORP of solution that has extremely low concentrations of oxidants and reductants, such as tap water, well water, or water treated with purifying equipment, there may be less responsiveness, repeatability, and stability, in general.
- When alkaline water is allowed to stand, its ORP undergoes big changes. Always measure alkaline ion water promptly.

ORP standard solution

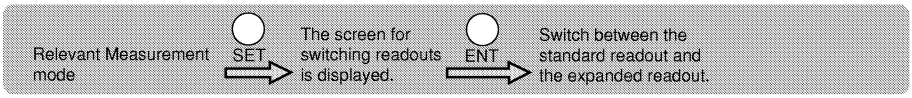
There are two kinds of standards substances. Under normal circumstances, it is sufficient to use only the one type of substance that is closest to the measured value.

Indicated value of ORP standard solution at various temperatures

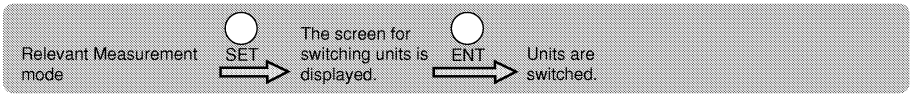
Standard solution ℃	160-22 Phthalic-acid chloride + quinhydrone	160-51 Neutral phosphate + quinhydrone
5	+274.2	+111.9
10	+270.9	+106.9
15	+266.8	+101.0
20	+262.5	+95.0
25	+257.6	+89.0
30	+253.5	+82.7
35	+248.6	+76.2
40	+243.6	+69.0

6. Using the various functions

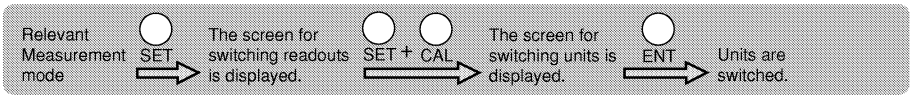
6.1 Switching to Expanded readout (High-accuracy display) 63



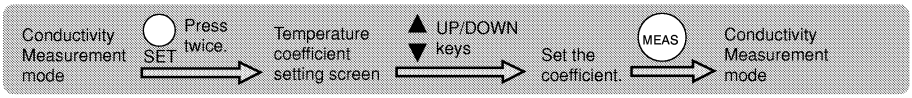
6.2 Switching measurement units 64
In the case of pH, ION, TURB, DO 64



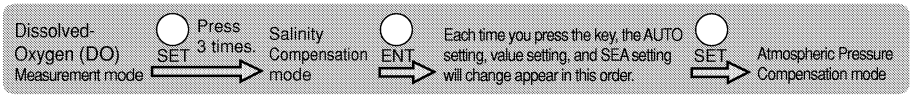
In the case of COND and DEP 65



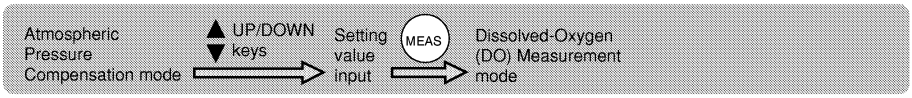
6.3 Temperature conversion for conductivity (COND) 67



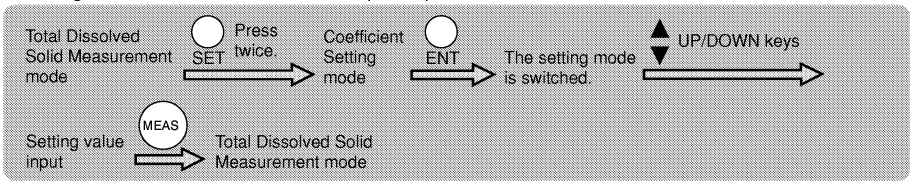
6.4 Dissolved-Oxygen (DO) environmental influence compensation 68
6.4.1 Salinity compensation 68



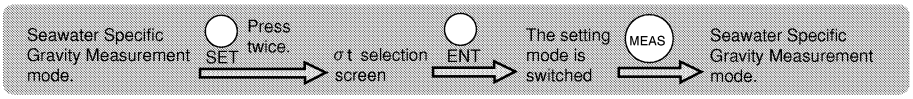
6.4.2 Atmospheric pressure compensation 69



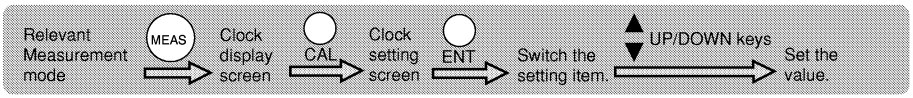
6.5 Setting a total dissolved solid (TDS) coefficient 70



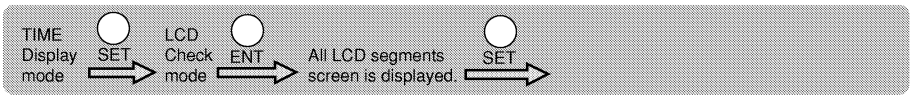
6.6 Displaying seawater specific gravity (σ_0, σ_{15}) 71



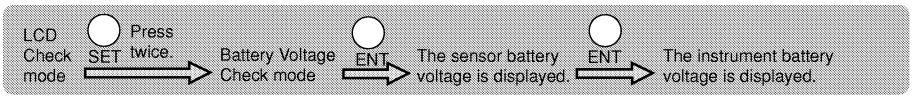
6.7 Setting the clock 72



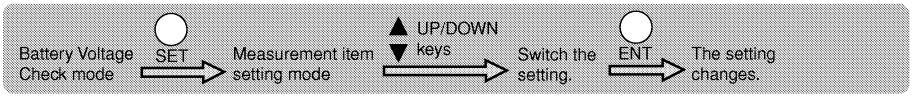
6.8 Key lock setting 73
6.9 Check mode 73
6.9.1 LCD check 74



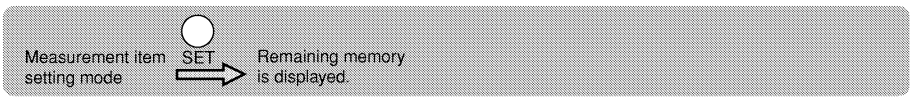
6.9.2 Battery voltage check 75



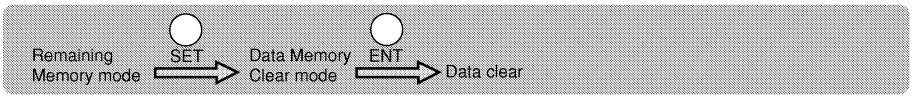
6.9.3 Measurement item setting 76



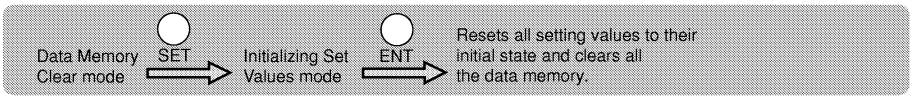
6.9.4 Remaining memory 77



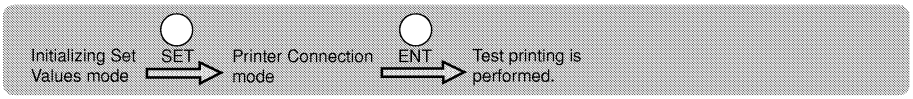
6.9.5 Data memory clear 78



6.9.6 Initializing set values 79

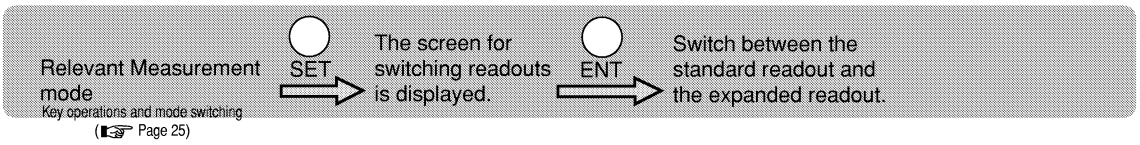


6.9.7 Printer connection, test print 81



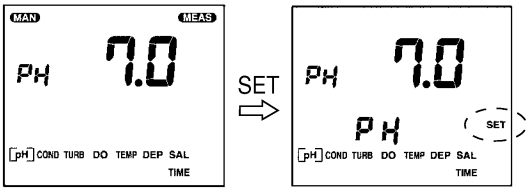
6.1 Switching to Expanded readout (High-accuracy display)

With the exception of oxidation-reduction potential (ORP), it is possible to switch between the Standard readout and the Expanded readout for the measurement value.



1. Press the **SET** key in the relevant Measurement mode.

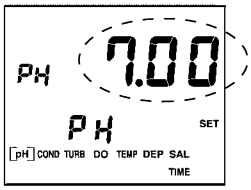
The screen for switching readouts is displayed.



Standard readout

2. Press the **ENT** key.

The screen can be switched between the standard readout and the expanded readout (High-accuracy display).



Expanded readout (High-accuracy display)

Note

- Switch readouts for each measurement items.
- Use the manual 2-point calibration (zero and span) when high accuracy is required for expanded readout (High-accuracy display).
- The expanded readout mode is automatically activated when the manual 2-point calibration mode is chosen.

3. Press the **MEAS** key to return to the Measurement mode.

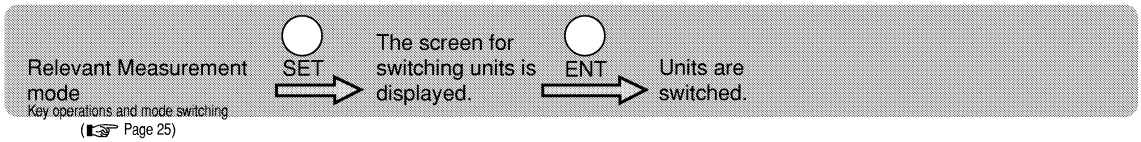
6.2 Switching measurement units

It is possible to switch between measurement units.

The units which can be switched are as follows:

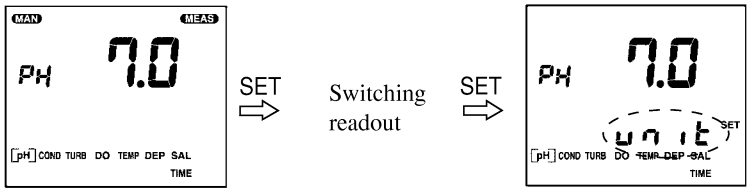
pH ..... pH or mV
Conductivity (COND) ..... S/m or mS/cm
Water depth (DEP) ..... m or ft
Turbidity (TURB) ..... NTU or mg/L
Dissolved Oxygen (DO) ..... mg/L or % (Oxygen saturation ratio)

In the case of pH, TURB, DO



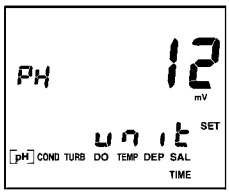
1. Press the **SET** key twice in the relevant Measurement mode.

Confirm that unit is displayed on the screen for switching units.



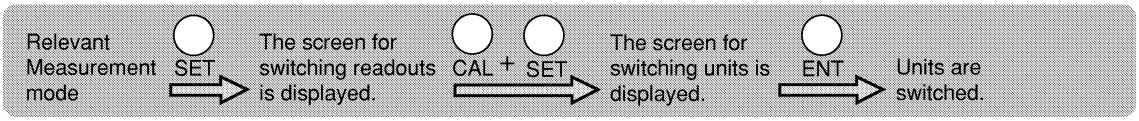
2. Press the **ENT** key.

Units are switched.



3. Press the **MEAS** key to return to the Measurement mode.

In the case of COND and DEP



1. Press the **SET** key in the Relevant Measurement mode.

The screen for switching readout is displayed.

2. Press the **SET** key while holding down the **CAL** key.

Confirm that un it is displayed on the screen for switching units.

3. Press the **ENT** key.

Units are switched.

4. Press the **MEAS** key to return to the Measurement mode.

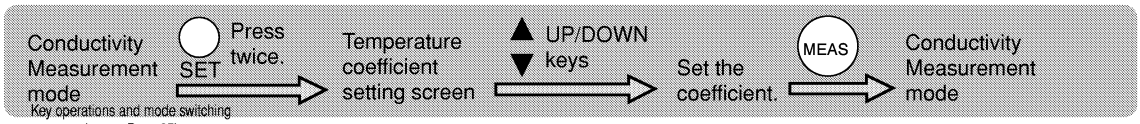
Measurement range

Measurement item		Measurement range		Measurement units
		Expanded	Standard	
pH		0.00 to 14.00	0.0 to 14.0	pH
		—	−1999 to 1999	mV in pH measurement
Conductivity (COND)	Range 1	0.90 to 9.99	0.9 to 9.9	S/m
		9.0 to 99.9	9 to 99	mS/cm
	Range 2	0.090 to 0.999	0.09 to 0.99	S/m
		0.90 to 9.99	0.9 to 9.9	mS/cm
	Range 3	0.0 to 99.9	0 to 99	mS/m
		0.000 to 0.999	0.00 to 0.99	mS/cm
Turbidity (TURB) *1		0.0 to 800.0	0 to 800	NTU (nephelometric turbidity units) or mg/L
Dissolved-oxygen (DO)		0.00 to 19.99	0.0 to 19.9	mg/L
		0.0 to 199.9	0 to 199	%
Temperature (TEMP)		0.00 to 55.00	0.0 to 55.0	°C
Water depth (DEP)		0.0 to 100.0	0 to 100	m
		0.0 to 330.0	0 to 330	ft
Salinity (SAL)		0.00 to 4.00	0.0 to 4.0	%
Total dissolved solids (TDS) *2	Range 1	5.5 to 65.0	5 to 65	g/L
	Range 2	0.55 to 6.50	0.5 to 6.5	g/L
	Range 3	0.000 to 0.650	0.00 to 0.65	g/L
Seawater specific gravity (σ_t)		0.0 to 50.0	0 to 50	–
Oxygen-reduction potential (ORP)		—	−1999 to 1999	mV

*1: Depending on the concentration range, the minimum turbidity is displayed as follows:
0 to 100 NTU ... 1 NTU for standard readout, 0.1 NTU for expanded readout.
100 to 800 NTU ... 10 NTU for standard readout, 1 NTU for expanded readout.
*2: The TDS range depends on the TDS factor settings. (Above ranges are given for a TDS coefficient of 0.65.)

6.3 Temperature conversion for conductivity (COND)

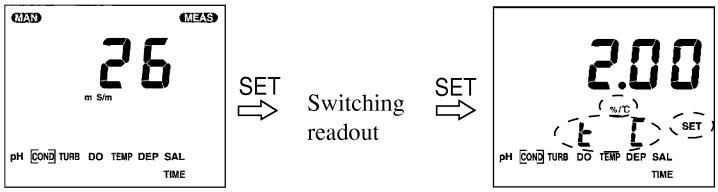
Sample conductivity (COND) varies with temperature, and this instrument uses a temperature conversion coefficient to automatically standardize the conductivity (COND) to the value at 25 °C. The initial setting value is 2 %/°C, which is the generally used value.



Key operations and mode switching (☞ Page 25)

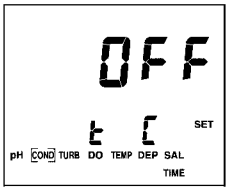
1. Press the **SET** key twice in the Conductivity (COND) Measurement mode.

The screen for setting temperature coefficients is displayed.



2. Use the **UP/DOWN** (▲ ▼) keys to set the coefficient.

The setting range is 0.00 to 3.00 %/°C.



With the ENT key, the temperature conversion is switched between ON and OFF.
The temperature conversion OFF mode is not a 25°C coefficient but a coefficient at the temperature of the sample.

3. Press the **MEAS** key.

The instrument returns to the Conductivity (COND) Measurement mode.

Note

- For temperature coefficients, refer to *Reference data*, page 98 to 99.

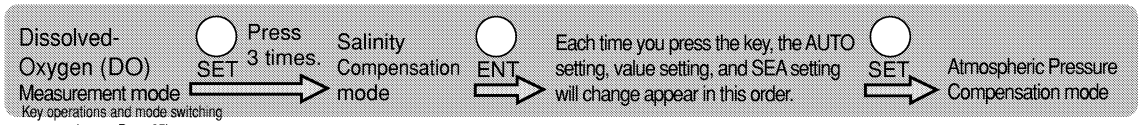
6.4 Dissolved-Oxygen (DO) environmental influence compensation

6.4.1 Salinity compensation

The indicated dissolved oxygen (DO) value can go over the actual value if salinity compensation isn't added because of the increase in salinity in the sample. To obtain a correct measured value for dissolved oxygen (DO) in the sample containing salinity, therefore, salinity compensation is needed. The following modes are available for calculation of salinity compensation.

AUTO..... Salinity compensation is performed automatically with salinity converted from a measured value for conductivity.

SEA ..... Compensation value appropriate for normal seawater is used.



Key operations and mode switching (☞ Page 25)

1. Press the **SET** key 3 times in the Dissolved-Oxygen (DO) Measurement mode.

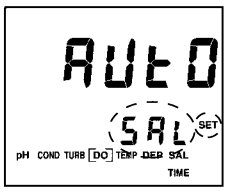
The salinity compensation mode currently set is displayed.

Important

- If you do not change the salinity compensation mode currently set, press the MEAS key to return to the Dissolved-Oxygen (DO) Measurement mode or press the SET key to select the Pressure Compensation mode.

2. Press the **ENT** key.

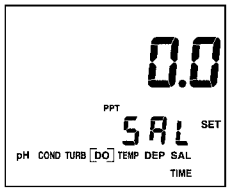
The following screens are displayed in sequence each time the ENT key is pressed: AUTO setting, value setting, SEA setting and AUTO setting.



3. From the screen on which the value is displayed, use the **UP/DOWN** (▲ ▼) keys to enter the setting value if the salinity is known.

For AUTO and SEA setting, this step need not be performed.

The setting range is 0.0 to 40.0 ppt (parts per thousand).

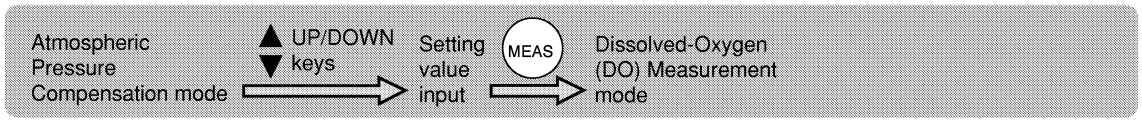


4. When the **SET** key is pressed, setting will be completed and the instrument will enter the Pressure Compensation mode.

5. Press the **MEAS** key to return to the Dissolved-Oxygen (DO) Measurement mode.

6.4.2 Atmospheric pressure compensation

Differences in the atmospheric pressure of the measurement location influence the Dissolved-Oxygen (DO) measurement. By setting (input) the actual atmospheric pressure of the measurement location into the instrument, it is possible to standardize the measured Dissolved-Oxygen (DO) value to a value at the standard atmospheric pressure (1013 hPa).



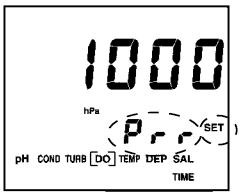
1. When the **SET** key is pressed on the salinity compensation screen, setting will be completed and the instrument will enter the Pressure Compensation mode.

Important

- If you do not change the Pressure Compensation mode currently set, press the MEAS key to enter the Dissolved-Oxygen (DO) Measurement mode.

2. Use the **UP/DOWN** (▲ ▼) keys to input a setting value.

The setting range is 100 to 1999 hPa.



3. When the **MEAS** key is pressed, setting will be completed and the instrument will enter the Dissolved-Oxygen (DO) Measurement mode.

Relation between height (m) and atmospheric pressure (hPa)

Height (m)	0	200	400	600	800	1000	1200	1400	1600	1800	2000	3000	3400
Pressure (hPa)	1013	990	966	943	921	899	877	856	835	815	795	701	666

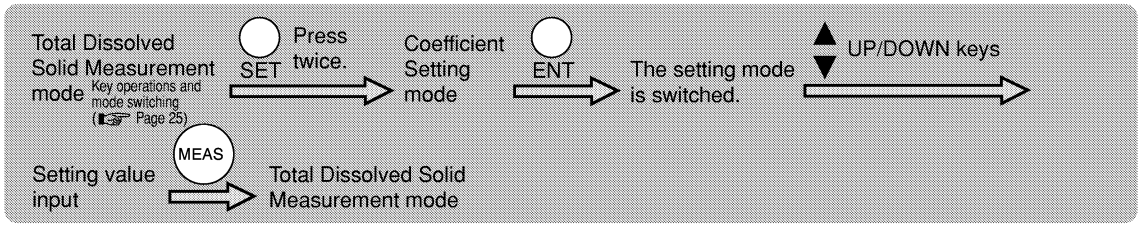
6.5 Setting a total dissolved solid (TDS) coefficient

The total dissolved solid amount (TDS) is a converted value obtained by multiplying the conductivity (COND) value by a known coefficient. Based on a conversion for KCl and $CaCO_3$ solutions, the coefficient initially set for the instrument depends on the conductivity (COND) value as shown below.

Conductivity (COND) (S/m)	Conversion coefficient
< 0.05	0.65
0.05 to 0.5	0.64
0.5 to 1	0.63
1 to 3	0.62
3 to 5	0.61
> 5	0.60

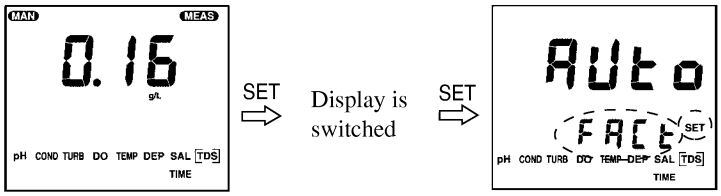
AUTO ..... Used to automatically calculate the total dissolved solid (TDS) amount with an initially set coefficient.

Setting value input ..... Used to determine the total dissolved solid (TDS) amount by setting any conversion coefficient irrespective of the conductivity (COND) value.



1. Press the **SET** key twice in the Total Dissolved Solid (TDS) Measurement mode.

The Coefficient Setting mode currently set is displayed.

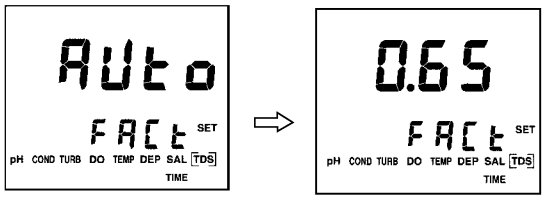


Important

- If you do not change the coefficient currently set, press the MEAS key to enter the Total Dissolved Solid (TDS) Measurement mode.

2. Press the **ENT** key.

The setting mode changes (AUTO/setting value input).



3. Use the **UP/DOWN** (▲ ▼) keys to input a setting value if required.

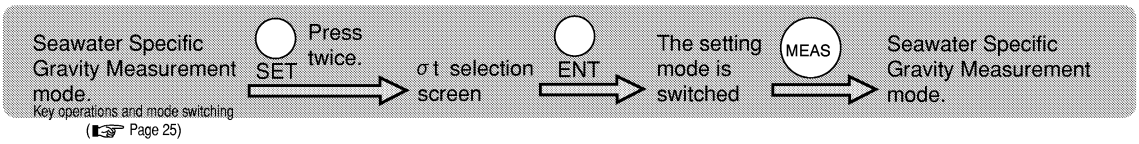
The setting range is 0.50 to 1.00.

4. When the **MEAS** key is pressed, setting will be completed and the instrument will enter the Total Dissolved Solid (TDS) Measurement mode.

6.6 Displaying seawater specific gravity (σ_0, σ_{15})

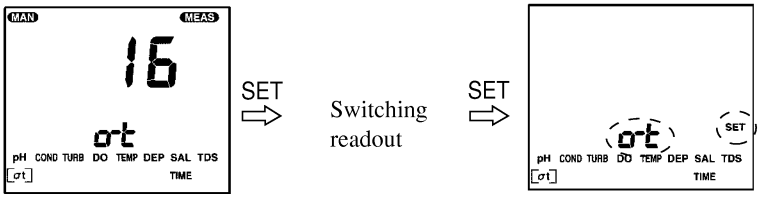
The specific gravity of seawater varies with temperature. By converting the measured value based on the value for a reference temperature, it is possible to compare sample measurement values at different temperatures.

σ_t ..... Specific gravity of seawater at the measurement temperature.
σ_0 ..... Seawater specific gravity at 0 °C.
σ_{15} ..... Seawater specific gravity at 15 °C.



1. Press the **SET** key twice in the Seawater Specific Gravity (σ_t) Measurement mode.

Seawater specific gravity (σ_t) selection screen is displayed.

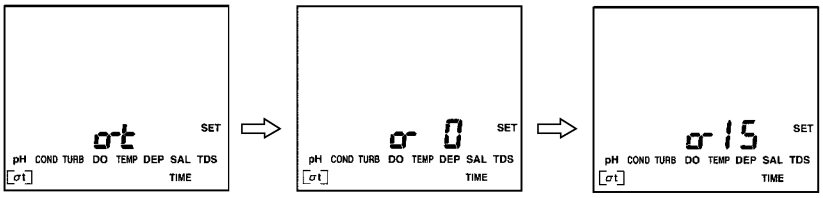


Important

- If you do not change the specific gravity currently set, press the MEAS key to enter the Seawater Specific gravity (σ_t) Measurement mode.

2. Press the **ENT** key.

The setting mode is switched.
($\sigma_0 \rightarrow \sigma_{15} \rightarrow \sigma_t \rightarrow \sigma_0 \ldots$)

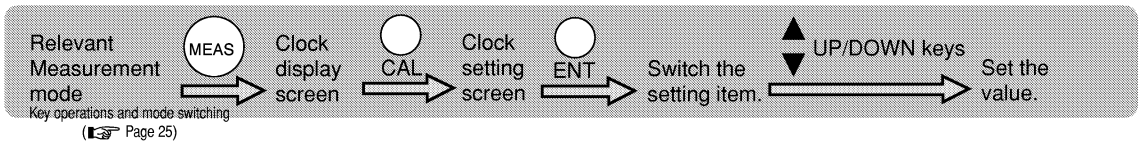


3. When the **MEAS** key is pressed, setting will be completed and the instrument will enter the Seawater Specific Gravity (σ_t) Measurement mode.

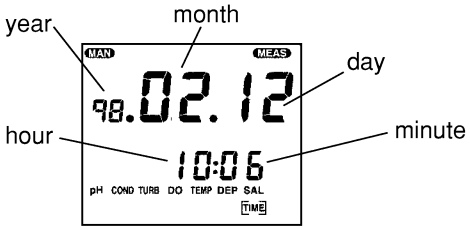
Note

- See page 100 for more about seawater specific gravity.

6.7 Setting the clock

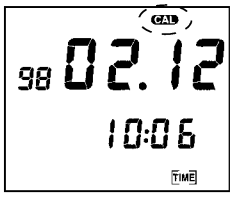


1. Use the **MEAS** key in the measurement mode to switch to the clock display screen.



2. Press the **CAL** key.

CAL light up and clock setting screen is displayed.



3. Press the **ENT** key to switch the measuring item.

(year → month → day → hour → minute → year ...). The setting item will blink.

4. Use the **UP/DOWN** (▲ ▼) keys to set the value.

5. Press **SET** key to confirm the setting.

Note

- When the MEAS key is pressed, the instrument will return to the clock display.

Important

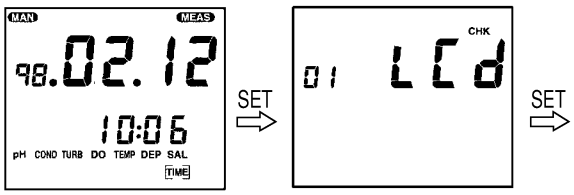
- When the MEAS key is pressed without pressing the SET key and the clock display is displayed again, settings are not changed.

6.8 Key lock setting

If you press the POWER key while pressing the UP (▲) key when the power is off, the instrument is then turned ON with the key locked and the key lock function works.
With the key locked, only the POWER and MEAS keys can be used and [LOCK] is displayed on the screen. To release this function, turn the instrument OFF first and then ON again.

6.9 Check mode

When the SET key is pressed in the measurement mode from the screen where "year, month, day and time" are displayed, the instrument performs self-diagnosis check.



Each time the SET key is pressed, the check mode item is switched sequentially.

Check mode items

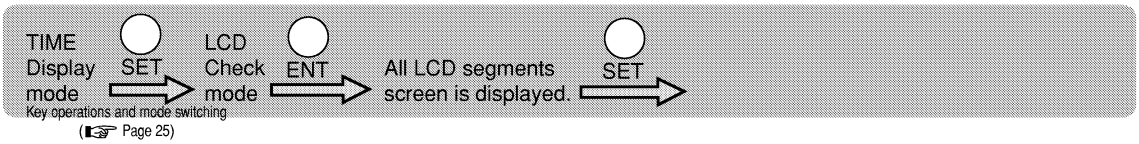
1 :	LCD check	Checks if all LCD segments will be displayed. (☞ Page 74)
2 :	Battery voltage check	Performs a simple battery voltage check for the instrument and sensors. (☞ Page 75)
3 :	Measurement item setting	Can set the measurement item to be stored. (☞ Page 76)
4 :	Remaining memory	Displays the number of data that can be stored now. (☞ Page 77)
5 :	Data memory clear	Clears the data memory. (☞ Page 78)
6 :	Initializing set values	Initializes all memory settings. (☞ Page 79)
7 :	Printer connection, test print	Performs a test print. (☞ Page 80)

Note

- In the check mode, it is possible to return to the Measurement mode by pressing the MEAS key.

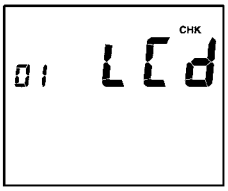
6.9.1 LCD check

All LCD segments are displayed.



1. Press the **SET** key in the Clock Display mode.

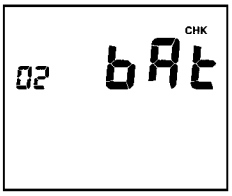
LCD check mode screen is displayed.



2. Press the **ENT** key.

3. Check to see if all LCD segments are displayed.

4. When the **SET** key is pressed, the instrument goes to the battery voltage check.

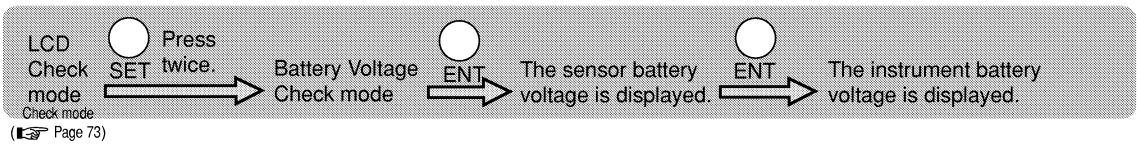


Note

- When the MEAS key is pressed, the instrument returns to the Clock Display mode.

6.9.2 Battery voltage check

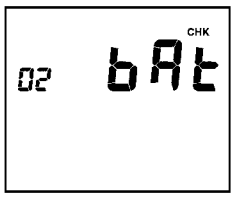
The battery voltage in use is displayed.



Check mode
(☞ Page 73)

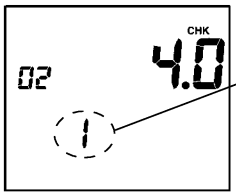
1. Press the **SET** key twice in the LCD Check mode.

Battery Voltage Check mode screen is displayed.



2. Press the **ENT** key.

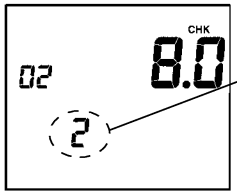
The sensor battery voltage is displayed.



1 : Sensor battery voltage
Criteria
3.0 to 5.0 V : Normal
Less than 3.0 V: Replace the battery.
(Error No. 2 will blink.)

3. Press the **ENT** key.

The instrument battery voltage is displayed.



2 : Instrument battery voltage
Criteria
5.5 to 11.0 V : Normal
Less than 5.5 V : Replace the battery.
(Error No.3 will blink.)

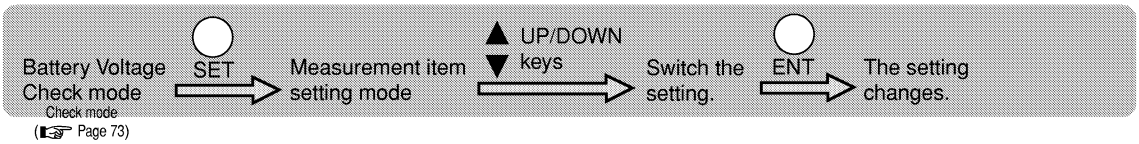
4. When the **SET** key is pressed, the instrument goes to the measurement item setting.

Note

- When the MEAS key is pressed, the instrument returns to the Clock Display mode.

6.9.3 Measurement item setting

Measuring items can be set.



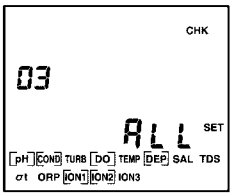
(Check mode Page 73)

1. Press the **SET** key in the Battery Voltage Check mode.

Display setting mode screen is displayed.

2. Use the **UP/DOWN** (▲ ▼) keys to switch the measurement item.

The selected item blinks.



3. Press the **ENT** key to switch between [set/ not set] for the blinking item.

An item for which "set" is selected is indicated with [ ].

Note

- If the temperature is "not set" data for each component is not temperature-compensated and is displayed as data at 25 °C.

4. When the **SET** key is pressed, the instrument goes to the remaining memory display.

Note

- When the MEAS key is pressed, the instrument returns to the Clock Display mode.

6.9.4 Remaining memory

The number of date that can be stored can be displayed.

Press the **SET** key in the Display Setting mode.

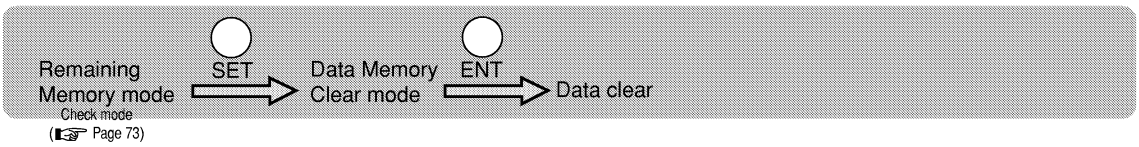
Remaining memory is displayed.

Note

- When the **SET** key is pressed, the instrument goes to the Data Memory Clear mode.
- When the MEAS key is pressed, the instrument returns to the Clock Display mode.

6.9.5 Data memory clear

All the data memory is cleared.

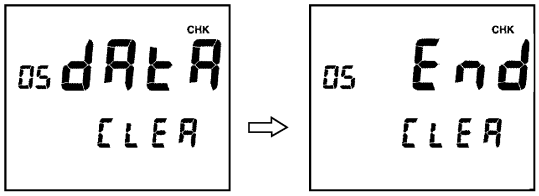


1. Press the **SET** key in the Remaining Memory mode.

Data memory clear mode screen is displayed.

2. Press the **ENT** key.

The data is cleared.



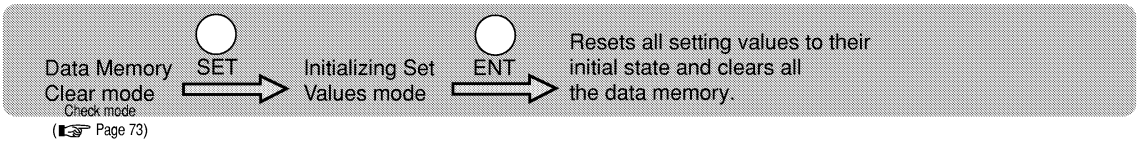
3. When the **SET** key is pressed, the instrument goes to the Memory Initialization mode.

Note

- When the MEAS key is pressed, the instrument returns to the Clock Display mode.

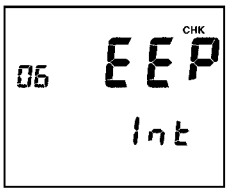
6.9.6 Initializing set values

All setting values are reset to their initial state.



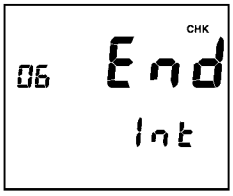
1. Press the **SET** key in the Data Memory Clear mode.

Initializing Set Values mode screen is displayed.



2. Press the **ENT** key.

All setting values are reset to their initial state.



3. When the **SET** key is pressed, the instrument goes to the Printer Connection mode.

Note

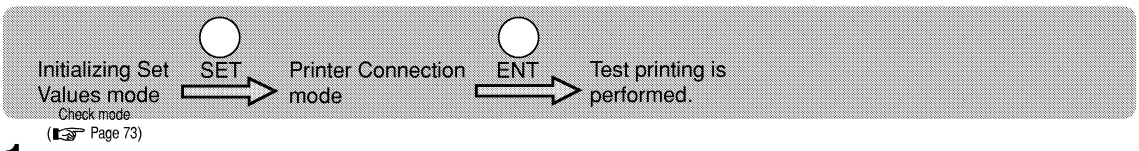
- When the MEAS key is pressed, the instrument return to the Clock Display mode.
- Data stored in the memory remains.

Initial setting

Item	Description	Initial value
Common	Display setting	Standard
	Data storage	Manual
pH	Unit	pH
COND	Unit	S/m
	Temperature coefficient	2.0 %/°C
DO	Salinity setting	AUTO
	Atmospheric pressure setting	1013 hPa
	Unit	mg/L
TURB	Unit	NTU
DEP	Unit	m
TDS	Coefficient	AUTO
σ_t	Unit	σ_t

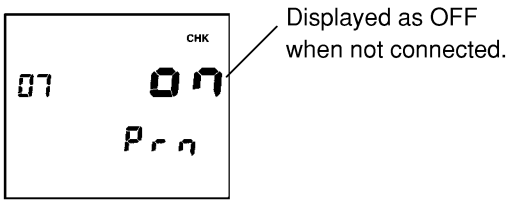
6.9.7 Printer connection, test print

This mode only operates when the function expansion unit is connected. A test print is performed if a printer is connected.



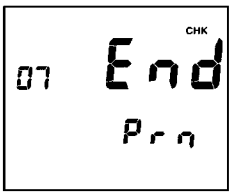
1. Press the **SET** key in the Initializing Set Values mode.

Printer Connection mode screen is displayed.



2. Press the **ENT** key to start printing.

Normally, "End" is displayed. If an error has occurred, "Err" is displayed.



3. When the **SET** key is pressed, the instrument will return to the first LCD check mode.

Note

- When the MEAS key is pressed, the instrument returns to the Clock Display mode.

7. Instrument specifications

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7.5 Option 94

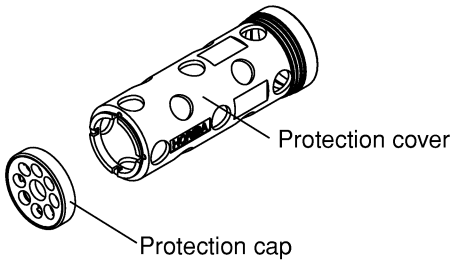
7.1 Daily maintenance

Sensor probe

● Storage method

After use, wash out with tap water and wipe off all contamination. Pour about 20 mL of pure water into the probe cap, install it on the sensor probe, and store in the carrying case.
In order to use the instrument regularly for a long time, store it after wiping off all contamination from the cable, sensor probe, and sensors.

Remove the protection cover once and completely wash out with tap water the left over sample on the screws. Reinstall the cover after having wiped off the drops of water. If there is any sample (especially sea water) left over on the screws, rust may form which may prevent the protection cover from being removed. (☞ Installation procedure, page 18.)
Depending on the level of contamination, remove the rubber protection cap from the tip of the protection cover and wash out with tap water. Reinstall it after wiping off the drops of water.

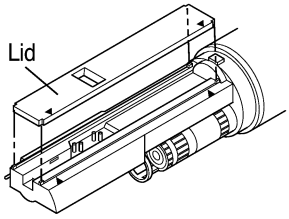


When storing with the pH/ORP and DO sensors attached to the probe, make sure to install the probe cap after having poured pure water into it.
Letting the pH/ORP and DO sensors get dry may cause deterioration of the instrument's performance. Should the sponge inside the probe cap be contaminated, replace it with a clean sponge (included).

TEMP/COND/TURB units

● To remove contamination

1. Remove the lid from the cell.
2. Clean the unit in tap water. If the unit is severely contaminated, use an absorbent cotton to remove contamination.
3. Attach the lid to the cell block before storage. (☞ page 29)



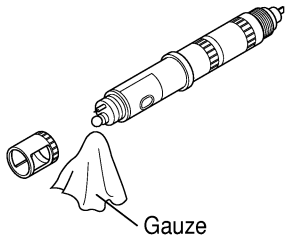
Important

- The cell has a window for turbidity measurement. Be careful to avoid damage to the window.
  In case of measurements, attach the lid to the cell in the correct direction.
- Don't remove the COND/TURB lid during calibration or measurement.
- Attach the lid to the cell with fitting four corners and facing ▲ marks each other.

pH/ORP sensors

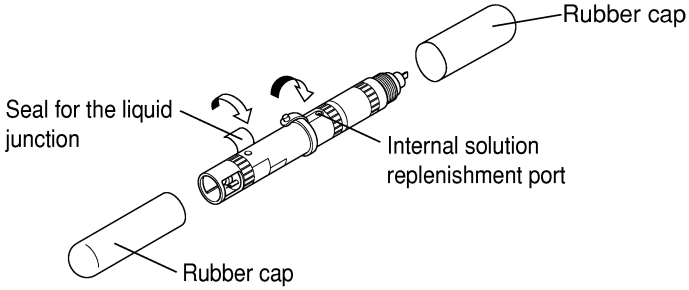
● To remove contamination

Use a piece of gauze dampened with detergent and wipe off contamination.



● Long-term storage

Remove the sensor from the sensor probe and check the internal solution replenishment port is closed. Then, attach a seal to the liquid junction and attach the rubber caps before storage.



● Monthly maintenance

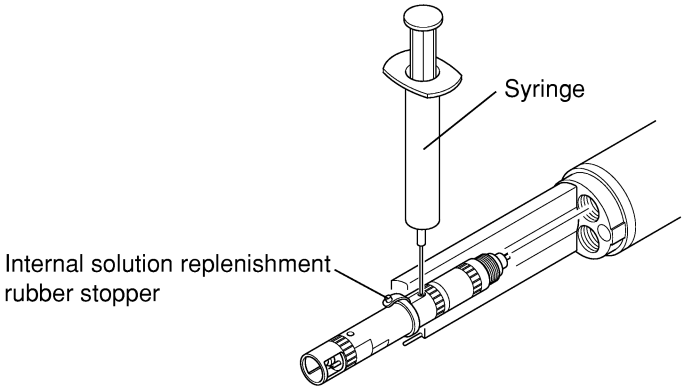
Replace the internal solution as described below:

1. Remove the sensor from the sensor probe using a sensor spanner.
2. Open the internal solution replenishment rubber stopper and remove the internal solution with a syringe.
3. Pour new internal solution (#330) to the level near rubber stopper. Be careful to avoid air bubbles from coming in the solition.
   Air bubbles in the internal solution will impair the sensors' pressure compensation function.

Important

- Shake the sensor to avoid bubbles in the internal solution from remaining at the bottom of the sensor.

4. Attach the sensor to the sensor probe.



DO sensor

● To remove contamination

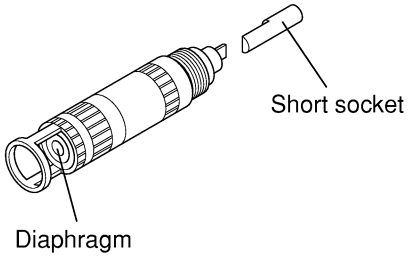
Wipe off contamination with gauze to avoid damage to the diaphragm.

● Long-term storage

Remove the sensor from the sensor probe using a sensor spanner. Set the supplied short socket and store the sensor in a cool(0 to 10℃), dark place.

Important

- Provide the DO sensor with a short socket or connect the sensor to the sensor probe for storage. Otherwise, the sensor may have a shorter life or stable instructions may not be obtained.
- The short socket is used when storing. Do not throw it away.



● Resetting the DO sensor when storing without having installed the short socket.

When leaving the DO sensor unattended for a brief period (1 or 2 days) without the short socket, the DO sensor can be reset by connecting it to the short socket or the probe. However, an amount of time corresponding to the period it was left unattended is necessary. If left unattended without being connected to the short socket or the probe for a long period (1 month), it cannot be reset.

● To replace the diaphragm.

Please read the instruction manual of the DO diaphragm replacement kit. (☞ page 89)

7.2 Troubleshooting

The instrument has a simple error message that informs users of operational errors and failure. Err No. is displayed at the bottom of the screen.

● Error message list

Err No.	Designation	Err No.	Designation
1	Sensor memory failure	6	Span calibration error
2	Sensor battery voltage drop	7	Calibration stability error
3	Instrument battery voltage drop	8	Printer error
4	Communications error	9	DATA IN error
5	Zero calibration error		

● Error and remedy

Important

- For err Nos. 5 to 7, the calibration err display disappears when a proper calibration is performed after the following action, or when the instrument is turned on again. For the other err Nos., the err display disappears after any of the following actions is taken.
- Error Nos. 2 and 3 are displayed even when using the AC adapter if the sensor probe battery voltage or instrument battery voltage drops is low on voltage.

Err NO.	Problem	Cause	Remedy
1	No data can be read from or written into the sensor probe memory.	Internal IC failure	Call your nearest store for sensor probe repair.
2	Sensor probe battery voltage drop	① Battery voltage drop ② Improper installation of the battery	① Replace the sensor probe battery. ② Set the batteries (LR03) in the correct direction.
3	Instrument battery voltage drop	① Battery voltage drop ② Improper installation of the battery	① Replace the instrument battery. ② Set the battery (6LR61) in the correct direction.
4	No communications possible between the instrument and the sensor probe	① Improper connection of the connector to the instrument ② Cable disconnection	① Connect the connector to the instrument properly and turn on the instrument again. ② Call your nearest store for cable repair.
5	No zero calibration possible	pH • The standard solution is contaminated. • Contamination on the pH glass membrane • Change in concentration of the internal solution for the reference electrode • Cracks in the pH glass electrode COND • The standard solution is contaminated. • The sensor is dirty. • The COND sensor is broken.	pH • Change the standard solution. • Clean the pH glass membrane. • Replace the internal solution for the reference electrode. • Replace the sensor. COND • Change the standard solution. • Clean the sensor. • Contact your nearest store.

Err NO.	Problem	Cause	Remedy
5	Zero calibration not possible	TURB	TURB
		• Air bubbles in the cell	• Swing the sensor probe while drawing a large arc.
		• Cell contamination	• Clean the cell.
		DO	DO
		• Damage to the diaphragm of the DO sensor	• Check the sensor and replace it if damaged.
		DEP	DEP
		• Contamination on the DEP sensor	• Clean the DEP sensor.
		• Damage to the DEP sensor	• Contact your nearest store.
6	Span calibration not possible	pH	pH
		• Contamination on the pH glass membrane	• Clean the pH glass membrane.
		• Change in concentration of the internal solution for the reference electrode	• Replace the internal solution for the reference electrode.
		• Cracks in the pH glass electrode	• Replace the sensor.
		• Damage to the connector pin	• Replace the sensor.
		COND	COND
		• The standard solution isn't correct.	• Calibrate with correct standard solution.
		• The standard solution value is set uncorrectly.	• Delete the calibration data for the conductivity, then calibrate the sensor again. (☞ Page 50)
		• The COND sensor is broken.	• Contact your nearest store.
		TURB	TURB
		• Air bubbles in the cell	• Swing the sensor probe while drawing a large arc.
		• Cell contamination	• Clean the cell.
		• The lid is attached uncorrectly.	• Confirm if the lid is attached correctly, then calibrate the sensor again. (☞ Page 29)
		DO	DO
		• Damage to DO sensor diaphragm	• Check the DO sensor and replace it if damaged.
		• DO sensor is unstable.	• Connect DO sensor to the sensor probe. Calibrate the sensor again 1 day later.
		• Damage to the connector pin	• Replace the sensor.
		DEP	DEP
		• Contamination on the DEP sensor	• Clean the DEP sensor.
		• Damage to the DEP sensor	• Contact your nearest store.
		TEMP	
		• Damage to the TEMP sensor	• Contact your nearest store.
7	The calibration value does not become stable within approximately three minutes.	① Sensor contamination	① Clean each sensor.
		② Dry sensor surface	② Pour the standard solution into the calibration beaker. Calibrate the sensor again 1 to 2 hours later.
		③ Severe temperature change	③ Calibrate the sensor in a place at a stable temperature or in a thermostatic oven.

Err NO.	Problem	Cause	Remedy
8	Printer unit failure		Turn OFF the instrument and use the remedy described below. Then turn ON the printer again.
		① Paper has jammed in the printer	① Remove the jammed sheet of paper
		② Improper printer unit connection	② Check to see if the printer is properl connected to the instrument.
		③ Printer failure	③ Replace the printer. * Contact your nearest store if the instrument does not recover after replacement of the printer.
9	Data cannot be stored because the memory is full.	No free space in the memory	Delete the data stored in the memory. (☞ Page 78)

● Other troubles

Remedies for various trouble with no Err No. displayed are described below.

Problem	Cause	Remedy
No data display with the power on	• No batteries	• Set new batteries.
	• Improper position of the positive and negative poles	• Set the batteries properly while paying attention to the positive and negative poles.
	• Battery voltage drop	• Replace the batteries with new ones.
	• Improper instrument battery contact	• Use radio pliers to narrow the positive terminal of the battery snap.
No setting change possible	• Automatic data storage is under way	• Press the CAL key to stop the automatic data storage.
No key operation possible	• The key lock function is working	• Turn OFF the instrument. Then turn ON the instrument again. (☞ Page 73)
	• Failure to calibrate the sensor or wrong calibration.	• Calibrate the sensor properly.
Blinking measured value	• Improper measurement sample	• Use a sample that is in the measurement range.
	• Sensor contamination	• Clean each sensor.
	• Poor calibration is possible. (The standard solution is contaminated.)	• Carry out correct calibration.
tYPE Err The Err is displayed and the operation cannot be performed.	• Improper connection of the cable connector to the instrument	• Connect the connector to the instrument properly and turn on the instrument again.
	• Cable disconnection	• Contact your nearest store.
	• Instrument inside failure	• Contact your nearest store.

● Troubleshooting for the TURB sensor

If an abnormal value such as -10, 800 or more is indicated, or indication does not become stable, follow as below instructions.

Remove the contamination of the sensor

Remove the cover of the turbidity (TURB) sensor, and clean the sensor with cotton swab.
Contamination or bubbles on the sensor may cause fluctuation of TURB values.

Remove bubbles around the sensor

When immersing sensor in the calibration cup, be sure lower it slowly. Quick immersion may cause bubbles on the sensor, which can have bad influence on calibration accuracy to give abnormal value indication.

Use of new standard solution

When calibration, clean the sensor before immersing it in the new standard solution. In case of zero calibration, when the standard solution is turbid or contaminated, calibrate again with the new standard one.

Points to be noted in making measurement

Immerse the sensor slowly in the sample. In case of abnormal measurement value observed, contamination or bubbles adhering may be suspected. So, shake greatly the sensor. Since immersion of the sensor in the sludge layer at the bottom of the sample can prohibit accurate measurement, shake greatly enough to remove the sludge.

● Maintenance of DO sensor

Durable life of DO sensor is generally one year, however, it may vary depending on the using condition. In case of the failure of calibration or breakage of the diaphragm, take either of the following steps according to the using period.

Within one year after purchasing :

Obtain diaphragm replacement kit (optional) to replace the used diaphragm and replenish the internal solution for restoration.

When exceeding one year after purchasing :

Replace by the new DO sensor.

● Materials

#5460 DO Sensor Diaphragm Replacement Kit Operation Manual

This operation manual explains how to replace the DO Sensor (#5460) Diaphragm.

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1 This kit comes with the following.

● Diaphragm sheets	10 sheets
● Diaphragm retaining ring	5 pcs.
● O−ring (S9)	5 pcs.
● Internal solution #305 (50 mL)	1 bottle
● Diaphragm retaining plate	1 pc.
● Replacement stand	1 pc.
● Syringe and needle	1 set
● Operation manual	1 sheet

2 Diaphragm Replacement

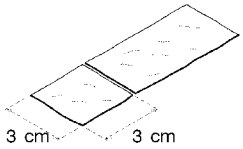
Chemical solution

Caution

The internal solution contains pottasium hydroxide (KOH) solution of high concentration.
If the solution comes in contact with hands or skin, wash immediately with water. If the solution comes in contact with the eyes, flush with ample amounts of water, then seek medical assistance.

1 Cut a diaphragm sheet to about 3 x 3 cm in size.

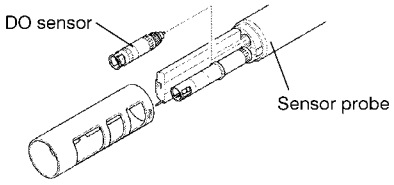
Note▶▶▶ Don't get any fingerprints or dust on the center part of the square.



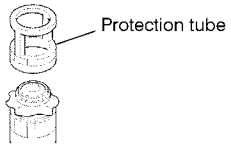
2 Detach the DO sensor from the sensor probe.

Ref▶▶▶ Refer to the U−21.22.23 Operation Manual, section 2.3.2 "Sensor Installation".

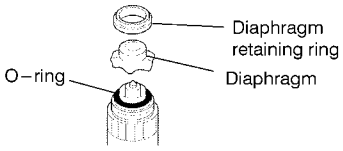
Note▶▶▶ If the short socket is not attached, instability may be seen when the sensor is used again.
Wear vinyl work gloves when handling the sensor. The KOH inside it is a strong alkaline and can irritate skin.



3 Detach the protection tube that holds the diaphragm in place. If it is difficult to remove, use some spanner, etc. to remove it.

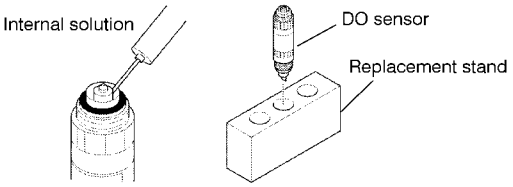


4 Detach the diaphragm retaining ring and diaphragm. Detach the diaphragm retaining ring and diaphragm if damaged or no longer functional.

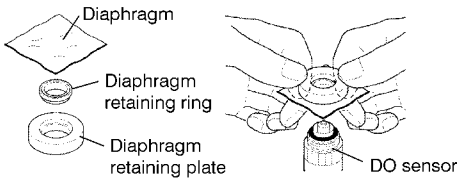


5 Set the sensor in the replacement stand ,and fill the internal solution with the attached syringe until the sensor tip is soaked with the solution.

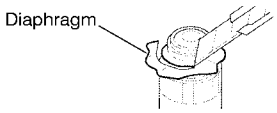
Note▶▶▶ Use the internal solution included in the kit for best performance.
In case some white crystals are seen, wipe them out completely with a Kimwipe®, etc.
In case the internal solution includes white crystals, remove the internal solution and fill up again. If the white crystals cannot be seen, just fill up.



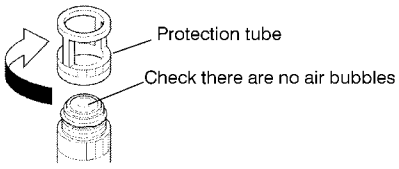
6 Fit the diaphragm retaining ring into the diaphragm retaining plate. Then, lay the diaphragm over the sensor and carefully cover with the ring and plate so that the diaphragm does not wrinkle. Finally, remove the retaining plate.



7 Cut the draped edge of the diaphragm to the shape of the sensor.

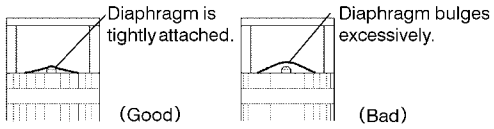


8 Check there are no air bubbles inside the sensor and tighten the protection tube securely.



9 Check the diaphragm bulges upward as shown on the below left and that it is not wrinkled.

Note▶▶▶ Check that span calibration can be made correctly.
Sensitivity lowers and response speed slows if the diaphragm does not bulge sufficiently.



For any question regarding this product, please contact your local agency, or inquire from the Customer Registration website (www.horiba.co.jp/register).

HORIBA, Ltd.

7.3 Specifications

NOTE ○: Applicable
—: Unapplicable

		U-22XD
Instrument	Water-proof construction	IP67
	Mass	Approximately 500 g (including the grip holder)
Sensor *1	Use in 2-inch well	○
	Measurement temperature	0 to 55 °C
	Storage temperature	-5 to 60 °C
	Measurement depth	to 100 m
	Maximum sensor outside diameter	47 mm
	Sensor length	380 mm
	Continuous use available *2	30 days
	Automatic data gathering at set time	○
	Mass (Cable10 m)	Approximately 1.9 kg
pH ● Two-point calibration ● Automatic temperature compensation	Measuring principle	Glass electrode method
	Range	pH0 to 14
	Resolution	0.01 pH
	Repeatability	±0.05 pH
	Accuracy	±0.1 pH
Dissolved-Oxygen ● Salinity conversion (0 to 40 ppt/Auto) ● Automatic temperature compensation	Measuring principle	Diaphragm galvanic battery method
	Range	0 to 19.99 mg/L
	Resolution	0.01 mg/L
	Repeatability	±0.1 mg/L
	Accuracy	±0.2 mg/L
Conductivity ● Auto range ● Automatic temperature conversion (25 °C)	Measuring principle	4 AC electrode method
	Range	0 to 9.99 S/m
	Resolution	0.1 % of full scale
	Repeatability	±1 %
	Accuracy	±3 %
Salinity	Measuring principle	Conductivity conversion
	Range	0 to 4 %
	Resolution	0.01 %
	Repeatability	±0.1 %
	Accuracy	±0.3 %
Total Dissolved Solid(TDS) ● Conversion factor setting	Measuring principle	Conductivity conversion
	Range	0 to 99.9 g/L
	Resolution	0.1 % of full scale
	Repeatability	±2 g/L
	Accuracy	±5 g/L
Seawater specific gravity ● Display σ_t, σ_0, σ_{15}	Measuring principle	Conductivity conversion
	Range	0 to 50 σ_t
	Resolution	0.1 σ_t
	Repeatability	±2 σ_t
	Accuracy	±5 σ_t
Temperature	Measuring principle	Thermistor method
	Range	0 to 55 °C
	Resolution	0.01 °C
	Repeatability	±0.3 °C
	Accuracy	±1.0 °C

		U-22XD
Turbidity (TURB)	Measuring principle	Penetration and scattering method
● Unit selection	Range (NTU or mg/L)	0 to 800 NTU
	Resolution	0.1 NTU
	Repetability	±3 %
	Accuracy	±5 %
Water depth	Measuring principle	Pressure method
	Range	0 to 100 m
	Resolution	0.1 m
	Repetability	±3 %
	Accuracy	±5 %
Oxidation-reduction potential (ORP)	Measuring principle	Platinum electrode method
	Range	± 1999 mV
	Resolution	1 mV
	Repetability	± 5 mV
	Accuracy	±15 mV
Simultaneous measurement items		10

Note: The accuracy rating value is obtained from measurements at intermediate point of the standard solution after two-point calibration (at room temperature and pressure). The repeatability and accuracy rating percentages are based on the full scale (except for salinity).

*1: Organic solvents, strong acids, and strong alkaline solvents cannot be measured.

*2: Based on the data measured automatically at 15 minutes intervals. The battery life taken into account. Periodical maintenance and calibration is necessary when a lot of shellfishes and seaweeds exist at the measurement point.

7.4 Spare parts

Sensors

Sensor	Model	Spare part number
pH sensor	6230	9037-0056-00
pH/ORP sensor	6280	9037-0057-00
DO sensor	5460	9037-0058-00

Standard and internal solutions

Solution	Model	Spare part number	Remark
pH 4 standard solution (500 mL)	100-4	9003-0016-00	Standard solution for AUTO calibration, which is in addition used for manual pH span calibration.
pH 7 standard solution (500 mL)	100-7	9003-0017-00	Standard solution for pH zero calibration
pH 9 standard solution (500 mL)	100-9	9003-0018-00	Standard solution for manual pH span calibration
Powder for ORP standard solution (250 mL × 10)	160-51	9003-0031-00	Powdered standard solution to be used for checking ORP behavior
Powder for ORP standard solution (250 mL × 10)	160-22	9003-0030-00	
pH reference internal solution (250 mL)	330	9037-0052-00	Replenishment internal solution for pH reference electrode

Others

	Model	Spare part number	Remark
Calibration beaker XD	–	9037-0086-00	This is similar to the standard accessory, and used for sensor calibration.
Connector plug for the prove	–	9037-0071-00	When using the probe separately from the instrument, this is used to maintain waterproof of the connector.
Sensor spanner	–	9037-0088-00	This is used to connect the sensor to the probe. Similar to the standard accessory.
DO diaphragm replacement kit	–	9037-0074-00	In case of breakage of the DO sensor diaphragm, it is used in the replacement of the diaphragm to restore the sensor.
Battery cover packing	–	9096-0013-00	Replacement packing to be used for battery box of the main unit.
System unit cover O-ring	–	9096-0014-00	Replacement packing to be used for EXT cover of the main unit.
Sensor O-ring	–	9037-0076-00	Replacement O-ring to be used for connector of pH/ORP sensor and Do sensor.
Probe cap XD	–	9037-0087-00	This cap is to be used when storing the sensor probe.
Battery caver O-ring	–	9037-0084-00	This replacement O-ring is used for the sensor probe's battery cover.
Silicon grease	–	9037-0085-00	This silicon grease is applied on the sensors' O-rings. Similar to the standard accessory.
Protection cover packing	–	9037-0091-00	This is packing for when taking off the probe cap and seal after installing the protection cover. (board packing and O-ring set)
Sponge	–	9037-0089-00	This replacement sponge is used for the probe cap XD.
Protection cap	–	9037-0090-00	This cap is to be attached to the protection cover.

* The spare parts above are prepared by dealers.
Order the part by designating the parts name, model and spare parts number.

7.5 Option

Parts name	Model	Remark
Expansion adaptor	U-2001	This is applicable to AC adapter connection, RS-232C communication, GPS connection, printer output, and data-collecting software.
System unit *	U-2002-100V U-2002-110V U-2002-220V	This is applicable to AC adapter connection, RS-232C communication, GPS connection, printer output, and data-collecting software. GPS and printer are included in a complete set.
AC adaptor (for 100 V)	AC-10	AC adapter intended to drive the U-20 series by AC power supply. This should be used together with U-2001 and U-2002.
Carrying case	W-2010	Compact carrying case for cable below 10 m in length . Not large enough to hold flow cell or guard.
Carrying case	W-2030	Bigger-sized carrying case for cable exceeding 30 m in length. Large enough to hold flow cell.
Flow cell	W-2100	To be used for measurement at a pumping up sample.
Probe guard	W-2200	To be used for measurement at a location where there is a flow or a location with a thick sludge layer residing at the bottom.
PC connection cable	—	Nine-pin connection cable to PC.

* Specify the power source and voltage of the printer when ordering.

8. Reference Data

● pH measurement

1. Principle of pH measurement

U-20XD series use the glass electrode method for pH measurements. The glass electrode method measures a potential difference between the glass film for pH and the comparison electrode. For more information, refer to JIS Z 8802 pH measurement method.

2. Temperature compensation

The electromotive force generated by the glass electrode changes depending on the temperature of the solution. Temperature compensation is used to compensate for the change in electromotive force caused by temperature.
This function does not compensate the change in pH caused by the temperature of the solution. When pH is to be measured, the temperature of the solution when the pH is measured must be recorded along with that pH value, even if a meter that has automatic temperature compensation is used. If the solution temperature is not recorded, the results of the pH measurement may be meaningless.

3. Types of standard solutions

When measuring pH, the pH meter must be calibrated using a standard solution. There are five kinds of standard solutions specified in "JIS 28802 pH measurement". For normal measurement, two of standard solutions with a pH of 4, 7, and 9 are sufficient to accurately calibrate the meter.
For standard solutions, refer to "JIS Z 8802 pH measurement".

pH 4 standard solution ..... 0.05 mol/L potassium hydrogen phthalate aqueous solution
(Phthalate)
pH 7 standard solution ..... 0.025 mol/L potassium dihydrogenphosphate, 0.025 mol/L sodium phospate aqueous solution
(Neutral phosphate)
pH 9 standard solution ..... 0.01 mol/L tetra-sodium boric acid aqueous solution
(Borate)

pH values of pH standard solutions at various temperatures settings.

Temp. (°C)	pH 4 standard solution Phthalate	pH 7 standard solution Neutral phosphate	pH 9 standard solution Borate
0	4.01	6.98	9.46
5	4.01	6.95	9.39
10	4.00	6.92	9.33
15	4.00	6.90	9.27
20	4.00	6.88	9.22
25	4.01	6.86	9.18
30	4.01	6.85	9.14
35	4.02	6.84	9.10
40	4.03	6.84	9.07
45	4.04	6.84	9.04

4. Supplements for pH measurement

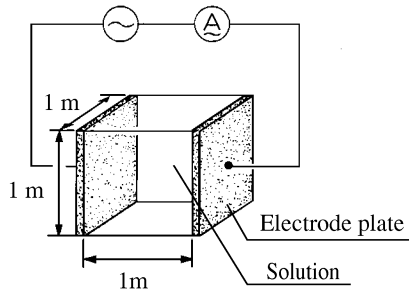
Pressure compensation diaphragm

U-20XD series can measure pH with high accuracy through the pressure compensation diaphragm without being affected by hydraulic pressure. Attention should be paid to the following points so that the diaphragm may function fully.
Before measurement, use a syringe and fill the reference electrode up to the replenish port with the internal solution. When injecting the polarity reference internal solution, be careful that air bubbles do not get into the solution.

● COND measurement

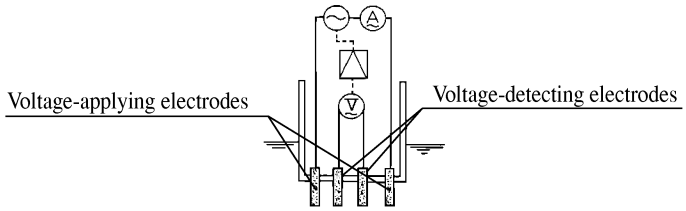
1. Four-AC-electrode method

Conductivity is an index of the flow of electrical current in a substance.
Salts dissolved in water are separated into cations and anions. Such solution is called electrolytic solution. Electrolytic solution has the property of allowing the flow of current according to Ohm's law. This property is referred to as ionic conductivity, since current flow is caused by ion movement in electrolytic solution. Metals, on the other hand, allow the flow of current by means of electrons. This property is called electronic conductivity, which is distinguished from ionic conductivity.
A cube with 1 m on each side, as shown in Fig. 1, is used to demonstrate an electrolytic solution. Two electrode plates are placed on opposite sides, and the cube is filled with a solution. If the resistance between these two electrode plates is represented by r (Ω), the conductivity of the solution L ($S.m^{-1}$) is represented as L=1/r. S stands for Siemens, a unit of measurement of conductance.



(Fig. 1 Definition of conductivity)

The most general method for measuring conductivity is based on the above principle, and is called the 2-electrode method. In the 2-electrode method the influence of polarization cannot be ignored for solutions with high conductivity and conductivity cannot be measure accurately. In addition, contamination on the surface of the electrode increases apparent resistance, resulting in inaccurate measurement of conductivity.
The U-20XD series has adopted the 4-electrode method to overcome these disadvantages of the the 2-electrode method. As shown in Fig. 2, the U-20XD series uses two voltage-detecting electrodes and two voltage-applying electrodes, for a total of four electrodes. The voltage-detecting electrodes are for detecting AC voltage, and the voltage-applying electrodes are for applying AC voltage.



(Fig. 2 Principle of the 4-electrode method)

Let us assume that the current, I (A), flows in a sample of conductivity L – under automatic control of the voltage-applying electrodes – so that the voltage at the voltage detecting-electrodes, E (V), remains constant at all times. Then, the resistance of the sample, R (Ω), across the voltage-detecting electrodes is represented as R=E/I. The resistance, R, of the sample is inversely proportional to its conductivity, L. Accordingly, a measurement of conductivity, Is, of a standard solution of known conductivity, Ls, enables calculation of conductivity of a sample according to the formula L = Ls (I/Is) from the ratio L : Ls = I : Is.
Even in the 4-electrode method, polarization occurs, since AC current flows in the voltage-applying electrodes. The voltage-detecting electrodes are, however, free from the effects of polarization, since they are separated from the voltage-applying electrodes, and furthermore, current flow is negligible. Therefore, the 4-electrode method is an excellent method to enable measurement of conductivity covering a very high range.

2. SI units

New measurement units, called SI units, have been in use from 1996. Accordingly, the U-20XD series also uses SI units. The following conversion table is provided for people who use the conventional kind of conductivity meter. Note that along with the change in unit systems, the measurement values and cell counts have also changed.

	Former units	→	SI units
Measurement	0.1 mS/cm	→	0.01 S/m
value	1 mS/cm	→	0.1 S/m
	100 mS/cm	→	10 S/m

3. Temperature coeffcient

In general, the conductivity of a solution varies largely with its temperature. The conductivity of a solution depends on the ionic conductivity, described earlier. As the temperature rises, conductivity becomes higher since the movement of the ions becomes more active. The temperature coefficient shows the change in % of conductivity per °C, with a certain temperature taken as the reference temperature. This is expressed in units of %/°C. The temperature coefficient assumes the premise that the conductivity of a sample changes linearly according to temperature. Strictly speaking, with actual samples, however, conductivity changes along a curve. Furthermore, the cuve varies with the type of sample. In the ranges of smaller temperature changes, however, samples are said to have the temperature coefficient of 2 %/°C (at reference tempreture 25 °C) this holds for most samples, except in certain special cases.
(The temperature coefficients for various types of solutions are listed on the next page.)
The U-20XD series uses an automatic temperature conversion function to calculate conductivity at 25 °C at a temperature coefficient of 2 %/°C, based on the measured value of the temperature. Results are displayed on the readout.
The U-20XD series's temperature conversion function is based on the following formula.

$$L_{25} = L_t / \{ 1 + K (t - 25) \}$$

L_{25} : Conductivity of solution converted to 25 °C
(value displayed on U-20XD series)
t : Temperature of solution at time of measurement (°C)
L_t : Conductivity of solution at t (°C)
K : Temperature coeffcient (%/°C)

Conductivity and temperature coefficient for various types of solutions

Conductivity and related temperature coefficients of representative substances (at 25 °C) are shown in the table below.

Substance	Concentra -tion wt%	Conducti -vity S/m	Temperature coeffcient %/°C	Tempera -ture °C
NaOH	5	19.69	2.01	15
	10	31.24	2.17	
	15	34.63	2.49	
	20	32.70	2.99	
KOH	25.2	54.03	2.09	15
	29.4	54.34	2.21	
	33.6	52.21	2.36	
	42	42.12	2.83	
NH_3	0.1	0.0251	2.46	15
	1.6	0.0867	2.38	
	4.01	0.1095	2.50	
	8.03	0.1038	2.62	
HCl	5	39.48	1.58	18
	10	63.2	1.56	
	20	76.15	1.54	
	30	66.20	1.54	
H_2SO_4	5	20.85	1.21	18
	10	39.15	1.28	
	20	65.27	1.45	
	40	68.00	1.78	
	50	54.05	1.93	
	60	37.26	2.13	
	100.14	1.87	0.30	
HNO_3	6.2	31.23	1.47	18
	12.4	54.18	1.42	
	31	78.19	1.39	
	49.6	63.41	1.57	
H_3PO_4	10	5.68	1.04	15
	20	11.29	1.14	
	40	20.70	1.50	
	45	20.87	1.61	
	50	20.73	1.74	
NaCl	5	6.72	2.17	18
	10	12.11	2.14	
	15	16.42	2.12	
	20	19.57	2.16	
	25	21.5	2.27	

Substance	Concentra -tion wt%	Conducti -vity S/m	Temperature coeffcient %/°C	Tempera -ture °C
Na_2SO_4	5	4.09	2.36	18
	10	6.87	2.49	
	15	8.86	2.56	
Na_2CO_3	5	4.56	2.52	18
	10	7.05	2.71	
	15	8.36	2.94	
KCl	5	6.90	2.01	18
	10	13.59	1.88	
	15	20.20	1.79	
	20	26.77	1.68	
	21	28.10	1.66	
KBr	5	4.65	2.06	15
	10	9.28	1.94	
	20	19.07	1.77	
KCN	3.25	5.07	2.07	15
	6.5	10.26	1.93	
NH_4Cl	5	9.18	1.98	18
	10	17.76	1.86	
	15	25.86	1.71	
	20	33.65	1.61	
	25	40.25	1.54	
NH_4NO_3	5	5.90	2.03	15
	10	11.17	1.94	
	30	28.41	1.68	
	50	36.22	1.56	
$CuSO_4$	2.5	10.90	2.13	18
	5	18.90	2.16	
	10	32.00	2.18	
	15	42.10	2.31	
CH_3COOH	10	15.26	1.69	18
	15	16.19	1.74	
	20	16.05	1.79	
	30	14.01	1.86	
	40	10.81	1.96	
	60	4.56	2.06	

● SAL conversion

The U-20XD series is designed to measure salinity as well as the other parameters.
Note that the "salinity" referred to here is the salinity of sea water. There is a constant relation between conductivity and salinity at certain temperatures.
Therefore, if data on the conductivity and temperature are available, the corresponding salinity is known. In other words, the salinity measurement of the U-20XD series is based on the principle of calculating the salt content, making use of the measured values of conductivity and temperature.
Note therefore, that measured results of all substances whose conductivity is detected are displayed as salinity. For example, the measured result is displayed as NaCl concentration, even if in fact the sample component is, for example, hydrochloric acid (HCl).

● TDS conversion

TDS is short for Total Dissolved Solids and means the total dissolved solid amount.
The conductivity of a solution is affected by the amount of salinity, minerals, and dissolved gases. That is, conductivity is an index that shows the total amount of all substances in the solution. Of these substances, TDS indicates only the amount of dissolved solids.
TDS can be used for a comparison of the state of substances composed of a single component such as NaCl. However, the use of TDS for the comparison of solutions of different types causes serious errors.
Conductivity and TDS are expressed by the following formulas:

Conductivity in SI units (S/m) ..... TDS(g/L) = L (S/m) × K × 10
TDS(g/L) = L (mS/m) × K ÷ 100
Conductivity in the old units (mS/cm) ..... TDS(g/L) = L (mS/cm) × K
K = TDS coefficient

Initial settings use the values listed in the table (☞ Page 70) that generally uses TDS coefficients.
For accurate TDS comparisons, find the TDS coefficient from measured conductivity values. Then set the value thus obtained and make measurements.

● σ_t conversion

Specific gravity of seawater

The density and specific gravity of seawater are equal numerically and generally are not distinguished strictly. Since seawater density ρ is between 1.000 and 1.031, 1 is subtracted from ρ and σ is obtained by multiplying the value by 1000.
The resultant value is used as the specific gravity of seawater.

$$\sigma = (\rho - 1) \times 1000$$

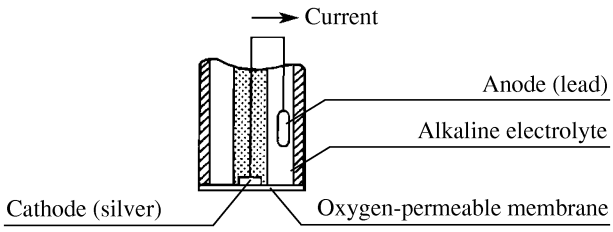
The density of seawater ρ is expressed by temperature, hydraulic pressure, and salinity functions. The density of seawater σ under the atmospheric pressure is expressed as σ_t. The density of seawater under the atmospheric pressure is determined by temperature and salinity.
The U-20XD series models make salinity measurement through temperature measurements and conductivity conversion and find σ_t through calculations.
In Japan σ_{15} at 15 °C is called a standard specific gravity and widely used while in foreign countries σ_0 at 0 °C is employed. σ_{15} and σ_0 are determined by the function of salinity.
In ocean surveys, in particular, these values σ_t, σ_{15}, and σ_0 are more widely used than conductivity and salinity and, in the U-20XD series models, newly added as measurement components.

● DO measurement

1. Principle of measurement

The "DO" referred to here means the concentration of oxygen dissolved in water. DO is essential to self-purification of river and sea and to water creatures such as fish. DO measurement is also essential to drainage and water quality control.

Fig. 3 shows the principle of measurement using a DO sensor.



(Fig. 3 Principle of DO sensor)

A noble metal (silver) is fitted closely to an oxygen-permeable membrane to make the cathode; a base metal (lead) is used as the anode. Both are immersed in an alkaline electrolyte with the anode-to-cathode external circuit closed. Oxygen diffusing through the oxygen-permeable membrane causes a reduction reaction at the cathode; this allows flow of current in the external circuit:

$$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$$

At the anode, oxidation reaction occur as follows:

$$2Pb \rightarrow 2Pb2^+ + 4e^-$$

The current is proportional to the quantity of oxygen diffusing through the oxygen-permeable membrane. Accordingly, measurement of the current makes the DO in a sample known.

The DO measuring method based on this principle is called the membrane-electrode method. This method allows convenient measurement of DO, especially when compared with chemical-analysis method, which needs complicated pre-treatment to eliminate the effects of oxidizing or reducing substances.

2. DO correction for salinity

When a solution and air are in contact and in complete equilibrium (saturated), DO: C [mg/L] in the solution, and the oxygen partial-pressure: Ps [MPa] in air are in the following relation:

$$C = Ps/H$$

H [MPa/ (mg/L)] is referred to as Henry's constant, which depends on the composition of the solution. In general, C becomes smaller as the salinity in the solution increases, since H becomes larger.

A DO sensor is intended to detect Ps in the above expression. Therefore, the DO measurement would be in error if the DO sensor were immersed either in air-saturated pure water or in solution with salt. To settle this problem, it is necessary to correct the DO reading based on the salinity of the sample using salinity correction.

Conventional DO meters make this salinity correction by inputting a known salinity value. This poses no problems if the salinity of the sample is known. In general, however, the salinity of the sample is usually not known, and the method is not practical even if the DO meters are equipped with the salinity correction function.

The U-20XD series is capable of measuring the salinity of a sample and automatically correcting the using this function.

3. Features of the U-20XD series DO sensors

In conventional DO measurements, it was necessary to keep the velocity of the flow constant because the velocity of flow led to fluctuation in indicated values. In our U-20XD series models, improvements in sensors have made it possible to make measurements with stable indications and with little influence of the velocity of flow.

● Turbidity (TURB) measurement

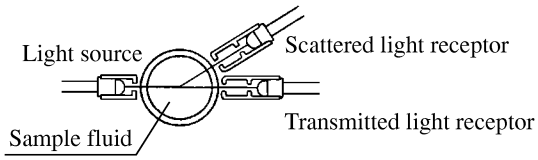
1. Principle of measurement

From among several types of turbidity-measuring methods available, the U-20XD series uses the light-transmission-scattering method, shown in Fig. 4.

Irradiation of a beam of light onto a sample brings about separation of the beam into (1) the light transmitted through the solution and (2) the light scattered by turbidity components in the sample. In the light-transmission-scattering method, the intensity of both transmitted light and the scattered light are measured using separate receptors, and the turbidity is obtained based on the ratio of the two.

With the U-20XD series, the light source is a pulse-lighting infrared-emission diode. The scattered light is measured at a point 60° offset from the light source. This light-absorption-scattering method has several advantages, including the fact that (1) the actual color of the sample fluid has little effect on the measurement of turbidity, (2) fluctuations in light quantity from the light source are easily compensated for, and (3) it allow the U-20XD series to be operated with relatively low-power consumption.

The turbidity value differs with the structure of the cell so changes with the instrument.



(Fig. 4 Principle of the light-transmission-scattering method)

2. Standard solution

U-20XD series can perform calibration using formazin (NTU) or kaolin standard solutions as a turbidity standard solution. However, units for the solution used for calibration should be displayed in measurements. Do not use more than 400 mg/L of kaolin standard solution because it increases precipitation speed, resulting in measurement error.

● DEP measurement

1. Depth (DEP) measurement

For the U-22XD model, depth measurement can be made through use of a pressure gauge. The principle of the depth measurement uses the relation between depth and pressure.

Although the measurement with the depth sensor is affected by atmospheric pressure, the depth sensor, however, makes zero-point adjustments through the automatic calibration before measurements.

2. Influence of temperature and calibration

The depth sensor depends greatly on temperature. For a wide difference between the temperature at which the sensor has been automatically calibrated and the temperature of the measurement sample, the sensor can make depth measurements with a higher accuracy by the following method:

Immerse the depth sensor of the sensor probe into the sample.

Keep the sensor immersed in the sample for approximately 30 minutes until the temperatures of the sensor and the sample are the same.

Then make the zero calibration of the sensor manually. (☞ Page 57)

● Measuring mV (oxidation-reduction potential (ORP))

ORP principles

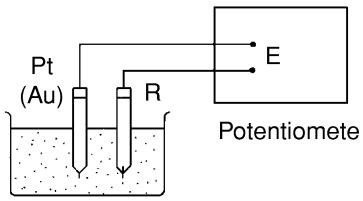
ORP (or "redox potential") is an abbreviation for oxidation-reduction potential. ORP is the energy level (potential) determined according to the state of equilibrium between the oxidants (M^{Z+}) and reductants $M^{(Z-N)+}$) that coexist within a solution.

$M^{z+} + ne^- \Leftrightarrow M^{(z-n)+}$.....①

If only ① exists within a solution, a metal electrode (platinum, gold, etc.) and a reference electrode are inserted into the solution, forming the ORP measuring system shown in Fig. 5. Measuring the potential (ORP) that exists between the two electrodes enables the potential to generally be expressed by the following equation.

$$E = E_0 - \frac{RT}{nF} \ ln \ \frac{a_M{}^{(z-n)+}}{a_M{}^{z+}} \text{ ..... ②}$$

E: Electric potential E_0 : Constant R : Gas constant T : Absolute temperature
n : Electron count F : Faraday constant a : Activity



(Fig. 5 Measuring mV)

For example, for a solution in which trivalent iron ions coexist with bivalent iron ions, equations ① and ② would be as follows.

$Fe^{3+} + e^- \Leftrightarrow Fe^{2+}$.....①

$$E = E_0 - \frac{RT}{F} \ ln \ \frac{a_{Fe}{}^{2+}}{a_{Fe}{}^{3+}} \text{ .....②}$$

When only one type of state of equilibrium 1 exists in the solution, the ORP of the solution can be determined uniquely by equation 2. What is important here is that ORP is determined by the ratio of activity between the oxidant (Fe^{3+}) and the reductant (Fe^{2+}) (using the equation $a_{Fe}{}^{2+}/a_{Fe}{}^{3+}$). Actually, however many kinds of states of equilibrium exist simultaneously between various kinds of ions, in most solutions. This means that under actual circumstances, ORP cannot be expressed using the simple equation shown above and that the physical and chemical significance with respect to the solution is not very clear.

In this respect, the value of ORP must be understood to be only one indicator of the property of a solution. The measurement of ORP is widely used, however, as an important index in the analysis of solutions (potentiametric titration) and in the disposal and treatment of solutions.

Recently, there have appeared various claims regarding this matter, such as that a high degree of ORP is effective in sterilization or that drinking water that has a low ORP reduces the chance of illness by reacting with the activated oxygen in the cells of the body. ORP is used as an index for alkaline drinking water.

Standard electrode (reference electrode) types and ORP

The ORP of a solution that is obtained through measurement is a value that corresponds to the reference electrode employed.
If different kinds of reference electrodes are used for measurement, the ORP value of the same solution may appear to be different. HORIBA uses Ag/AgCl with 3.33 mol/L KCl as the reference solution for reference electrodes. According to general technical literature, standard hydrogen electrodes (N.H.E.) are often used as the standard electrode.
The relationship between N.H.E. and the ORP that is measured using an Ag/AgCl with 3.33 mol/L KCl electrode is expressed by the following equation.

$E_{N.H.E.} = E + 206 - 0.7\,(t - 25)\text{mV} \qquad t = 0 - 60\,℃$

$E_{N.H.E.}$: Measured ORP value using N.H.E. as the reference electrode

E: Measured ORP value using Ag/AgCl with 3.33 mol/L KCl as the reference electrode

Potential sign

Standard ORP is expressed in the following way, in literature related to electrochemistry and analytical chemistry.

A $Li^{+} + e^{-} \rightarrow Li$

E0=-3.024 V VS N.H.E.

However, in some literature, the "+" and "-" signs are reversed.

B $Li \rightarrow Li^{+} + e^{-}$

E0=+3.024 V VS N.H.E.

In expressions like B, above, the reaction is just reversed and there is no essential difference. But this kind of expression does invite confusion. The majority of the world, today, is consistent in its use of the signs as they are used in A, above. For this reason, HORIBA, too, uses signs concerning ORP that are consistent with A, above.

表 3

For any question regarding this product,
please contact your local agency,
or inquire from the Customer Registration
website (www.horiba.co.jp/register).

HORIBA, Ltd.

First edition: November 2001
CODE : I1000908000

ATTACHMENT 3

LOW-FLOW GROUNDWATER SAMPLING PROCEDURES

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ATTACHMENT 4

GROUNDWATER MONITORING FORMS

GROUNDWATER SAMPLING FORM # _____

Site Location_____ **Well ID**_____

Project Number_____ **Well Type** ☐ Monitoring ☐ Extraction ☐ Probe

Weather_____ **Well Material** ☐ PVC ☐ Stainless Steel ☐ Steel

Field Crew_____ **Date**_____

_____ **Sample Time**_____

PURGE VOLUME

Casing Diameter

☐ 2-inch ☐ 4-inch ☐ 6-inch ☐ 8-inch ☐ Other_____

Total Depth of Casing (TD in feet BTOC)_____. Water Level Depth (WL in feet BTOC)_____.

Screen Interval (feet BTOC) from_____ to _____.

Purge Volume (gal) = Total Well Depth (ft) - Depth to Water (ft) x gallon/feet of casing = Casing Volume (gal) X No. of Volumes

(1 1/2" = 0.092, 2" = 0.163, 4" = 0.653)

PURGE METHOD

Bailer Type: ☐ Teflon ☐ Stainless Steel ☐ Other_____

Pump Type: ☐ Peristaltic ☐ Submersible ☐ Centrifugal ☐ Other_____

PURGE TIME **PURGE VOLUME** **PURGE RATE**

Start _____Stop_____Elapsed_____minutes _____gallons Flow Rate_____gpm

FIELD PARAMETER MEASUREMENTS

Time	Volume (gallons)	pH (+/- 0.1 pH units)	Temperature (+/- 0.2 C)	Conductivity (+/- 3 %)	DO (+/- 0.1mg/L or 10 %)	REDOX (+/ 10 mV)	Turbidity (+/ 10% NTU)	Depth to Water

Color: ☐ Clear ☐ Amber ☐ Tan ☐ Brown ☐ Gray ☐ Milky White ☐ Other_____

Odor: ☐ None ☐ Low ☐ Medium ☐ High ☐ Very Strong ☐ Sulfur ☐ Hydrocarbon ☐ Other_____

Turbidity: ☐ Clear ☐ Low ☐ Medium ☐ High ☐ Very Turbid ☐ Other_____

SAMPLING METHOD

Bailer - Type: ☐ Teflon ☐ Stainless Steel ☐ Disposable ☐ Other _____

Pump - Type: ☐ Peristaltic ☐ Submersible ☐ Centrifugal ☐ Other_____

SAMPLE INFORMATION

Sample ID	Number of Sample Containers/ Volume	Analysis	Preservative	Lab	QA/QC	COMMENTS

Purge Water Disposal ☐ Ft Wainwright IDW Disposal Facility ☐ Other_____

GROUNDWATER SAMPLING FORM # _____

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ATTACHMENT 5

RL AND QC ACCEPTANCE CRITERIA

EPA Method SW8260B
EPA Method SW8270C

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RLs and QC Acceptance Criteria for Method SW8260B Water

Method	Analyte	Reporting Limit (ug/L)	Control Limits (% R)	Precision Water (% RPD)
SW8260B (water)	Dichlorodifluoromethane	1.0	67–161	≤ 20
	Chloromethane	1.0	60–150	≤ 20
	Vinyl Chloride	1.0	64–149	≤ 20
	Bromomethane	3.0	53–141	≤ 20
	Acetone	10	40-135	≤ 20
	Chloroethane	1.0	62-152	≤ 20
	Trichlorofluoromethane	1.0	57-129	≤ 20
	1,1-Dichloroethene	1.0	68-130	≤ 20
	Methylene Chloride	5.0	78-128	≤ 20
	Carbon Disulfide	2.0	57-146	≤ 20
	Trans-1,2-Dichloroethene	1.0	83-124	≤ 20
	1,1-Dichloroethane	1.0	85-125	≤ 20
	2,2-Dichloropropane	1.0	70-135	≤ 20
	cis-1,2-Dichloroethene	1.0	87-114	≤ 20
	2-Butanone	10	75-133	≤ 20
	Bromochloromethane	1.0	87-126	≤ 20
	Chloroform	1.0	89-117	≤ 20
	1,1,1-Trichloroethane	1.0	82-120	≤ 20
	Carbon Tetrachloride	1.0	83-130	≤ 20
	1,1-Dichloropropene	1.0	87-123	≤ 20
	Benzene	0.4	88-117	≤ 20
	1,2-Dichloroethane	1.0	82-122	≤ 20
	Trichloroethene	1.0	72-119	≤ 20
	1,2-Dichloropropane	1.0	89-116	≤ 20
	Dibromomethane	1.0	89-119	≤ 20
	Bromodichloromethane	0.5	86-112	≤ 20
	cis-1,3-Dichloropropene	0.5	90-122	≤ 20
	Toluene	1.0	87-115	≤ 20
	Trans-1,3-Dichloropropene	1.0	85-119	≤ 20
	1,1,2-Trichloroethane	1.0	84-114	≤ 20
	Tetrachloroethene	1.0	85-123	≤ 20
	1,3-Dichloropropane	0.4	86-118	≤ 20
	Dibromochloromethane	0.5	88-119	≤ 20
	1,2-Dibromoethane	1.0	86-119	≤ 20
	Chlorobenzene	0.5	89-115	≤ 20
	1,1,1,2-Tetrachloroethane	0.5	90-116	≤ 20

RLs and QC Acceptance Criteria for Method SW8260B Water (continued)

Method	Analyte	Reporting Limit (µg/L)	Control Limits (% R)	Precision Water (% RPD)
SW8260B (water)	Ethylbenzene	1.0	88-118	≤ 20
	p & m-Xylene	2.0	83-119	≤ 20
	o-Xylene	1.0	89-116	≤ 20
	Styrene	1.0	91-116	≤ 20
	Bromoform	1.0	81-126	≤ 20
	Isopropylbenzene	1.0	90-118	≤ 20
	Bromobenzene	1.0	87-117	≤ 20
	1,1,2,2,-Tetrachloroethane	1.0	63-128	≤ 20
	1,2,3-Trichloropropane	1.0	73-124	≤ 20
	n-Propylbenzene	1.0	86-121	≤ 20
	2-Chlorotoluene	1.0	86-116	≤ 20
	4-Chlorotoluene	1.0	86-116	≤ 20
	1,3,5-Trimethylbenzene	1.0	87-118	≤ 20
	tert-Butylbenzene	1.0	86-121	≤ 20
	1,2,4-Trimethylbenzene	1.0	87-117	≤ 20
	sec-Butylbenzene	1.0	88-124	≤ 20
	1,3-Dichlorobenzene	1.0	88-116	≤ 20
	1,4-Dichlorobenzene	0.5	88-120	≤ 20
	1,2-Dichlorobenzene	1.0	86-114	≤ 20
	n-Butylbenzene	1.0	85-122	≤ 20
	1,2-Dibromo-3-chloropropane	2.0	76-121	≤ 20
	1,2,4-Trichlorobenzene	1.0	84-125	≤ 20
	Hexachlorobutadiene	1.0	67-131	≤ 20
	Naphthalene	2.0	75-131	≤ 20
	1,2,3-Trichlorobenzene	1.0	84-128	≤ 20
	4-Methyl-2-pentanone	10	81-134	≤ 20
	2-Hexanone	10	74-127	≤ 20
	Methyl Iodide	1.0	67-137	≤ 20
	Vinyl acetate	1.0	20-125	≤ 20
	Acrylonitrile	10	84-118	≤ 20
	Trans 1,4-Dichloro-butene	1.0	78-144	≤ 20
	Methyl-tert-butyl ether	5.0	86-116	≤ 20
	Surrogates			
	4-Bromofluorobenzene		78-124	
	1,2-Dichloroethane-D4		72-119	
	Dibromofluormethane		85-115	
	Toluene-d8		84-113	

RLs/QC Acceptance Criteria for Method SW8270C Water

Method	Analyte	Reporting limits (µg/L)	Accuracy Water (% R)	Precision Water (% RPD)
SW8270C (water)	2-Methylphenol	20	50-87	≤ 30
	3&4-Methylpheno	20	50-86	≤ 30
	Hexachlorobutadiene	20	50-94	≤ 30
	2,4-Dinitrotoluene	20	50-122	≤ 30
	Hexachlorobenzene	20	50-114	≤ 30
	Hexachloroethane	20	25-84	≤ 30
	Nitrobenzene	20	40-90	≤ 30
	Pentachlorophenol	140	50-119	≤ 30
	2,4,5-Trichlorophenol	20	50-100	≤ 30
	2,4,6-Trichlorophenol	20	50-101	≤ 30
	N-Nitrosodimethylamine	20	25-73	≤ 30
	N-Nitroso-di-n-prpylamine	20	25-104	≤ 30
	Phenol	10	25-53	≤ 30
	Aniline	20	50-94	≤ 30
	Bis(2-Chloroethyl)ether	20	50-99	≤ 30
	Isophorone	30	50-110	≤ 30
	2-Chlorophenol	20	40-90	≤ 30
	1,3-Dichlorobenzene	20	50-82	≤ 30
	2-Nitrophenol	20	50-90	≤ 30
	2,4-Dimethylphenol	20	50-100	≤ 30
	1,4-Dichlorobenzene	20	50-82	≤ 30
	Benzoic Acid	50	25-63	≤ 30
	1,2-Dichlorobenzene	20	50-84	≤ 30
	bis(2-Chloroisopropyl)ether	20	40-93	≤ 30
	bis(2-Chloroethoxy)methane	30	50-98	≤ 30
	Benzyl alcohol	20	40-87	≤ 30
	2,4-Dichlorophenol	20	50-95	≤ 30
	1,2,4-Trichlorobenzene	30	50-92	≤ 30
	Naphthalene	20	50-86	≤ 30
	4-Chloroaniline	20	50-99	≤ 30
	4-Chloro-3-methylphenol	20	50-104	≤ 30
	2-Methylnaphthalene	30	50-97	≤ 30
	Hexachlorocyclopentadiene	30	50-100	≤ 30
	2-Chloronaphthalene	30	50-101	≤ 30
	2-Nitroaniline	20	50-109	≤ 30
	Dimethylphthalene	20	50-105	≤ 30
	2,6-Dinitrotoluene	20	50-117	≤ 30
	Acenapthylene	20	50-102	≤ 30

RLs/QC Acceptance Criteria for Method SW8270C Water (continued)

Method	Analyte	Reporting limits (µg/L)	Accuracy Water (% R)	Precision Water (% RPD)
SW8270C (water)	3-Nitroaniline	20	50-109	≤ 30
	Acenaphthene	30	50-105	≤ 30
	2,4-Dinitrophenol	180	50-117	≤ 30
	4-Nitrophenol	140	40-100	≤ 30
	Dibenzofuran	20	50-113	≤ 30
	Diethylphthalate	20	50-104	≤ 30
	Fluorene	20	50-102	≤ 30
	4-Chlorophenyl-phenyl ether	20	50-102	≤ 30
	4-Nitroaniline	20	50-109	≤ 30
	2-Methyl-4,6-dinitrophenol	180	50-125	≤ 30
	N-Nitrosodiphenylamine	20	50-111	≤ 30
	Azobenzene	200	50-103	≤ 30
	4-Bromophenyl-phenylether	20	50-102	≤ 30
	Phenanthrene	20	50-115	≤ 30
	Anthracene	20	50-106	≤ 30
	Di-n-butylphthalate	20	50-110	≤ 30
	Fluoranthene	20	50-107	≤ 30
	Pyrene	20	50-121	≤ 30
	Butylbenzylphthalate	20	50-128	≤ 30
	3,3-Dichlorobenzidine	20	50-118	≤ 30
	Benz (a) anthracene	20	50-118	≤ 30
	Chrysene	20	50-120	≤ 30
	Bis(2-Ethylhexyl)phthalate	20	50-136	≤ 30
	di-n-Octylphthalate	20	50-156	≤ 30
	Benzo (b) fluoranthene	20	50-128	≤ 30
	Benzo(k) fluoranthene	30	50-128	≤ 30
	Benzo(a)pyrene	20	50-121	≤ 30
	Dibenzo (a,h) Anthracene	30	50-137	≤ 30
	Indeno (1,2,3-c,d) Pyrene	20	50-136	≤ 30
	Benzo(g,h,I)perylene	30	50-137	≤ 30
	Surrogates:			
	2-Fluorobiphenyl		50-110	
	Terphenyl-d14		50-135	
	2,4,6-Tribromophenol		40-108	
	2-Fluorophenol		40-92	
	Phenol –d8		25-53	
	Nitrobenzene-d5		40-90	

APPENDIX B
SITE-SPECIFIC SAFETY AND HEALTH PLAN

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DRAFT REVISION 1

SITE CHARACTERIZATION AND REMEDIATION

SITE-SPECIFIC SAFETY AND HEALTH PLAN

FORT WAINWRIGHT, ALASKA

CONTRACT NO. W911KB-04-P-0136

Prepared for:

Department of the Army
U.S. Army Corps of Engineers, Alaska District
P.O. Box 6898
Elmendorf AFB, AK 99506-6898

Prepared by:

235 East 8th Avenue, Suite 210
Anchorage AK 99501

June 2005

SITE CHARACTERIZATION AND REMEDIATION

SITE-SPECIFIC SAFETY AND HEALTH PLAN

Fort Wainwright, Alaska

APPROVAL SIGNATURE PAGE

Plan Prepared by: _____ **Date:_____**
David Bates and Gloria Beckman

Plan Approved by: _____ **Date:_____**
Bruce Miller, CIH

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ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Government Industrial Hygienists
APR	air purifying respirator
AS/SVE	Air Sparge/Soil Vapor Extraction
BTEX	benzene, toluene, ethylbenzene, and xylene
CFR	Code of Federal Regulations
CGI	combustible gas indicator
CIH	Certified Industrial Hygienist
CPR	cardiopulmonary resuscitation
1,2-DCA	1,2-dichloroethane
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Office
DRO	diesel range organics
eV	electrovolts
FA-CPR	first aid-cardiopulmonary resuscitation
GFCI	ground faulted circuit protector
GRO	gasoline range organics
HAZWOPER	hazardous waste operations and emergency response
HR	heart rate
HSM	Health and Safety Manager
HTRW	hazardous, toxic and radioactive waste
IDLH	immediately dangerous to life and health
LEL	lower explosive level
lpm	liters per minute
MSDS	material safety data sheet
North Wind	North Wind, Inc.
NSC	National Safety Council
OEL	occupational exposure limit
OM&M	operation, maintenance, and monitoring
OSHA	Occupational Safety and Health Administration
OU2	Operable Unit 2
OVA	organic vapor analysis
PCBs	polychlorinated biphenyls
PCE	tetrachloroethene

ACRONYMS AND ABBREVIATIONS (continued)

PID	photoionization detector
POL	petroleum, oil, and lubricant
PPE	personal protective equipment
ppm	parts per million
ROD	Record of Decision
SAR	supplied-air respirator
SCBA	self contained breathing apparatus
SOP	standard operating procedure
SPCC	Spill Prevention Control Countermeasure Plan
SSHP	Site-Specific Safety and Health Plan
SVOCs	semi-volatile organic compounds
TCE	Trichloroethylene
TSDF	transportation, storage, and disposal facility
USACE	U. S. Army Corps of Engineers
USARGAK	U. S. Army Garrison, Alaska
UST	underground storage tank
VOCs	volatile organic compounds

1.0 INTRODUCTION

The U.S. Army Corps of Engineers, Alaska District (USACE) has tasked North Wind, Inc. (North Wind) with performing a site characterization, assessment, removal and stockpiling of contaminated soil, and groundwater well installation at various locations on Fort Wainwright, Alaska. This project is being performed under Contract No. W911KB-04-P-0136.

North Wind has prepared this Site-Specific Safety and Health Plan (SSHP) to establish guidelines and practices for conducting the fieldwork to ensure the safety and health of field personnel. The SSHP incorporates Standard Operating Procedures (SOPs) in the *North Wind, Inc. Corporate Health and Safety Program Manual*, and requirements from the USACE Safety and Health Requirements Manual, EM 385-1-1, and the USACE Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities, ER 385-1-92, as applicable to the project tasks. Where conflicting requirements may exist within these requirements, the most stringent requirements will be followed. In addition, this SSHP adopts procedures in the project work plans, technical memorandums, and OM&M manuals, as applicable to the tasks under this scope of work.

This signed copy of the final SSHP shall be kept at the project site during field activities and will be amended or revised as project activities or conditions change or when supplemental information becomes available. The Site Safety and Health Officer (Site Manager) will be familiar with the SSHP contents and will be responsible for implementing the SSHP requirements. Prior to commencement of field activities, North Wind personnel and subcontractors must review the SSHP and sign Attachment 1, Employee Sign-Off Form.

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2.0 PROJECT INFORMATION AND DESCRIPTION

This section provides basic project, climatological, and background information.

Table 1 Project Information

Contract Number(s)	W911KB-04-P-0136
Client	U.S. Army Corps of Engineers, Alaska District
Project/Site Name	Delineation and Remediation of Contaminated Soil at Stryker Brigade Cantonment Area
Site Address	Fort Wainwright, Fairbanks, Alaska
North Wind Program Manager	John Ingold
North Wind Office	235 East 8th Ave Suite 210, Anchorage, AK 99501
Date Health and Safety Plan Prepared	October 2004
Dates This Plan Has Been Amended	N/A
Site Access	Pass security checkpoint to get on base
Site Size	Various Locations On Post
Site Topography	Relatively flat
Prevailing Weather	Average monthly temperature and precipitation information is provided below.

Table 2 Average Monthly Climate Data, Fairbanks, Alaska (1961 – 1990)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°F)	-17.8	-14	-1.2	20.1	37.8	49.2	52.2	46.9	36	17.8	-5.2	-14.6
Precipitation (in.)	0.52	0.44	0.35	0.34	0.62	1.3	1.88	1.91	1.04	0.92	0.75	0.85
Source: Greg McCurdy, Western Regional Climate Center, 1997.												

2.1 Site Description and History

Fort Wainwright occupies a 915,000-acre military reservation located west of Fairbanks, Alaska. Fort Wainwright was originally established in 1938 as a cold-weather testing station. The facility was renamed Ladd Army Air Field by the U.S. Army in December 1939. During World War II, it served as a crew-transfer point in the Army Air Corps' lend-lease program. In 1947, the newly established U.S. Air Force took over the facility and renamed it Ladd Air Force Base. It was used as a re-supply and maintenance base for the remote Distant Early Warning Sites and

an experimental station in the Arctic Ocean. In 1961, all base operations were transferred back to the U.S. Army and the base was renamed Fort Wainwright. Currently, primary missions at Fort Wainwright include training of infantry soldiers in the arctic environment, testing of equipment in arctic conditions, preparation of troops for defense of the Pacific Rim, and rapid deployment of troops worldwide. Fort Wainwright includes the main post area, a range complex, and two maneuver areas. On-site industrial activities include use of fixed-wing aircraft, helicopters, and vehicle maintenance and support activities. Figure 1 presents a Project location map of Fort Wainwright.

2.2 North Wind as General/Prime Contractor

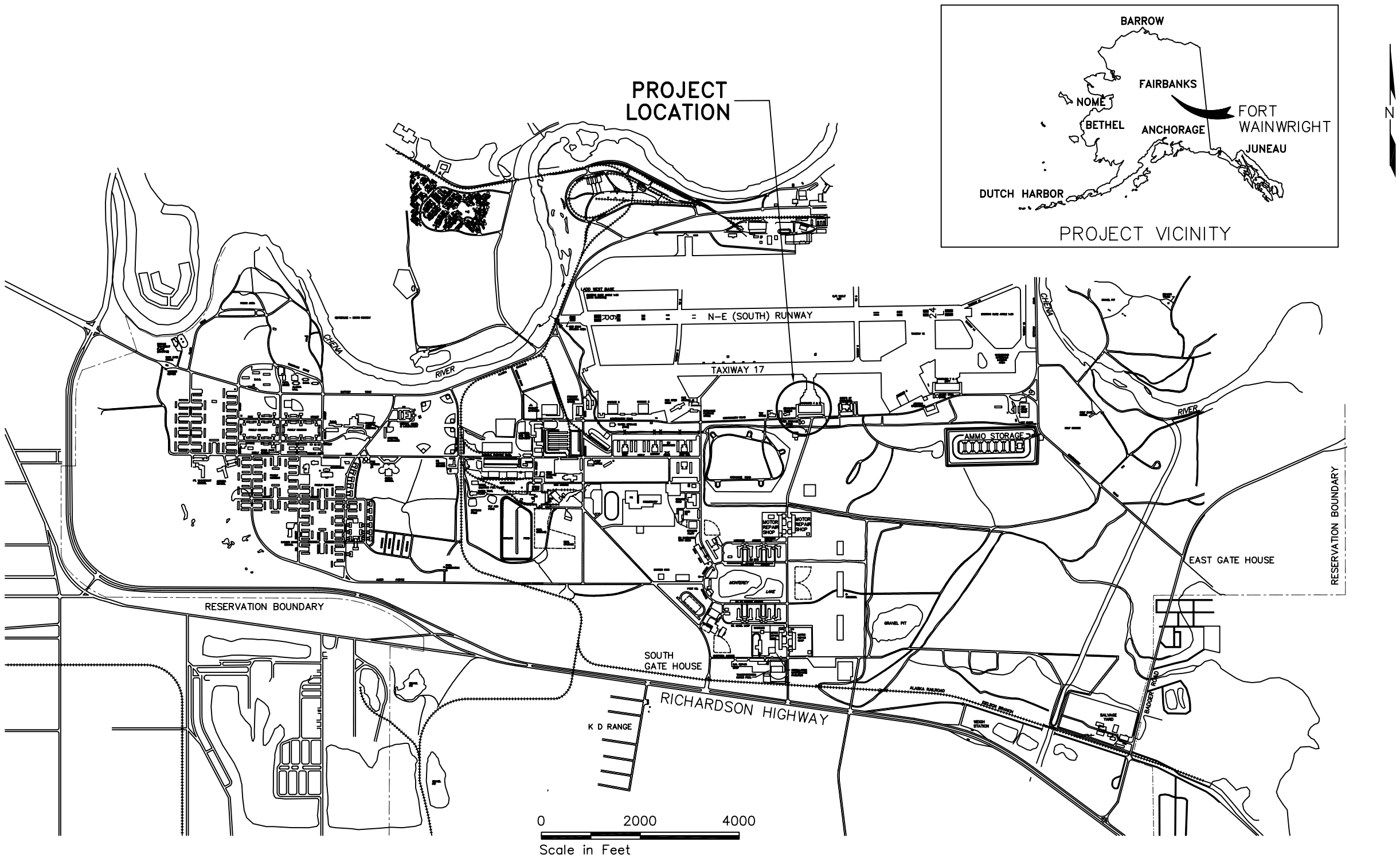
North Wind will function as the general/prime contractor performing oversight during all field activities conducted during this project. The following tasks are included:

- Subsurface soil and groundwater sampling,
- Contaminated soil excavation and stockpiling,
- Excavation-bottom soil sampling,
- Soil stockpile sampling, and
- Groundwater well installation (permanent and temporary wells)

Where applicable, only personnel trained in hazardous waste operations and emergency response (HAZWOPER) will perform work involved with the activities listed above.

FORT WAINWRIGHT, ALASKA

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, ALASKA DISTRICT
CONTRACT NO. W911KB–04–P–0136



MAP SOURCE: USACE

Figure 1
Project Location Map

SITE-SPECIFIC SAFETY AND HEALTH PLAN
SITE CHARACETIZATION AND REMEDIATION
Fort Wainwright, Alaska June 2004

North Wind
235 E. 8th Avenue, Suite 210
Anchorage, Alaska 99501
(907) 277-5488

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Fieldwork at Fort Wainwright may require additional activities not foreseen under the work plans. In this case, the Site Manager will coordinate new activities with the corporate Site Manager and will address and document the safety and health issues in the tail gate meetings.

Table 3 Activities Associated with Contaminated Soil Delineation and Remediation

Site Activities	Work Tasks
Soil Sampling	♦ Hollow-stem auger drilling ♦ Split-barrel soil sampling ♦ Excavation-bottom soil sampling ♦ Stockpile soil sampling
Groundwater Well installation	♦ Drill rig for 2 inch wells ♦ GeoProbe for temporary wells
Groundwater Sampling	♦ Low flow pump to collect samples and purge well
Soil Excavation and Stockpiling	♦ Excavate contaminated soil with heavy equipment ♦ Stockpile contaminated soil ♦ Install liner/cover on soil stockpiles
Soil Transport	♦ Load/transport contaminated soil to treatment facility
Surveying	♦ Survey soil boring locations

This SSHP contains a health and safety risk analysis for each task. The risk analysis includes task-specific hazard controls and requirements for monitoring and protection. Any tasks added to the project and not included in this plan require an approved amendment or revision to this plan before work on that task begins. Refer to Section 2.4 for procedures related to tasks that do not fall under the scope of 29 CFR 1910.120 HAZWOPER standard.

2.3 HAZWOPER-Regulated Tasks

The following tasks will be conducted under 29 CFR 1910.120 HAZWOPER standard:

- Drilling,
- Soil sampling (bottom-hole, stockpile, and subsurface),
- Soil excavation,
- Soil stockpiling,
- Well installation,
- Groundwater sampling,
- Air monitoring, and
- Surveying

- Investigation-derived waste sampling and disposal;
- Contaminated material loading for off-site disposal; and
- Oversight of remediation and restoration activities.

2.4 Non-HAZWOPER-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of 29 CFR 1910.120 HAZWOPER are exempt. To meet this exemption, it must be demonstrated that personnel performing tasks will not be exposed to or potentially exposed to contaminants from the site above the applicable occupational exposure limit (OEL). Prior approval from the North Wind HSM is required for tasks where this exemption is to be applied. Table 4 presents identified non-HAZWOPER regulated tasks associated with this scope of work at Fort Wainwright.

Table 4 Non-HAZWOPER Regulated Tasks

TASKS	CONTROLS
♦ Utility Locate/Excavation Clearance ♦ General heavy equipment work (excavation of non-contaminated areas, surface grading, grubbing, etc.) ♦ Non-contaminated waste removal/hauling	♦ Brief on hazards, hazard mitigation and controls, limits of access, and emergency actions and procedures ♦ Posting of HAZWOPER controlled areas as appropriate (refer to Section 8.0 for details) ♦ Sample and monitor of areas to validate contaminant exposure concentrations as appropriate (refer to Section 5.0)

Table 5 Potential Hazards Associated With Delineation and Remediation of Contaminated Soils, Fort Wainwright

Potential Hazards	Drilling	Soil Sampling Bottom-Hole and Stockpile Sampling	Soil Excavation/ Stockpiling	Surveying	Contaminated soil loading and Transport	Restoration Tasks
Noise > 85 dBA	X	X	X		X	X
Electrical	X		X			
Hoisting/rigging and suspended loads	X					
Buried utilities, lines, tanks	X		X			
Slip, trip, fall	X	X		X	X	X
Back strain	X	X			X	X
Excavation entry		X		X		
Trenches / excavations		X	X	X		
Visible lightning	X	X	X	X	X	X
Vehicle traffic	X		X		X	X
Work near leading end or open excavation		X	X	X		X
Struck-by/caught-between/pinch point	X		X		X	X
Flammable/combustible materials/liquids	X		X		X	X
Entanglement	X					
Drilling	X					
Heavy equipment	X		X		X	X
Overhead hazards	X		X	X	X	X

dBA = decibels IDW = investigative derived waste

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3.0 PROJECT ORGANIZATION AND PERSONNEL

3.1 North Wind's Employee Medical Surveillance and Training Program

The employees listed below participate in the North Wind Comprehensive Health and Safety Program and medical surveillance program accordance with 29 CFR 1910.120 requirements. The employees listed below are currently enrolled in the North Wind medical surveillance program. In addition to receiving baseline and annual physical exams, project personnel performing HAZWOPER tasks will be required to have 40-hour initial HAZWOPER training, 3-day supervised HAZWOPER project experience, and 8-hour annual HAZWOPER refresher training. Level D personal protective equipment (PPE) will be worn during all tasks performed. At least one employee designated "first aid- cardiopulmonary resuscitation" (FA-CPR) trained or certified by the American Red Cross, or equivalent must be present during all tasks performed in exclusion or decontamination zones. Certain tasks (e.g., confined-space entry) and contaminants with OSHA substance-specific standards (e.g., lead) require additional training and medical surveillance. These additional training and medical surveillance requirements will be identified and met as applicable to this project prior to initiating field activities. All personnel conducting HAZWOPER tasks must have current fitness for duty form (physician's written opinion) or equivalent issued by a physician stating that they are medically qualified to perform HAZWOPER tasks and listing and restrictions as applicable.

Table 6 North Wind Project Personnel

Employee Name	Office	Responsibility	PPE Requirements
Gloria Beckman	Anchorage	Project Manager	Level D
Dan McGauhey	Fairbanks	Site Safety and Health Officer/Site Management	Level D Site Manager
Joseph Gillespie	Anchorage	Operations Manager/Geologist	Level D
Julie Clark	Anchorage	Field Technician	Level D

3.2 Field Team Chain of Command and Communication Procedures

If events or incidents occur that require notification of client representatives, the individuals listed in Table 7 should be contacted.

Table 7 Client Points of Contact

Name	Title	Agency	Telephone Number
Therese Deardorff	Remedial Program Manager	U.S. Army Garrison, Alaska	(907) 384-2716 or (907) 441-5921
Cristal Fosbrook	Chief, Environmental & Restoration Branch	U.S. Army Garrison, Alaska	(907) 384-3044 or (907) 384-2713
Robert Brock	Project Manager	USACE	(907) 753-5612
Kate Siftar	Chief, Environmental Compliance Division	U.S. Army Garrison, Alaska	(907) 353-6220 or (907) 353-9686

Table 8 presents the North Wind representatives that should be contacted in the event of an emergency.

Table 8 North Wind Points of Contact

Position	Name	Location/Telephone Number
Project Manager	Gloria Beckman	Anchorage (907) 277-5488 or Anchorage (907) 338-9448
Health and Safety Director	Bruce Miller, CIH	Idaho (208) 557-7900 or Idaho (208) 520-4644 (cell)
Site Safety and Health Officer	Dan McGauhey or Designee	Anchorage (907) 277-5488 or Anchorage (907) 441-2543
The Site Manager will contact the North Wind Project Manager and Health and Safety Manger in the vent of any health or safety incident or near miss. In general, the Program Manager will contact the client. The Site Manager will then complete a North Wind Form 520, Incident Report Form.		

Table 9 presents the North Wind subcontractor representatives that should be contacted in the event of an emergency.

Table 9 Subcontractor Points of Contact

Subcontractor	Contact Name	Telephone Number	Service
Hughes Drilling	Bob Hughes	(907) 262-6639	Soil boring
Design Alaska	Eric Gabrielson	(907) 452-1421	Surveying analysis
SGS	Steve Crupi	(907) 562-2343	Laboratory analysis

The subcontractors listed above and those added after the development of this plan are covered by this SSHP and must be provided access to a copy of this SSHP. The USACE must also approve all subcontractors before work begins. However, this plan does not address specific procedures for operating equipment associated with the subcontractor's specialty (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to North Wind for review before fieldwork begins. Subcontractors must comply with the requirements of this SSHP. North Wind's Site Manager will verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). North Wind's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established work procedures.

North Wind will observe subcontractors' safety performance to ensure compliance with this SSHP. Individual subcontractors are responsible for observation of hazards and unsafe practices of their personnel and taking the appropriate corrective action to eliminate or mitigate all hazards. All unsafe acts, conditions, or incidents will be brought to the attention of the North Wind Site Manager, Program Manager, and North Wind SHM. Health and safety related communications with North Wind and their subcontractors should be conducted as follows:

- Brief all project-related North Wind personnel and subcontractors on the provisions of this SSHP. Allow them to read and review the plan and require them to sign the Employee Sign-off Form included in Attachment 1 prior to their beginning work.
- Subcontractors shall brief their project team on the hazards, associated mitigation, and emergency actions related to their work.

- When apparent non-compliant or unsafe conditions or practices are observed, stop work as necessary, then notify the subcontractor safety representative and require corrective action. The subcontractor is responsible for determining and implementing necessary controls and corrective actions.

- When repeat non-compliant or unsafe conditions/acts are observed, stop work as necessary, then notify the subcontractor safety representative and stop the affected work until adequate corrective measures are implemented.

- When an apparent imminent danger exists, immediately stop work and remove all affected employees and subcontractors, notify the subcontractor safety representative, and stop the affected work until adequate corrective measures are implemented. Notify the Program Manager and HSM as appropriate. Also, notify the U.S. Army Garrison, Alaska (USARGAK) representative Point of Contacts as shown in Table 7.

- Document all verbal health and safety related communications in the project field logbook, daily reports, or other records.

4.0 SITE-CONTROL PLAN

4.1 Site-Control Procedures

The Site Manager will be specifically responsible for the following tasks:

- Maintain, at the work site, copies of the Fort Wainwright Spill Prevention Control and Countermeasure (SPCC) Plan, USARGAK 200-1 Regulations, and USARGAK Institutional Controls SOP, and ensure that all personnel are familiar with the requirements of these documents.
- Conduct a site safety briefing before starting field activities or as tasks and site conditions change.
- Discuss the following site safety topics: the Safety and Health Plan; site-specific hazards; work zone locations; personal protective equipment (PPE) requirements; equipment use and safety; special procedures; and emergency actions
- Record attendance at safety briefings in a logbook and document the topics discussed.
- The Site Manager will also conduct initial air monitoring in an appropriate level of protection, then report these results to the HSM to determine to need for upgrading or downgrading PPE as appropriate.
- Conduct periodic inspections of work practices to determine the compliance to and effectiveness of this plan. The Site Manager will note deficiencies, report them to the HSM, and correct the situation or revise the SSHP as deemed appropriate by the HSM.
- Establish support, decontamination, and exclusion zones. Delineate these zones with flags or cones as appropriate. The support zone should be upwind of the decontamination and exclusion zones (where practical). Establish access control at the entry and exit from each work zone.

All personnel will participate in the following site control tasks:

- Post the Occupational Safety and Health Administration (OSHA) job-site poster in a central and conspicuous location.
- Establish on-site communication consisting of the following:
    - Line-of-sight and hand signals;
    - Air or vehicle horn;

- Two-way radio or cellular telephone if available;
- Establish off-site communication; and
- Establish and maintain the "buddy system."

4.2 HAZWOPER Compliance Plan

Certain work activities are covered by the 29 CFR 1910.120 HAZWOPER standard and therefore require personnel training and medical surveillance as described above. Anticipated HAZWOPER tasks (Section 2.4) may occur concurrently with non-HAZWOPER tasks. Non-HAZWOPER-trained personnel will be trained in accordance with all applicable state and federal OSHA requirements and be briefed on the hazards of the co-located HAZWOPER activities as applicable in accordance with 29 Code of Federal Regulations (CFR) 1200, Hazard Communications. The following outline detailed procedures to be followed when approved activities specified in Section 2.0 do not require 24- or 40-hour OSHA training.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors above the applicable OEL before non-HAZWOPER-trained personnel are allowed on the site, or while non-HAZWOPER-trained staff are working in proximity to HAZWOPER activities. Other data (e.g., soil sampling) also must support the no potential for exposure determination. The HSM must approve the interpretation of these data and agree to all non-HAWOPER tasks. Refer to Section 5.0 and Subsection 8.26 for air monitoring and sampling requirements and contaminant data, respectively.

- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used at project/exclusion zone boundaries to ensure that non-HAZWOPER-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.

- Where monitoring confirms a potential for exposureabove an OEL, non-HAZWOPER-trained personnel must be removed from the site until the potential for exposure to health and safety hazards no longer exists.

- When monitoring indicates a potential for exposure above an OEL within a designated area or around a particular operation, the Site Manager must post the exclusion zone and inform non-HAZWOPER-trained personnel of the following:

    - Nature of the existing contamination and its locations;
    - Limitations to their access; and
    - Emergency action plan for the site.

5.0 AIR MONITORING/SAMPLING

The following sections present information on air monitoring and sampling activities to be conducted during installation and operation and maintenance activities.

5.1 Air Monitoring Specifications

Table 10 presents the specific details of the for contaminated soil delineation and remediation air monitoring program.

Table 10 Air Monitoring Program

Instrument	Tasks	Action Levels[a]	PPE Level/Actions to Take	Frequency [b]	Calibration
PID: 10.2 eV or 11.7 eV lamp or equivalent	Drilling, excavation of contaminated soils, sampling contaminated soils, handling and transport of contaminated soils	<10 ppm (all areas other than gasoline contamination areas) <2.5 ppm gasoline contaminated areas	Level D	Initially and periodically during tasks which expose contaminated media.	Daily
		10 -25 ppm non-gasoline contaminated areas 2.5-5 ppm in gasoline contaminated areas	IF Episodic, reposition workers upwind and continue to monitor. IF Sustained, reposition workers upwind. If monitoring continues to show elevated levels, take detector tube sample as described below. If benzene is detected above 2.5 ppm, position air mover[c] to exhaust source from breathing zone, leave area temporarily until level dissipates or don Level C respiratory protection and report results to Program Manager.		

Table 10 Air Monitoring Program (continued)

Instrument	Tasks	Action Levels[a]	PPE Level/Actions to Take	Frequency [b]	Calibration
		>50 ppm non-gasoline contaminated areas	IF Episodic, reposition workers upwind and continue to monitor. IF Sustained, reposition workers upwind. If monitoring continues to show elevated levels, position air mover[c] to exhaust source from breathing zone, leave area temporarily until level dissipates or don Level C respiratory protection and report results to Program Manager.		
Combustible Gas Instrument (CGI): MSA Model 260 or 261 or equivalent	Drilling, excavation of contaminated soils, sampling contaminated soils, handling and transport of contaminated soils	0-10%[d]	No explosion hazard	Periodically during boring or trenching based on elevated PID readings	Daily
		10-25% LEL[d]	Potential explosion hazard		
		>25% LEL[d]	Explosion hazard; evacuate or vent		
Detector Tube: Draeger benzene-specific 0.5/c (0.5-10 ppm range) with pre-tube, or equivalent	For all activities in gasoline areas PID/FID >2.5 ppm in breathing zone sustained for >1 minute	<2.5 ppm in gasoline contaminated areas	Level D	Initially and periodically when PID/FID reads >1 ppm	Not applicable
		>2.5 ppm in gasoline contaminated areas	IF Episodic, reposition workers upwind and continue to monitor. IF Sustained, reposition workers upwind. If monitoring continues to show elevated levels, position air mover[c] to exhaust source from breathing zone, leave area temporarily until level dissipates or don Level C respiratory protection and report results to Program Manager.		

Table 10 Air Monitoring Program (continued)

Instrument	Tasks	Action Levels[a]	PPE Level/Actions to Take	Frequency [b]	Calibration
O_2Meter: MSA Model 260 or 261 or equivalent	Drilling, excavation of contaminated soils, sampling contaminated soils, handling and transport of contaminated soils	>25%c O_2	Explosion hazard; leave area and use mechanical ventilation[c] to force air into area	Periodically during boring or trenching based on elevated PID readings	Daily
		20.9%[d] O_2	Normal O_2		
		<19.5%[d] O_2	O_2 deficient; do not enter area. Use mechanical ventilation to force fresh air into area.		

[a] Action levels apply to sustained measurements in the breathing-zone above background for 1 minute.
[b] The exact frequency of monitoring depends on field conditions and is to be determined by the Site Manager; generally, every 5 to 15 minutes; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., "Breathing Zone/MW-3", "at surface/SB-2", etc.).
[c] If LEL is measured above 10% or O_2 is greater than 25%, then air mover must be rated for explosive atmospheres.
[d] If the measured percent of O_2 is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O_2 action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O_2 action levels are required for confined-space entry (refer to Section 8.20).
CGI = combustible gas indicator, eV = electrovolts, LEL = lower explosive limit, O_2 = oxygen, PID = photoionization detector, ppm = parts per million, SCBA = self contained breathing apparatus

5.2 Calibration Specifications

The air monitoring and sampling equipment calibration procedures are presented in Table 11.

Table 11 Air Monitoring Device Calibration Procedures

(Refer to the respective manufacturer's instructions for proper instrument maintenance procedures)				
Instrument	**Gas**	**Span**	**Reading**	**Method**
PID: Photovac 2020; 10.2 eV bulb	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm regular Tygon tubing
PID: Photovac 2020, 11.7 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	1.5 lpm regular Tygon tubing
RF = Response Factor; CF = Concentration Factor; lpm = liters per minute				

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6.0 PERSONAL PROTECTIVE EQUIPMENT

The personal protective equipment requirements for contaminated soil delineation and remediation activities are presented in Table 12.

Table 12 PPE Specifications

Task	Level[a]	Body	Head	Respirator [b]
General work uniform when no chemical exposure is anticipated	D	Work clothes; safety-toe, steel-shank leather work boots or insulated boots in winter; work gloves	Hardhat [c] Safety glasses Ear protection [d]	None required
All tasks with potential for contact with contaminated media	Modified D	COVERALLS: Uncoated Tyvek® BOOTS: Safety-toe, steel-shank chemical-resistant boots OR safety-toe, steel-shank leather work boots with outer rubber boot covers or insulated boots in winter. GLOVES: Inner surgical-style nitrile glove and outer work glove for material handling tasks.	Hardhat [c] Splash shield [c] Safety glasses Ear protection [d]	None required
All tasks if air monitoring Action Levels in Table 5.1 are exceeded	C	COVERALLS: Polycoated Tyvek® BOOTS: Safety-toe, steel-shank chemical-resistant boots OR steel-toe, steel-shank leather work boots with outer rubber boot covers or insulated boots in winter. GLOVES: Inner chemical-resistant nitrile glove and outer work glove for material handling tasks.	Hardhat [c] Splash shield [c] Ear protection [d] Spectacle inserts	air purifying respirator (APR), half face (full face for benzene exposure above 5 ppm), with combination organic vapor HEPA cartridges[e]

Reasons for Upgrading or Downgrading Level of Protection	
Upgrade[f]	**Downgrade**
Request from individual performing tasks. Change in work tasks that will increase contact or potential contact with hazardous materials. Contaminant of concern exceeds action level. Known or suspected presence of dermal hazards.	New information showing that contaminants have dropped below specified action level. Elimination of specific hazard requiring upgrade. Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. North Wind will provide PPE only to North Wind employees.
[b] No facial hair is permitted that would interfere with respirator face-to-facepiece seal.
[c] Hardhat and splash-shield areas are to be determined by the Site Manager.
[d] Ear protection should be worn when noise levels exceed 85 dBA (e.g., conversations cannot be held at distances of 3 feet or less without shouting).
[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are greater than the midpoint of Level C range (refer to Section 5)--then at least every 4 hours. If encountered conditions are different than those anticipated in this SSHP, contact the HSM for changeout schedule.
[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an Site Manager qualified at that level is present.

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7.0 DECONTAMINATION

The Site Manager must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the Site Manager with coordination from the HSD The Site Manager must ensure that procedures are established for disposing of materials generated on the site.

No eating, drinking, or smoking is permitted in contaminated areas or exclusion or decontamination zones. The Site Manager will establish areas for eating, drinking, and smoking.

7.1 Decontamination Specifications

Table 13 presents the decontamination procedures to be followed during contaminated soil delineation and remediation activities.

Table 13 Decontamination Specifications

Personnel	Sample Equipment	Heavy Equipment
♦ Boot wash/rinse ♦ Glove wash/rinse ♦ Outer-glove removal ♦ Protective clothing removal ♦ Inner-glove removal ♦ Respirator removal (if worn) ♦ Hand wash/rinse (as required) ♦ Face wash/rinse (as required) ♦ Dispose of PPE in municipal trash, or contain for disposal (as specified by facility or project waste management requirements) ♦ Dispose of personnel rinse water to facility or sanitary sewer, or contain for off-site disposal (as specified by facility or project waste management requirements)	♦ Wash/rinse equipment using Alconox® or equivalent detergent and rinse with potable and de-ionized water.	♦ Mechanical cleaning of dirt and debris ♦ Power wash (as required) ♦ Steam clean (as required) ♦ Dispose of equipment rinse water to facility or sanitary sewer, or contain for off-site disposal (as specified by facility or project waste management requirements)

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8.0 HAZARD CONTROLS

This section describes safe work practices and control measures used to reduce or eliminate potential hazards. It is critical that all personnel understand and follow the task-specific requirements of this SSHP. Engineering controls, hazard isolation, specialized work practices, and the use of PPE will all be implemented to eliminate or mitigate all potential hazards and exposures. However, every person on the project site must play their role in the identification and control of hazards. North Wind employees and subcontractors must remain aware of the hazards they face regardless of who is responsible for hazard control. North Wind employees and subcontractors who do not understand any of these provisions should contact the Site Manager for clarification. All applicable requirements of USACE EM 385-1-1, shall be met.

8.1 Project-Specific Hazards - Cranes

- All crane operations shall be conducted in accordance with 29 CFR 1926, Subpart N, Cranes, Derricks, Hoists, Elevators, and Conveyors.
- Only certified crane operators are permitted to operate cranes.
- Perform crane inspections in accordance with the manufacturer's recommendations.
- Complete a site survey prior to staging equipment to identify all potential hazards (e.g. underground vaults, utilities, power pole, powerlines, etc.).
- Maintain minimum 20-foot clearance from overhead power distribution lines.
- Maintain safe distance from operating cranes and stay aware of crane movement. Avoid positioning yourself between fixed objects and operating cranes and crane pinch points; remain outside of the crane swing and turning radius. Never turn your back on operating cranes.
- Approach cranes only after receiving the operator's attention. The operator shall acknowledge your presence and stop movement of the crane. Never approach operating cranes from the side or rear where the operator's vision is compromised.
- When required to work in proximity to operating cranes, wear high-visibility vests to increase visibility to operators. For work performed after daylight hours, vests shall be made of reflective material or include a reflective stripe or panel.

- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel.
- Cranes shall not be used to lift or lower personnel.
- If crane becomes electrically energized, personnel shall be instructed not to touch any part of the crane or attempt to touch any person who may be in contact with the electrical current. Those inside the crane will stay there until the electrical source has been de-energized. The utility company or appropriate party shall be contacted to de-energize the line. No one will approach the crane until it has been de-energized.
- An accessible fire extinguisher of 5BC rating, or higher, shall be available at all operator stations or cabs of equipment.
- Do not exceed hoist load limits.
- Ensure load is level and stable before hoisting.
- Inspect all rigging equipment prior to use. Do not use defective rigging for any reason.
- Only use rigging equipment for the purpose for which it was designed and intended.

8.2 Project-Specific Hazards - Drilling

- Conduct utility locates prior to the start of drilling operations. Obtain and complete the required dig permit from Fort Wainwright Department of Public Works. Maintain completed Fort Wainwright utility locate/dig permit form at work site at all times.
- Complete a site survey prior to staging equipment to identify all potential hazards (e.g. underground vaults, utility, power pole, powerlines, etc.).
- Only authorized qualified personnel are permitted to operate drill rigs.
- Open boreholes will be covered or barricaded.
- Verify that rig mast will not enter the 20-foot minimum clearance for overhead power distribution lines when mast is raised or rotated to facilitate directional well installation.
- Stay clear of areas surrounding drill rigs during every startup.
- Stay clear of the rotating augers and other rotating components of drill rigs.

- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel.

- Do not wear loose-fitting clothing or items such as rings or watches that could get caught in moving parts. Long hair should be restrained. Drilling personnel will be aware of body position during all material handling tasks.

- If equipment becomes electrically energized, personnel shall be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party shall be contacted to have the line de-energized. No one will approach the equipment until it is de-energized.

- Drilling platforms and working surfaces will be kept clean of slip hazards and clear of tripping hazards.

- Steel-toed boots, hearing protection and eye protection should be worn during drilling/driving operations.

- Smoking around drilling operations is prohibited.

8.3 Project-Specific Hazards - Lockout/Tagout

- All lockout/tagout activities shall meet the requirements of 29 CFR 1910.147, The Control of Hazardous Energy (lockout/tagout).

- Do not work on equipment when unexpected operation could result in injury, unless lockout/tagout procedures are implemented.

- Staff working under a lockout/tagout procedure must have completed the North Wind Lockout/Tagout training course. Project-specific training may also be required on site-specific lockout/tagout procedures.

- Standard lockout/tagout procedures include the following six steps:

  1. Notify all personnel in the affected area of the lockout/tagout.
  2. Shut down the equipment using normal operating controls.
  3. Isolate all energy sources to the part or equipment to be worked on.
  4. Apply individual lock and tag to each energy-isolating device.
  5. Relieve or restrain all potentially hazardous stored or residual energy.
  6. Verify the isolation and zero energy state of the equipment. Once verified that the equipment is at the zero energy state, work may begin.

- All safeguards must be put back in place, all affected personnel notified that lockout/tagout has been removed, and controls positioned in the safe mode prior to lockout/tagout removal.

- Do not remove another person's lock or tag and never relinquish control of the key to your personal lock.

8.4 Project-Specific Hazards - Excavation

- All excavation practices shall meet the requirements of 29 CFR 1926, Subpart P, Excavations.

- Conduct utility locates prior to beginning excavation operations.

- Complete Excavation Clearance Request Form (Attachment Number 4).

- Complete site survey prior to staging equipment to identify all potential hazards (e.g. underground vaults, utilities, power pole, powerlines, etc.).

- Maintain minimum 20-foot clearance from power distribution lines when operating excavation equipment.

- Do not enter the excavations unless completely necessary. Enter only after the competent person has completed the daily inspection, and has authorized entry and verified that all safety requirements have been met.

- Follow all excavation entry requirements established by the competent person.

- Do not enter excavations where protective systems are damaged or unstable.

- Do not enter excavations where objects or structures above the work location may become unstable and fall into the excavation.

- Do not enter excavations with the potential for a hazardous atmosphere until the air has been tested and found to be at safe levels.

- Do not enter excavations with accumulated water unless precautions have been taken to prevent excavation cave-in.

8.5 Project-Specific Hazards - Respiratory Protection

- Respirator users must have completed appropriate respirator training within the past 12 months. Level C training is required for air-purifying respirators (APR) use and Level B training is required for supplied-air respirators (SAR) and self-contained breathing apparatus (SCBA) use.

- Respirator users must complete the respirator medical monitoring protocol and have been approved for the specific type of respirator to be used in accordance with 29 CFR 1910.134.

- Tight-fitting facepiece respirator (negative or positive pressure) users must have passed an appropriate fit test within the past 12 months.

- Respirator use shall be limited to those activities identified in this plan. If changing site conditions alter the effectiveness of the specified respiratory protection, the HSM shall be notified to amend the written plan.

- Tight-fitting facepiece respirator users shall not have facial hair that interferes with the face-to-facepiece seal and will perform positive and negative pressure checks before each use.

- Canisters/cartridges shall be replaced according to the change-out schedule specified in this plan. Respirator users shall notify the Site Manager of any detection of vapor breakthrough or breathing resistance. The Site Manager shall report any breakthrough events to the HSM for schedule upgrade.

- Respirators shall be inspected before each use and during cleaning.

- Respirators in regular use shall be cleaned and disinfected as often as necessary to ensure they are maintained in a clean and sanitary condition.

- Respirators shall be properly stored to protect against contamination and deformation.

- Field repair of respirators shall be limited to routine maintenance. Defective respirators shall be removed from service.

- When breathing air is supplied by cylinder or compressor, the Site Manager shall verify that the air meets Grade D air specifications.

8.6 Project-Specific Hazards - Rigging

- All rigging and rigging practices shall meet the requirements of 29 CFR 1926.251, Rigging Equipment for Material Handling.

- Personnel will not be permitted under any suspended load regardless of the height.

- Inspect all rigging equipment prior to use for kinking, crushing, birdcaging, and corrosion. Do not use defective rigging for any reason.

- Only use rigging equipment for the purpose it was designed, intended and rated.

- Attach rigging to engineered lifting points.
- Hoists shall not be used to lift or lower personnel.
- Do not exceed hoist or rigging load limits. Wire rope safety factor shall be in accordance with ANSI B 30.5-1968 or SAE J959-1966.
- Ensure load is level and stable before hoisting.
- Use taglines to stabilize loads unless doing so will create additional hazards.

8.7 Project-Specific Hazards - Fall Protection

- All fall protection equipment and practices shall meet the requirements of 29 CFR 1926 Subpart M, Fall Protection.
- Fall protection systems must be used to eliminate fall hazards when performing construction activities at a height of 6 feet or greater and when performing general industry activities at a height of 4 feet or greater.
- Staff exposed to fall hazards must have completed a Fall Protection training course and received project-specific fall protection training. Do not use fall protection systems on which you have not been trained.
- The Site Manager must complete the Project Fall Protection Evaluation Form and provide project-specific fall protection training to all staff exposed to fall hazards. The Project Fall Protection Evaluation Form is provided in Attachment 5 of this plan.
- The Site Manager shall act as competent person and shall inspect and oversee the use of fall protection systems. Follow all requirements established by the competent person for the use and limitation of fall protection systems.
- A registered professional engineer shall oversee the use of horizontal lifelines.
- Only one person shall be attached to a vertical lifeline at any given time.
- Remain within the guardrail system when provided. Leaning over or stepping across a guardrail system is not permitted.
- Do not stand on objects (boxes, buckets, bricks, blocks, etc.) or ladders to increase working height on top of platforms protected by guardrails.
- Inspect personal fall arrest systems prior to each use. Do not use damaged fall protection systems at any time or for any reason.

- Set-up personal fall arrest systems so that you can neither free-fall more than 6 feet nor contact any lower level.
- Only attach personal fall arrest systems to anchorage points capable of supporting at least 5,000 pounds.
- Use fall protection equipment for fall protection only and not to hoist materials.
- Do not use personal fall arrest systems that have been subjected to impact loading.
- Notify Site Manager immediately if a fall has taken place.

8.8 Project-Specific Hazards - Energized Electrical

- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Electrical wiring and equipment shall be de-energized prior to conducting work unless it can be demonstrated that de-energizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.
- All electrical systems shall be considered energized until lockout/tagout procedures are implemented.
- The Energized Electrical Work permit provided in Attachment 4 of this plan must be completed prior to working on unprotected energized electrical systems.
- Follow all control measures and procedures identified on the Energized Electrical Work permit.

8.9 General Hazards - General Practices and Housekeeping

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness requires enough illumination intensity to read a newspaper without difficulty.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.

- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- Oil and grease from routine operation and maintenance activities shall be cleaned from walking and working surfaces to reduce slip hazard.
- Areas under construction and where work is being performed shall be fenced to exclude public access and a sign shall be posted with emergency contact names and numbers for both day and night hours.

8.10 General Hazards - Hazard Communication

The Site Manager will perform the following:

- Using the project specific Chemical Product Hazard Communication Form in Attachment 2, complete an inventory of chemicals brought on site.
- Confirm that an inventory of chemicals brought on site by North Wind and/or subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which employees are potentially exposed.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the chemical's identity and hazard warnings. Store all chemicals properly, in accordance with their MSDSs.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

8.11 General Hazards - Shipping and Transportation of Chemical Products

The U.S. Department of Transportation (DOT) may define chemicals brought to the site as hazardous materials. All staff that ship the materials or transport them by road must receive training in shipping dangerous goods in accordance with 49 CFR, Transportation as applicable to project activities and shipping requirements. Trained staff must properly identify, label, pack and document all hazardous materials that are shipped (e.g., via Federal Express) or transported by road. Contact the HSM for additional information.

8.12 General Hazards - Lifting

- Use mechanical lifting aids whenever possible.
- Lifting of materials will be limited to 50 lbs or one-third a person's body weight, whichever is less. If a load exceeds this weight, two people or a mechanical lifting device will be used.
- Proper lifting techniques must be used when lifting any object.
- Plan storage and staging to minimize lifting or carrying distances.
- Split heavy loads into smaller loads.
- Have someone assist with lifting, especially for heavy or awkward loads.
- Make sure the path of travel is clear prior to the lift.

8.13 General Hazards - Fire Prevention

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet. Extinguishers must:
    1. Be maintained in a fully charged and operable condition;
    2. Be visually inspected each month; and
    3. Undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.

- Post “Exit” signs over exiting doors, and post “Fire Extinguisher” signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

8.14 General Hazards - Electrical

- Only authorized qualified personnel are permitted to work on unprotected energized electrical systems.
- Only authorized personnel are permitted to enter high-voltage areas.
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment; remove from service.
- All temporary wiring, including extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:
  1. Equipped with third-wire grounding;
  2. Covered, elevated, or protected from damage when passing through work areas;
  3. Protected from pinching if routed through doorways; and
  4. Not fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated and Underwriters Laboratory approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and

grounded, or where insulating barriers have been installed to prevent physical contact.

- Maintain at least 10 feet from overhead power lines for voltages of 50 kV or less, and 10 feet plus one-half inch for every 1 kV over 50 kV.
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

8.15 General Hazards - Stairways and Ladders

- A stairway or ladder is generally required when a break in elevation of 19 inches or greater exists.
- Personnel should avoid using both hands to carry objects while on stairways. If unavoidable, use extra precautions.
- Personnel must not use pan and skeleton metal stairs until permanent or temporary treads and landings are provided for the full width and depth of each step and landing.
- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Ladders must be used only for the purpose for which they were designed and shall not be loaded beyond their rated capacity.
- Only one person at a time shall climb on or work from an individual ladder.
- User must face the ladder when climbing, keeping belt buckle between side rails.
- Ladders shall not be moved, shifted, or extended while in use.
- User must use both hands to climb and use a rope to raise and lower equipment and materials.
- Straight and extension ladders must be tied off to prevent displacement.
- Ladders that may be displaced by work activities or traffic must be secured or barricaded.
- Portable ladders must extend at least three feet above landing surface.
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder.

- Stepladders are to be used in the fully opened and locked position.
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top or straddle a stepladder.
- Fixed ladders 24 feet in height or taller must be provided with fall protection devices.
- Fall protection should be considered when working from extension, straight, or fixed ladders greater than six feet from lower levels and both hands are needed to perform the work, or when reaching or working outside of the plane of ladder siderails.

8.16 General Hazards - Heat Stress

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers if possible.
- Avoid direct sun whenever possible. Working under direct sun can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the Site Manager to avoid progression of heat-related illness.

Table 14 presents the symptoms and treatment options of heat stress.

Table 14 Symptoms and Treatment of Heat Stress

	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low.	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery is usually prompt and complete.	Use mild drying lotions and powders, and keep skin clean and prevent infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!

Monitoring Heat Stress

These procedures should be considered when the ambient air temperature exceeds 70°F, the relative humidity is greater than 50 percent, or when workers exhibit symptoms of heat stress. The heart rate (HR) should be measured at the radial pulse for 30 seconds, as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 100 beats/minute or 20 beats/minute above resting pulse. If the HR is higher than that, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 100 beats/minute at the beginning of the next rest period, the work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 100 beats/minute, or 20 beats/minute above resting pulse.

8.17 General Hazards - Cold Stress

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate raingear is a must in cool weather.

- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).

- Wind-Chill Index is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.

- NSC Guidelines for Work and Warm-Up Schedules can be used with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.

- Persons who experience initial signs of immersion foot, frostbite or hypothermia should consult the Site Manager to avoid progression of cold-related illness.

- Observe one another for initial signs of cold-related disorders.

- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

Table 15 presents the symptoms and treatment options of cold stress.

Table 15 Symptoms and Treatment of Cold Stress

	Immersion (Trench) Foot	Frostbite	Hypothermia
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm–but **not** hot–water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but **not** coffee or alcohol. Get medical attention.

Table 16 presents information on wind chill factors and associated preventative control measures.

8.18 General Hazards - Compressed Gas Cylinders

- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinder valves must be closed when cylinders are not in use or during transport.
- Cylinders must be secured in an upright position at all times.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.

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Table 16 Combined Wind Chill Table and Work/Rest Controls

Estimated Wind Speed (mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (oF)1											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40 [2]	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
Hazard Category	1	1	2	2	3	4	4	5	5	5	5	5

Based on Table 2 of the American Conference of Government Industrial Hygienists (ACGIH) 1996 TLVs, page 78, taken from U.S. Army Research Institute of Environmental Medicine, Natick, MA.; and from Table 3 TLV Work/Warm-up Schedule for 4-hr shifts (ACGIH 1996 TLVs, page 78, adapted from Occupational Health & Safety Div. Saskatchewan Dept. of Labour

[1]Trenchfoot and immersion foot may occur at any point on this chart.

Equivalent chill temperature requiring dry clothing to maintain core body temperature above 36°C (96.8°F) per cold stress TLV.

[2]Wind Speeds greater than 40 mph have little additional effect.

Hazard Category	Hazard	Work Practice Controls
1	Little Danger in < 1 hr with dry skin.	Project Precautions. Monitor weather and personnel for signs/symptoms.
2	Little Danger in < 1 hr with dry skin. Maximum danger of false sense of security.	75 min max work periods with 2 breaks of 10 min (see TLV Table 3 for additional info).
3	Increasing danger. Danger from freezing of exposed flesh within one minute.	30 min max work periods with 5 breaks of 10 min (see TLV Table 3 for additional info).
4	Danger. Danger from freezing of exposed flesh within one minute.	15 min max work period every hour.
5	Great Danger. Flesh may freeze within 30 seconds.	Operations only under procedures approved by H&S Manager.

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8.19 General Hazards - Procedures for Locating Buried Utilities

Fort Wainwright Utility Mark-Out Service

Name: Vic King, Fort Wainwright Directorate of Public Works

Phone: 907-353-7139

- Complete the installation excavation permit, shown in Attachment 4, for all project sites requiring subsurface work
- Where available, obtain utility diagrams for the facility.
- Review locations of sanitary and storm sewers, electrical conduits, water supply lines, natural gas lines, and fuel tanks and lines.
- Review proposed locations of intrusive work with facility personnel knowledgeable about locations of utilities. Check locations against information from utility mark-out service.
- When uncertain about utility locations, conduct excavation or drilling of the upper depth interval manually.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon).
- When the client or other on-site party is responsible for determining the presence and locations of buried utilities, the Site Manager should confirm that arrangement.

8.20 Biological Hazards and Controls - Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a sting kit if you have had allergic reactions in the past, and inform the Site Manager and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction and seek medical attention if a reaction develops.

8.21 Biological Hazards and Controls - Bloodborne Pathogens

Exposure to bloodborne pathogens may occur when rendering first aid or cardio-pulmonary resuscitation (CPR) or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and personal protective equipment are required. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

8.22 Biological Hazards and Controls - Bears

- Avoid thick brush and other bear habitat.
- Avoid surprising bears; look for signs; make noise (talking, singing, whistling, etc.).
- Avoid crowding bears.
- Avoid attracting bears with food and garbage.
- If bear approaches, make noise and wave arms. Do not run.
- If bear stands on back legs, try backing away slowly. If bear follows, stop immediately.
- If brown bear touches you, fall to the ground and play dead. Lie flat on stomach or roll into a ball with hands behind neck. Do not move until bear is gone. If it returns, play dead again.

8.23 Biological Hazards and Controls - Caribou and Moose

- Remain 100 yards away from caribou and moose.

8.24 Chemical Contaminants of Concern

Numerous previous soil and groundwater investigations have identified and characterized the chemical contaminants of concern for the Fort Wainwright area; however, no sampling has been conducted in the Stryker Brigade Cantonment Area. Table 17 presents contaminants that may be present (based on what has been found in other areas on Fort Wainwright), the media in which they are typically found, and the symptoms and effects of exposure.

Table 17 Contaminants of Concern

(Refer to project files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Benzene	GW: 2,055 µg/L Soil: 3,700 µg/kg	0.5 ppm STEL 2.5 ppm	500 Ca	Eye, nose, skin, and respiratory irritation; headache; nausea; dermatitis; fatigue; giddiness; staggered gait; bone marrow depression	9.24
1,2-Dichloroethane (Ethylene Dichloride)	GW: 41 µg/L Soil: 500 µg/kg	10 ppm	50 Ca	CNS depression, nausea, vomiting, dermatitis, eye irritation, liver, kidney, and CNS damage; corneal opacity.	11.05
Diesel fuel oils	GW: 6,410 µg/L Soil: 54,000 mg/kg	Specific to fuel constituent	Specific to fuel constituent	Primary systemic effect is CNS depression. High vapor levels; nausea, confusion, drowsiness, convulsions, and coma. Ingestion: nausea, vomiting, and in severe cases drowsiness progressing to coma. Liquid may cause skin and eye irritation.	NL
Dioxins	Sediment: 1.4 mg/kg of 2,3,7,8-TCDD TEQ	NL	NL Ca	Irritation of eyes, skin, respiratory system, and mucous membranes; nausea; and CNS damage.	NL
Ethylbenzene	GW: 630 µg/L Soil: 31,000 µg /kg	100 ppm	800	Eye, skin, and mucous membrane irritation; headache; dermatitis; narcotic effects; and coma.	8.76
Gasoline	GW: 24,000 µg/L Soil: 5,300 mg /kg	300 ppm	NL	Eye, skin, and mucous membrane irritation. Vapor is a CNS depressant. Low vapor level (500 to 1,000 ppm) exposure: flushing, staggered gait, slurred speech, and mental confusion. High vapor level (>5,000 ppm) exposure: coma or death from respiratory failure. Ingestion and aspiration: chemical pneumonitis, pulmonary edema and hemorrhage, and kidney damage.	NL
PCBs	Sediment: 9.8 µg /kg of 4.4´-DDD	0.5 mg/m^3	5 Ca	Eye and skin irritation, acne-form dermatitis, liver damage, reproductive effects.	UK
Trichloroethene	GW: 0.43 mg/L Soil: 130 µg/kg	100 ppm	1,000 ppm Ca	Eye and skin irritation, headache, vertigo, visual disturbance, fatigue, giddiness, tremors, somnolence, nausea, vomiting, dermatitis, cardiac arrhythmias, paresthesia, and liver injury.	9.45

Table 17 Contaminants of Concern (Continued)

Contaminant	Location and Maximum[a] Concentration	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Toluene	GW: 7,105 µg/L Soil: 91,000 µg /kg	50 ppm	500	Eye and nose irritation, fatigue, weakness, confusion, dizziness, headache, dilated pupils, excessive tearing, nervousness, muscle fatigue, paresthesia, dermatitis, liver and kidney damage.	8.82
Xylenes	GW: 3,200 µg/L Soil: 220,000 µg/L	100 ppm	900	Irritated eyes, skin, nose, throat; dizziness; excitement; drowsiness; incoherence; staggering gait; corneal vacuolation; anorexia; nausea; vomiting; abdominal pain; and dermatitis.	8.56

Potential Routes of Exposure		
Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.	**Inhalation**: Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.	**Other**: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water).
[b] Appropriate value of PEL, REL, or TLV listed.
[c] IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.
[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown. CNS = Central Nervous System

9.0 SPILL CONTAINMENT PROCEDURES

This section covers established practices for the prevention, discovery, containment, and reporting of spills of petroleum, oil, and lubricants (POL) as required by Title 40, CFR Part 112; and as specifically described in the Fort Wainwright SPCC Plan, included as Attachment 8 to this SSHP.

North Wind, including its subcontractors, will not store petroleum fuel on-site for contaminated soil delineation and remediation activities during this project. Fuel required for construction equipment will be delivered and dispensed by a local civilian fuel distributor.

North Wind employees and its subcontractors shall be made aware of the SPCC Plan (do , and it will be the guiding document in case a fuel spill should occur in the area under North Wind's jurisdiction.

9.1 Potential Spill Sites

Section 3.0 of the SPCC Plan identifies sites on Fort Wainwright where the potential for spills exists. The potential for spills during contaminated soil delineation and remediation activities will be during fueling of construction equipment from a contracted fuel tanker.

9.2 Spill Prevention Procedures

If equipment fueling occurs while North Wind HAZWOPER-trained personnel are on-site they will monitor the event to ensure it follows those procedures in the SPCC Plan, Section 4, that apply, and that fueling takes place in the designated area.

9.3 Spill Countermeasures

In the event of a fuel spill at a site under North Wind's jurisdiction, the procedures of the SPCC Plan, Section 6, will be strictly followed. These include discovery, notification and reporting, response, cleanup, and disposal of recovered material.

Spill reporting procedures must be carefully followed to ensure notification and involvement of all appropriate agencies and personnel. The notification and reporting procedures outlined in Section 6, including the Figures 6-1, 6-2, and 6-3, will be completed in order. In addition, notification will be made to those persons listed in Table 7 Client Points of Contact, on page 14 of this plan.

10.0 EMERGENCY RESPONSE PLAN

10.1 Pre-Emergency Planning

The Site Manager performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with North Wind's on-site parties, the facility, and local emergency-service providers as appropriate. To prepare the emergency plan, the Site Manager will perform the following:

- Review the facility emergency and contingency plans where applicable;
- Determine what on-site communication equipment is available (e.g., two-way radio, air horn);
- Determine what off-site communication equipment is needed (e.g., nearest telephone, cell phone);
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital. He or she will communicate this information to on-site personnel.
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, on-site operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving the route to the hospital.
- Brief new workers on the emergency response plan.

The SSHO will evaluate emergency response actions and initiate appropriate follow-up actions.

10.2 Emergency Equipment and Supplies

The Site Manager should mark the locations of emergency equipment as listed on Table 18 on the site map and post the map.

Table 18 Emergency Equipment and Supplies

Emergency Equipment and Supplies	Location
10-pound fire extinguisher (A:B:C classes)	Support zone/heavy equipment
First aid kit	Support zone/field vehicle
Eye wash	Support & decon zone/field vehicle
Potable water	Support & decon zone/field vehicle
Bloodborne-pathogen kit	Support zone/field vehicle

10.3 Incident Response

During fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down work operations and evacuate the immediate work area;
- Notify appropriate response personnel;
- Account for personnel at the designated assembly area(s); and
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled. Following control, all incidents shall be reported to the Program Manager, Client, and Fort Wainwright points of contact as listed in Table 7.

10.4 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to North Wind Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured

person is reluctant to accept medical treatment, contact the North Wind medical consultant. During non-emergencies, follow these procedures as appropriate:

- Notify appropriate emergency response authorities.
- The Site Manager will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Trained personnel in first aid and CPR administer first aid (voluntary basis).
- Get medical attention for the injured person immediately.
- Perform decontamination where feasible, but lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a North Wind matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 10.7.

10.5 Evacuation

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.
- The Site Manager will designate evacuation route(s) and assembly area(s) before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The Site Manager and a “buddy” will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The Site Manager will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The Site Manager will write up the incident as soon as possible after it occurs and submit a report to the North Wind Program Manager and SHD.

10.6 Evacuation Signals

Table 19 presents the evacuation signals that should be used during normal work activities and emergency situations.

Table 19 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of air/vehicle horn	Emergency; leave site now.

10.7 Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the Program Manager and HSM.
- For North Wind work-related injuries or illnesses, contact and help the Human Resources administrator complete a North Wind Incident Report Form (attachment 4). The form must be completed within 24 hours of the incident.
- For North Wind's subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to North Wind Human Resources director.
- Notify and submit reports to client as required by the applicable contract.

11.0 APPROVAL

This SSHP has been written for use by North Wind only. North Wind claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

11.1 Original Plan

Table 20 SSHP Authors

	Name	Date
Written By:	David Bates	September 2004
Approved By:	Bruce Miller, CIH	September 2004

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NORTH WIND, INC.

SAFETY AND HEALTH PLAN

ATTACHMENT 1

EMPLOYEE SIGNOFF FORM—FIELD SAFETY INSTRUCTIONS

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EMPLOYEE SIGNOFF FORM
FIELD SAFETY INSTRUCTIONS

Health and Safety Plan

The North Wind project employees and subcontractors listed below have been provided a copy of this SSHP for review and as a resource, have read and understood it, and agree to abide by its provisions.

Project Name:	**Project Number:**

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

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NORTH WIND, INC.

SAFETY AND HEALTH PLAN

ATTACHMENT 2

PROJECT SPECIFIC CHEMICAL PRODUCT HAZARD COMMUNICATION FORM

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PROJECT-SPECIFIC CHEMICAL PRODUCT HAZARD COMMUNICATION FORM

Site Specific Safety and Health Plan

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the Site Manager shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to North Wind and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name:	**Project Number:**

MSDSs will be maintained on-site in a field copy of the SSHP.

HAZARDOUS CHEMICAL PRODUCTS INVENTORY

Chemical	Quantity	Location	MSDS Available	Container Labels	
				Identity	Hazard
Methane	1 liter, compressed	Support Zone	Y		
Isobutylene	1 liter, compressed	Support Zone	Y		
Pentane	1 liter, compressed	Support Zone	Y		
Hydrochloric acid	< 500 ml	Support Zone/sample bottles	Y		
Nitric acid	< 500 ml	Support Zone/sample bottles	Y		
Sulfuric Acid	< 500 ml	Support Zone/sample bottles	Y		
Sodium hydroxide	< 500 ml	Support Zone/sample bottles	Y		
Methanol	< 1 Gallon	Support/Decon Zones	Y		
Alconox/Liquinox	< 1liter	Support/Decon Zones	Y		

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NORTH WIND, INC.

SAFETY AND HEALTH PLAN

ATTACHMENT 3

EMERGENCY CONTACTS

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EMERGENCY CONTACTS

Safety and Health Plan

North Wind, Inc.
24-Hour Emergency Telephone Numbers
Day (907)277-5488 — Night (907)338-9448

Project Name: Ft. Wainwright Soils Management	**Project Number:** 2316
Medical/Fire/Spill Emergency : 911	**Local Occupational Physician**: None
Security & Police – 8-911 353-7889 (non-emergency)	**North Wind's Manager for Health and Safety** Name: Bruce Miller/ID Phone: (208) 528-8718 Cell: (208) 520-4644 24-hour emergency beeper: (208) 520-4644
Utilities Emergency Water: Charles Davenport, 353-7139 Gas: Charles Davenport, 353-7139 Electric: Charles Davenport, 353-7139	**Health and Safety Manager (HSM)** Name: Bruce Miller/ID Phone: (208) 528-8718 Cell: (208) 520-4644
Site Safety & Health Officer (Site Manager) Name: David Bates or designee Phone: (907) 277-5488	**Corporate Human Resources Department** Name: Tara Gartrell Phone: (208) 557-7912
Program Manager Name: John Ingold Phone: (907) 277-5488 Cell: (907) 242-1877	**Worker's Compensation and Auto Claims** Initial Claims: Tara Gartrell Phone: (208) 557-7912 After hours: (208) 522-7953 Report fatalities AND report vehicular accidents involving pedestrians, motorcycles, or more than two cars.
Federal Express Dangerous Goods Shipping Phone: (800) 238-5355 **North Wind Emergency Number for Shipping Dangerous Goods** Phone: (208) 528-8718	**Worker's Compensation and Auto Claims** Fremont industrial Indemnity Phone: (907) 762-6700 Report fatalities AND report vehicular accidents involving pedestrians, motorcycles, or more than two cars.
Contact the Program Manager. Generally, the Program Manager will contact relevant government agencies.	
Facility Alarms: -NA	**Evacuation Assembly Area(s):** Onsite and offsite assembly points will be designated before work begins
Facility/Site Evacuation Route(s): Evacuation routes will be designated by the Site Manager before work begins.	
Hospital Name/Address: Bassett Army Hospital	**Hospital Phone #: 911** 353-5143 (Non-emergency)
Directions to Hospital: Figure 5 on the following page presents routes to Bassett Army Hospital.	

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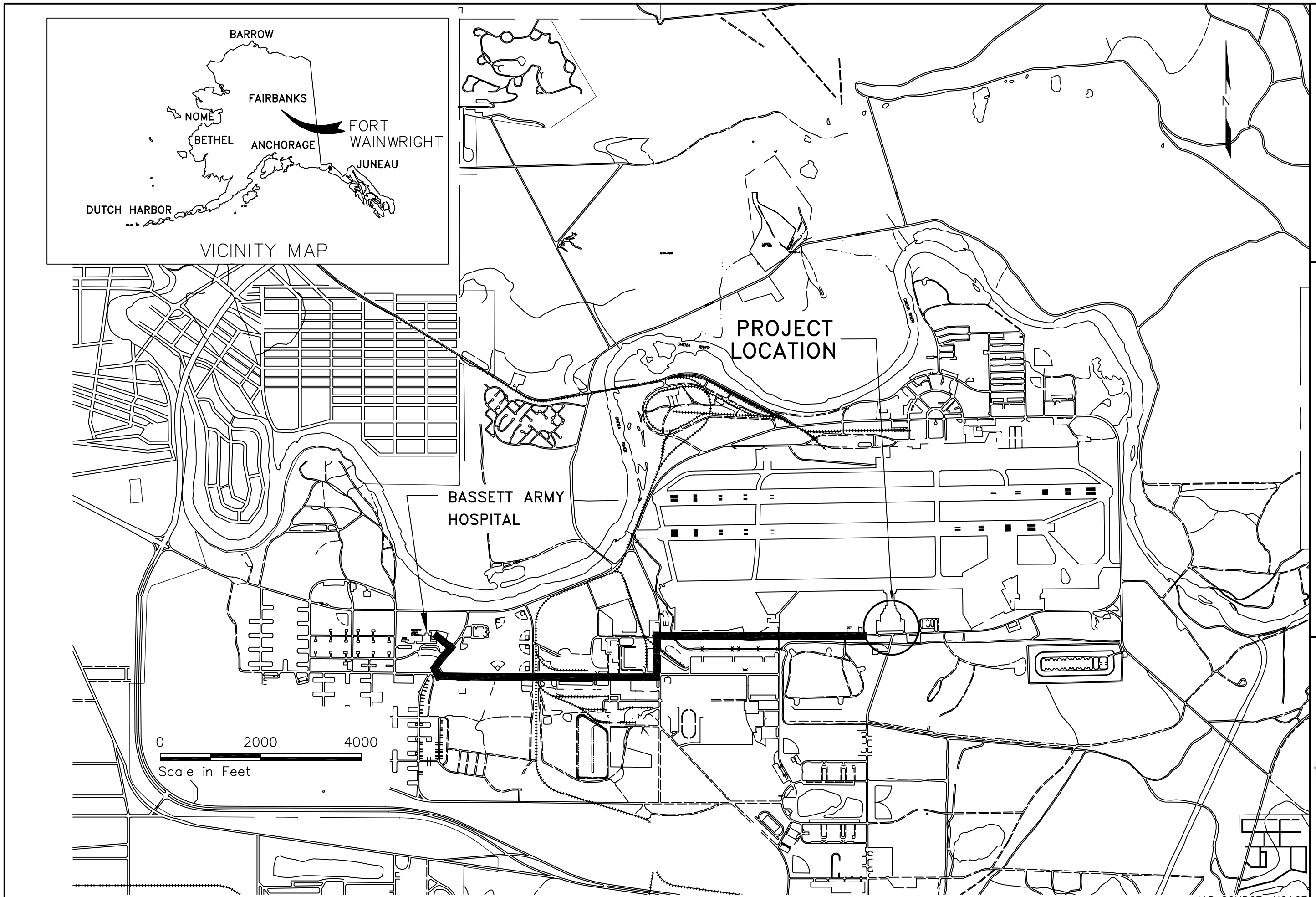

Figure 2
Hospital Evacuation Route Map

DRAFT SITE SPECIFIC SAFETY AND HEALTH PLAN
SITE CHARACTERIZATION AND REMEDIATION
Fort Wainwright, Alaska June 2005

North Wind
235 E. 8th Avenue, Suite 210
Anchorage, Alaska 99501
(907) 277-5488

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NORTH WIND, INC.

SAFETY AND HEALTH PLAN

ATTACHMENT 4

PROJECT HEALTH & SAFETY FORMS AND PERMITS

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ENERGIZED ELECTRICAL WORK PERMIT

Site Specific Safety and Health Plan

Energized electrical parts to which an employee may be exposed shall be de-energized before being worked on or near, unless deenergizing the parts introduce additional or increased hazards or is infeasible due to equipment design or operational limitations. In such cases, this permit must be used to assess the specific hazards and provide measures to control the hazards. This permit is intended to be used for specific equipment/tasks and should not be used in a generic manner.

PROJECT/TASK INFORMATION	
Project Name:	Project Number:
Date task to start:	Estimated duration of work:
Description of task:	

EQUIPMENT INFORMATION		
Describe reasons why electrical parts cannot be de-energized:		
Describe the construction and operations of the equipment:		
Does this equipment have a disconnect?	Yes	No
Location:		
Describe the hazards involved with this work activity:		

CONTROL MEASURES (provide required equipment and application)
Personal protective equipment:
Isolation and shielding materials:
Insulated tools:
Testing equipment:

PROCEDURES		
A step-by-step work procedure has been created for the work to be done?	Yes	No

Attach procedure to permit. The following individuals have reviewed, understood and agreed to abide by the provisions of the step-by-step procedure and this permit. North Wind employees also have successfully completed the General Electrical Safety Training in the Basic Program.

Name	Signature	Date

APPROVALS		
	Signature	Date
Client/Owner of Equipment		
North Wind Program Manager		
Health and Safety Manager		

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NORTH WIND, INC.

SAFETY AND HEALTH PLAN

ATTACHMENT 5

PROJECT FALL PROTECTION EVALUATION FORM

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PROJECT FALL PROTECTION EVALUATION FORM

Site Specific Safety and Health Plan

This form is to be completed by North Wind's project Site Manager prior to performing activities that expose North Wind's personnel to fall hazards.

The form is used to: 1) identify project fall hazards and determine fall protection systems available to mitigate the hazards, 2) identify personal fall arrest system equipment required, and 3) provide project-specific fall protection training. Activities and work locations must be evaluated to determine potential fall hazards. If personnel are exposed to fall hazards greater than 6' during construction activities or 4' during general industry activities, fall protection systems must be used.

PROJECT INFORMATION

Project Name:	Project Number:	Date:
Scope of Work:		
Work Area:		Maximum Working Height:
Describe Fall Hazard Activities:		

FALL HAZARD DETERMINATION & FALL PROTECTION SYSTEMS

		CONVENTIONAL SYSTEMS				ALTERNATIVE SYSTEMS				
Fall Hazard		Guard Rail	Safety Net	PFAS	Cover	Positioning Device	Warning Line	Controlled Access Zone	Safety Monitoring	Fall Protection Plan
	Unprotected sides and edges									
	Leading edges									
	Holes									
	Wall openings									
	Ramps, runways and walkways									
	Hoist areas									
	Excavations									
	Wells, pits and shafts									
	Dangerous equipment									
	Formwork and reinforcing steel work									
	Precast concrete erection									
	Overhand bricklaying									
	Low-slope roofing work									
	Steep roof									
	Residential construction									
	Other surfaces									

*Fall protection plans may only be used if conventional systems are determined to be infeasible or would create a greater hazard. Contact HS&E Staff for plan development.

PROJECT FALL PROTECTION EVALUATION FORM (Continued)

Site Specific Safety and Health Plan

	Full body harness		Rope grab		Lanyard, ripstitch		Lifeline, vertical
	Boatswain's chair		Lanyard, standard		Lanyard, self-retracting		Lifeline, self-retracting
	Descent system		Lanyard, shock-absorbing		Lifeline, horizontal		Winch
	Other equipment:						

TRAINING REQUIREMENTS

The Site Manager shall use this form to inform project staff of the potential fall hazards and specific fall protection systems to be used to control the hazards. Site Manager shall instruct staff on the proper use, limitations, and inspection procedures for each fall protection component and system.

Comments:

Site Manager Signature:	Date:

PROJECT FALL PROTECTION EVALUATION FORM
TRAINING SIGNOFF SHEET

Site Specific Safety and Health Plan

Personnel listed below may be exposed to fall hazards on this project and have successfully completed: 1) North Wind's initial fall protection training, and 2) project-specific training on the actual fall protection equipment and systems to be used. Employees agree to abide by the training received.

Project Name:	Project Number:

Site Manager Name:

Employee Name	Office	Training Completed (Site Manager Initials)	
		Initial Program	Project-Specific

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NORTH WIND, INC.

SAFETY AND HEALTH PLAN

ATTACHMENT 6

APPLICABLE MATERIAL SAFETY DATA SHEETS

Diesel Fuels
Gasoline
Benzene
Toluene
Ethylbenzene
Total Xylenes
Trichloroethene
Tetrachloroethene
Polychlorinated biphenyl
Methanol
Alconox Detergent
Isobutylene in air
Combustible Calibration Gas
Fuel Oil
Bentonite
Lead
Mercury

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CORNELL

Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

ALCONOX, DETERGENT 24298-5

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Cornell University does not in any way warrant or imply the applicability, viability or use of this information to any person or for use in any situation.

Section 1 - Product and Company Identification
ALCONOX, DETERGENT 24298-5

Product Identification: ALCONOX, DETERGENT 24298-5
Date of MSDS: 02/09/1989 **Technical Review Date:** 03/05/1991
FSC: 6810 **NIIN: LIIN:** 00N014198
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: ALDRICH CHEMICAL COMPANY
Post Office Box: 355
Manufacturer's Address1:
Manufacturer's Address2: MILWAUKEE, WI 53201
Manufacturer's Country: US
General Information Telephone: 414-273-3850
Emergency Telephone: N/P
Emergency Telephone: N/P
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 60928
Special Project Code: N

Contractor Information

Contractor's Name: ALDRICH CHEMICAL CO INC
Post Office Box: 355
Contractor's Address1: 1001 WEST ST PAUL AVE
Contractor's Address2: MILWAUKEE, WI 53233
Contractor's Telephone: 414-273-3850
Contractor's CAGE: 60928

Section 2 - Compositon/Information on Ingredients
ALCONOX, DETERGENT 24298-5

Ingredient Name: ALCONOX.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: RTECS Code: X
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:

Ozone Depleting Chemical:

Section 3 - Hazards Identification, Including Emergency Overview
ALCONOX, DETERGENT 24298-5

Health Hazards Acute & Chronic: ACUTE: CAUSE EYE AND SKIN IRRITATION. MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.

Signs & Symptoms of Overexposure:
SEE HEALTH HAZARDS.

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route of Entry Indicators:
Inhalation: YES
Skin: NO
Ingestion: NO

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NOT RELEVANT

Section 4 - First Aid Measures
ALCONOX, DETERGENT 24298-5

First Aid:
EYES: IMMEDIATELY FLUSH WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. SKIN: IMMEDIATELY WASH WITH SOAP AND COPIOUS AMOUNTS OF WATER. WASH CONTAMINATED CLOTHING BEFORE REUSE. INHAL: REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. CALL MD. INGEST: CALL MD IMMEDIATELY (FP N).

Section 5 - Fire Fighting Measures
ALCONOX, DETERGENT 24298-5

Fire Fighting Procedures:
WEAR NIOSH/MSHA APPROVED SCBA AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
Unusual Fire or Explosion Hazard:
EMITS TOXIC FUMES UNDER FIRE CONDITIONS.
Extinguishing Media:
WATER SPRAY. CO2, DRY CHEMICAL POWDER, ALCOHOL OR POLYMER FOAM.
Flash Point: Flash Point Text: N/K

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/K
Upper Limit(s): N/K

Section 6 - Accidental Release Measures
ALCONOX, DETERGENT 24298-5

Spill Release Procedures:
WEAR NIOSH/MSHA APPROVED SCBA, RUBBER BOOTS & HEAVY RUBBER GLOVES. SWEEP UP, PLACE IN A BAG AND HOLD FOR WASTE DISPOSAL. AVOID RAISING DUST. VENT AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMP LETE.

Section 7 - Handling and Storage
ALCONOX, DETERGENT 24298-5

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
ALCONOX, DETERGENT 24298-5

Repiratory Protection:
NIOSH/MSHA APPROVED RESPIRATOR.
Ventilation:
MECHANICAL EXHAUST REQUIRED.
Protective Gloves:
RUBBER GLOVES.
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).
Other Protective Equipment: SAFETY SHOWER AND EYE BATH.
Work Hygenic Practices: WASH THOROUGHLY AFTER USE AND BEFORE EATING, DRINKING, SMOKING OR USING SANITARY FACILITIES (FP N).
Supplemental Health & Safety Information: WASTE DISP METH: GENERATE HEAT AND FUMES WHICH CAN BE CONTROLLED BY THE RATE OF ADDITION. OBSERVE ALL FEDERAL, STATE & LOCAL LAWS.

Section 9 - Physical & Chemical Properties
ALCONOX, DETERGENT 24298-5

HCC: N1
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: N/K
Melting/Freezing Point: Melting/Freezing Text: N/K
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: N/K **Vapor Density:** N/K
Percent Volatile Organic Content:
Specific Gravity: N/K
Volatile Organic Content Pounds per Gallon:

pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/K
Solubility in Water: N/K
Appearance and Odor: NONE SPECIFIED BY MANUFACTURER.
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
ALCONOX, DETERGENT 24298-5

Stability Indicator: YES
Materials to Avoid:
STRONG OXIDIZING AGENTS.
Stability Condition to Avoid:
NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:
CO, CO2 & SOX.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT

Section 11 - Toxicological Information
ALCONOX, DETERGENT 24298-5

Toxicological Information:
N/P

Section 12 - Ecological Information
ALCONOX, DETERGENT 24298-5

Ecological Information:
N/P

Section 13 - Disposal Considerations
ALCONOX, DETERGENT 24298-5

Waste Disposal Methods:
SM QTYS: CAUTIOUSLY ADD TO LRG STIRRED EXCESS OF WATER. ADJUST PH TO NEUTRAL, SEPARATE ANY INSOLUBLE SOLIDS/LIQ & PACKAGE THEM FOR HAZ WASTE DISP. FLUSH AQUEOUS SOLN DOWN DRAIN W/PLENTY OF WATER. THE HYDROLYSIS AND NEUT RXN MAY (SEE SUPP DATA)

Section 14 - MSDS Transport Information
ALCONOX, DETERGENT 24298-5

Transport Information:
N/P

Section 15 - Regulatory Information
ALCONOX, DETERGENT 24298-5

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
ALCONOX, DETERGENT 24298-5

Other Information:
N/P

HMIS Transportation Information

Product Identification: ALCONOX, DETERGENT 24298-5
Transporation ID Number: 19427
Responsible Party CAGE: 60928
Date MSDS Prepared: 02/09/1989
Date MSDS Reviewed: 08/13/1991
MFN: 08/13/1991
Submitter: N TN
Status Code: C

Container Information
- **Unit of Issue:** NK
- **Container Quantity:** NK
- **Type of Container:**
- **Net Unit Weight:**

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:
NOT REGULATED FOR TRANSPORTATION

Department of Transportation Information

DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
DOT PSN Code: ZZZ
Symbols: N/R
DOT PSN Modifier:

Hazard Class: N/R
UN ID Number: N/R
DOT Packaging Group: N/R
Label: N/R
Special Provision(s): N/R
Packaging Exception: N/R
Non Bulk Packaging: N/R
Bulk Packaging: N/R
Maximimum Quanity in Passenger Area: N/R
Maximimum Quanity in Cargo Area: N/R
Stow in Vessel Requirements: N/R
Requirements Water/Sp/Other: N/R

IMO Detail Information

IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION
IMO PSN Code: ZZZ
IMO PSN Modifier:
IMDG Page Number: N/R
UN Number: N/R
UN Hazard Class: N/R
IMO Packaging Group: N/R
Subsidiary Risk Label: N/R
EMS Number: N/R
Medical First Aid Guide Number: N/R

IATA Detail Information

IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
IATA PSN Code: ZZZ
IATA PSN Modifier:
IATA UN Id Number: N/R
IATA UN Class: N/R
Subsidiary Risk Class: N/R
UN Packaging Group: N/R
IATA Label: N/R
Packaging Note for Passengers: N/R
Maximum Quantity for Passengers: N/R
Packaging Note for Cargo: N/R
Maximum Quantity for Cargo: N/R
Exceptions: N/R

AFI Detail Information

AFI Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
AFI Symbols:
AFI PSN Code: ZZZ
AFI PSN Modifier:
AFI UN Id Number: N/R
AFI Hazard Class: N/R
AFI Packing Group: N/R
AFI Label: N/R
Special Provisions: N/A
Back Pack Reference: N/A

HAZCOM Label Information

Product Identification: ALCONOX, DETERGENT 24298-5
CAGE: 60928

Assigned Individual: N
Company Name: ALDRICH CHEMICAL CO INC
Company PO Box: 355
Company Street Address1: 1001 WEST ST PAUL AVE
Company Street Address2: MILWAUKEE, WI 53233 US
Health Emergency Telephone:
Label Required Indicator: Y
Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

BENTONITE

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
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Section 1 - Product and Company Identification
BENTONITE

Product Identification: BENTONITE
Date of MSDS: 11/06/1991 **Technical Review Date:** 06/02/1992
FSC: 6850 **NIIN:** 00-263-8640
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: FISHER SCIENTIFIC, CHEMICAL DIV.
Post Office Box: N/K
Manufacturer's Address1: 1 REAGENT LANE
Manufacturer's Address2: FAIR LAWN, NJ 07410
Manufacturer's Country: US
General Information Telephone: 201-796-7100
Emergency Telephone: 201-796-7100 OR 201-796-7523
Emergency Telephone: 201-796-7100 OR 201-796-7523
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 1B464
Special Project Code: N

Item Description

Item Name: DESICCANT,ACTIVATED
Item Manager: S9G
Specification Number: MIL-D-3464E
Type/Grade/Class: TYPE I
Unit of Issue: CN **Quantitative Expression:** 00000000005GL
Unit of Issue Quantity: 1
Type of Container: CAN/PAIL

Contractor Information

Contractor's Name: FISHER SCIENTIFIC CO. CHEMICAL MFG DIV
Contractor's Address1: 1 REAGENT LANE
Contractor's Address2: FAIR LAWN, NJ 07410-2802
Contractor's Telephone: 201-796-7100
Contractor's CAGE: 1B464

Section 2 - Compositon/Information on Ingredients
BENTONITE

Ingredient Name: BENTONITE (AS NUISANCE DUST OR PARTICULATES NOT OTHERWISE REGULATED)
Ingredient CAS Number: 1302-78-9 **Ingredient CAS Code:** M
RTECS Number: CT9450000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:

% High Volume: % High Volume Code:
% Text: 100
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: 15 MG/M3 TOTAL DUST **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 10 MG/M3 TDUST;8990 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
BENTONITE

Health Hazards Acute & Chronic: ACUTE-INHALE:HIGH CONCENTRATIONS OF DUST MAY CAUSE IRRITATION.SKIN:NO ADVERSE EFFECTS.EYE:PARTICLES IN THE EYE MAY CAUSE IRRITATION.ORAL:INGESTION OF LARGE AMOUNTS MAY CAUSE INTESTINAL OBSTRUCTION.CHR ONIC-MAY CAUSE PNEUMOCONIOSIS,CHEST PAIN,COUGH,DYSPNEA,CYANOSIS,FATIGUE & BRONCHITIS.

Signs & Symptoms of Overexposure:
HIGH CONCENTRATIONS OF DUST MAY CAUSE IRRITATION BY INHALATION. PARTICLES IN THE EYE MAY CAUSE IRRITATION. INGESTION OF LARGE AMOUNTS MAY CAUSE INTESTINAL OBSTRUCTION.

Medical Conditions Aggravated by Exposure:
PERSONS WITH PRE-EXISTING RESPIRATORY DISORDERS BE MORE SUSCEPTIBLE TO THE EFFECTS OF THE SUBSTANCE.

LD50 LC50 Mixture: LD50 (INTRAVENOUS, AT) 35 MG/KG

Route of Entry Indicators:
- **Inhalation:** YES
- **Skin:** YES
- **Ingestion:** NO

Carcenogenicity Indicators
- **NTP:** NO
- **IARC:** NO
- **OSHA:** NO

Carcinogenicity Explanation: N/P

Section 4 - First Aid Measures
BENTONITE

First Aid:
GET MEDICAL ATTENTION IF SYMPTOMS PERSIST.SKIN:WASH WITH SOAP & WATER.EYE:FLUSH WITH WATER FOR 15 MINUTES,HOLDING EYELIDS

OPEN.INHALED:REMOVE TO FRESH AIR & PROVIDE OXYGEN/CPR IF NEEDED.ORAL:DO NOT IN DUCE VOMITING.IF VOMITING OCCURS,KEEP HEAD BELOW HIPS DUE TO ASPIRATION HAZARD.TREAT SYMPTOMATICALLY AND SUPPORTIVELY.CALL PHYSICIAN.

Section 5 - Fire Fighting Measures
BENTONITE

Fire Fighting Procedures:
WEAR FULL PROTECTIVE CLOTHING AND NIOSH-APPROVED SELF-CONTAINED BREATHING APPARATUS. MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. AVOID BREATHING VAPOR OR DUST.
Unusual Fire or Explosion Hazard:
NEGLIGIBLE FIRE HAZARD
Extinguishing Media:
WATER SPRAY, CO2, FOAM/DRY CHEMICAL. WATER SPRAY MAY BE USED TO KEEP FIRE EXPOSED CONTAINERS COOL & FLUSH SPILLS AWAY.
Flash Point: Flash Point Text: NONE

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/R
Upper Limit(s): N/R

Section 6 - Accidental Release Measures
BENTONITE

Spill Release Procedures:
USE NIOSH APPROVED DUST MASK/RESPIRATOR & PROTECTIVE GLOVES. SWEEP UP OR VACUUM AND TRANSFER INTO A CONTAINER FOR LATER DISPOSAL OR RECOVERY.

Section 7 - Handling and Storage
BENTONITE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
BENTONITE

Repiratory Protection:
USE NIOSH APPROVED DUST MASK/RESPIRATOR OR SELF-CONTAINED BREATHING APPARATUS.
Ventilation:
GOOD GENERAL VENTILATION IS SUFFICIENT FOR MOST CONDITIONS (10 ROOM VOLUMES PER HOUR).
Protective Gloves:
AS REQUIRED
Eye Protection: DUST-RESISTANT SAFETY GOGGLES

Other Protective Equipment: EYE WASH STATION, QUICK DRENCH SHOWER AND IMPERVIOUS CLOTHING
Work Hygenic Practices: OBSERVE GOOD PERSONAL HYGIENE PRACTICES AND RECOMMENDED PROCEDURES. DO NOT WEAR CONTAMINATED CLOTHING OR FOOTWEAR.
Supplemental Health & Safety Information: N/P

Section 9 - Physical & Chemical Properties
BENTONITE

HCC: N1
NRC/State License Number: N/R
Net Property Weight for Ammo: N/R
Boiling Point: Boiling Point Text: N/R
Melting/Freezing Point: Melting/Freezing Text: UNKNOWN
Decomposition Point: Decomposition Text: UNKNOWN
Vapor Pressure: N/R **Vapor Density:** N/R
Percent Volatile Organic Content:
Specific Gravity: UNKNOWN
Volatile Organic Content Pounds per Gallon:
pH: N/R
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/R
Solubility in Water: INSOLUBLE
Appearance and Odor: VERY FINE, ODORLESS, HYGROSCOPIC, PALE BUFF OR CREAM-COLORED TO GRAYISH POWDER
Percent Volatiles by Volume: N/R
Corrosion Rate: UNKNOWN

Section 10 - Stability & Reactivity Data
BENTONITE

Stability Indicator: YES
Materials to Avoid:
LITHIUM: MOLTEN LITHIUM ATTACKS SILICATES.
Stability Condition to Avoid:
MOISTURE. SWELLS TO APPROXIMATELY TWELVE TIMES ITS VOLUME WHEN ADDED TO WATER.
Hazardous Decomposition Products:
THERMAL DECOMPOSITION MAY RELEASE ACRID SMOKE AND IRRITATING FUMES.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
N/R

Section 11 - Toxicological Information
BENTONITE

Toxicological Information:
N/P

Section 12 - Ecological Information

BENTONITE

Ecological Information:
N/P

Section 13 - Disposal Considerations
BENTONITE

Waste Disposal Methods:
KEEP IN COVERED DRUMS, PENDING DISPOSAL. HANDLE & DISPOSE IN FULL COMPLIANCE WITH ALL APPLICABLE FEDERAL, STATE & LOCAL REGULATIONS.

Section 14 - MSDS Transport Information
BENTONITE

Transport Information:
N/P

Section 15 - Regulatory Information
BENTONITE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
BENTONITE

Other Information:
N/P

HMIS Transportation Information

Product Identification: BENTONITE
Transporation ID Number: 62923
Responsible Party CAGE: 1B464
Date MSDS Prepared: 11/06/1991
Date MSDS Reviewed: 06/02/1992
MFN: 06/02/1992
Submitter: D DG
Status Code: C

Container Information
- **Unit of Issue:** CN
- **Container Quantity:** 1
- **Type of Container:** CAN/PAIL
- **Net Unit Weight:** N/K

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:

Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
DOT PSN Code: ZZZ
Symbols: N/R
DOT PSN Modifier:
Hazard Class: N/R
UN ID Number: N/R
DOT Packaging Group: N/R
Label: N/R
Special Provision(s): N/R
Packaging Exception: N/R
Non Bulk Packaging: N/R
Bulk Packaging: N/R
Maximimum Quanity in Passenger Area: N/R
Maximimum Quanity in Cargo Area: N/R
Stow in Vessel Requirements: N/R
Requirements Water/Sp/Other: N/R

IMO Detail Information

IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION
IMO PSN Code: ZZZ
IMO PSN Modifier:
IMDG Page Number: N/R
UN Number: N/R
UN Hazard Class: N/R
IMO Packaging Group: N/R
Subsidiary Risk Label: N/R
EMS Number: N/R
Medical First Aid Guide Number: N/R

IATA Detail Information

IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
IATA PSN Code: ZZZ
IATA PSN Modifier:
IATA UN Id Number: N/R
IATA UN Class: N/R
Subsidiary Risk Class: N/R
UN Packaging Group: N/R
IATA Label: N/R

Packaging Note for Passengers: N/R
Maximum Quantity for Passengers: N/R
Packaging Note for Cargo: N/R
Maximum Quantity for Cargo: N/R
Exceptions: N/R

AFI Detail Information

AFI Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
AFI Symbols:
AFI PSN Code: ZZZ
AFI PSN Modifier:
AFI UN Id Number: N/R
AFI Hazard Class: N/R
AFI Packing Group: N/R
AFI Label: N/R
Special Provisions: N/A
Back Pack Reference: N/A

HAZCOM Label Information

Product Identification: BENTONITE
CAGE: 1B464
Assigned Individual: N
Company Name: FISHER SCIENTIFIC CO. CHEMICAL MFG DIV
Company PO Box:
Company Street Address1: 1 REAGENT LANE
Company Street Address2: FAIR LAWN, NJ 07410-2802 US
Health Emergency Telephone: 201-796-7100 OR 201-796-7523
Label Required Indicator: Y
Date Label Reviewed: 06/02/1992
Status Code: C
Manufacturer's Label Number: UNKNOWN
Date of Label: 06/02/1992
Year Procured: N/K
Organization Code: F
Chronic Hazard Indicator: N/P
Eye Protection Indicator: YES
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: CAUTION
Health Hazard: Slight
Contact Hazard: Slight
Fire Hazard: None
Reactivity Hazard: None

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Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

BENZENE

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
BENZENE

Product Identification: BENZENE
Date of MSDS: 01/01/1985 **Technical Review Date:** 02/29/1984
FSC: 6810 **NIIN:** 00-973-8588
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: BURDICK & JACKSON LAB (SEE SUP DATA)
Manufacturer's Address1: 1953 S HARVEY STREET
Manufacturer's Address2: MUSKEGON, MI 49442-6101
Manufacturer's Country: US
General Information Telephone: 616-726-3171
Emergency Telephone: 616-726-3171
Emergency Telephone: 616-726-3171
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: BURDI
Special Project Code: N

Item Description

Item Name: BENZENE,ACS
Item Manager:
Specification Number: NK
Type/Grade/Class: NK
Unit of Issue:
Unit of Issue Quantity:
Type of Container: BOTTLE,GLASS

Contractor Information

Contractor's Name: BURDICK & JACKSON, INC.
Contractor's Address1: 1953 S. HARVEY STREET
Contractor's Address2: MUSKEGON, MI 49442
Contractor's Telephone: 616-726-3171
Contractor's CAGE: BURDI

Contractor Information

Contractor's Name: BURDICK AND JACKSON DIV OF BAXTER HEALTHCARE CORP.
Contractor's Address1: 1953 S HARVEY STREET
Contractor's Address2: MUSKEGON, MI 49442-6101
Contractor's Telephone: 616-726-3171, CHEMTREC 800-424-9300
Contractor's CAGE: 2H215

Section 2 - Compositon/Information on Ingredients
BENZENE

Ingredient Name: BENZENE (SARA III)
Ingredient CAS Number: 71-43-2 **Ingredient CAS Code:** M
RTECS Number: CY1400000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:

>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: >90
% Enviromental Weight:
Other REC Limits: N/P
OSHA PEL: 1PPM/5STEL;1910.1028 **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 10 PPM; A2; 9192 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 10 LBS
DOT Reporting Quantity: 10 LBS
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
BENZENE

Health Hazards Acute & Chronic: N/P

Signs & Symptoms of Overexposure:
EYE: IRRIT. VAPOR: DIZZY,NAUSEA,INCOORDINATION,STUPOR,UNCONSCIOUSNESS & CHANGE IN BLOOD COMPOSITION.

Medical Conditions Aggravated by Exposure:
N/P

LD50 LC50 Mixture: N/P

Route of Entry Indicators:
- **Inhalation:** N/P
- **Skin:** N/P
- **Ingestion:** N/P

Carcenogenicity Indicators
- **NTP:** N/P
- **IARC:** N/P
- **OSHA:** N/P

Carcinogenicity Explanation: N/P

Section 4 - First Aid Measures
BENZENE

First Aid:
EYE: FLUSH WITH WATER 15 MIN,GET MED ATTN. INHALATION: REMOVE FROM EXPOSURE,GIVE ARTIFICIAL RESPIRATION IF NEEDED,GET MEDICAL ASSISTANCE.

Section 5 - Fire Fighting Measures
BENZENE

Fire Fighting Procedures:
SELF-CONT BREATH APP,WATER FOG TO COOL EXPOSED CONTAINERS.
Unusual Fire or Explosion Hazard:
BURNS VIGOROUSLY AND EMITS ACID FUMES.
Extinguishing Media:
FOAM,CO*2,DRY CHEMICAL
Flash Point: Flash Point Text: 12F/-11C

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): 1.3
Upper Limit(s): 7.9

Section 6 - Accidental Release Measures
BENZENE

Spill Release Procedures:
PROTECT FROM IGNITION. WEAR SELF CONTAINED BREATHING APPARATUS.

Section 7 - Handling and Storage
BENZENE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
BENZENE

Repiratory Protection:
NIOSH/MSHA APPROVED RESP DEVICE IN ACCORD WITH EXPOSURE OF CONCERN.
Ventilation:
LOCAL/HIGH RATE MECHANICAL
Protective Gloves:
CHEMICAL TYPE
Eye Protection: GOGGLES/FACE MASK
Other Protective Equipment: AS REQUIRED TO PREVENT SKIN CONTACT.
Work Hygenic Practices: N/P
Supplemental Health & Safety Information: MFR CONT: PHILLIPS PETROL CO MFR'S THE RAW MATERIAL,BURDICK & JACKSON LAB. REFINES IT TO DESIRED PCT,SPEC & GRADE. CONTAINER SIZE: 500 ML BOTTLE

Section 9 - Physical & Chemical Properties
BENZENE

HCC: F5

NRC/State License Number: N/A
Net Property Weight for Ammo: N/A
Boiling Point: Boiling Point Text: 176F/80C
Melting/Freezing Point: Melting/Freezing Text: N/A
Decomposition Point: Decomposition Text: N/A
Vapor Pressure: 100 **Vapor Density:** 2.77
Percent Volatile Organic Content:
Specific Gravity: 0.884
Volatile Organic Content Pounds per Gallon:
pH: N/P
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: <1 (ETHYL ETHER)
Solubility in Water: NEGLIGIBLE
Appearance and Odor: COLORLESS LIQUID. AROMATIC HYDROCARBON ODOR
Percent Volatiles by Volume: 100
Corrosion Rate: N/P

Section 10 - Stability & Reactivity Data
BENZENE

Stability Indicator: YES
Materials to Avoid:
STRONG OXIDANTS
Stability Condition to Avoid:
N/P
Hazardous Decomposition Products:
N/P
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
N/P

Section 11 - Toxicological Information
BENZENE

Toxicological Information:
N/P

Section 12 - Ecological Information
BENZENE

Ecological Information:
N/P

Section 13 - Disposal Considerations
BENZENE

Waste Disposal Methods:
BURN UNDER CONTROLLED CONDITIONS. COMPLY WITH LOCAL,STATE AND FEDERAL REGULATIONS.

Section 14 - MSDS Transport Information

BENZENE

Transport Information:
N/P

Section 15 - Regulatory Information
BENZENE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
BENZENE

Other Information:
N/P

HMIS Transportation Information

Product Identification: BENZENE
Transporation ID Number: 95976
Responsible Party CAGE: BURDI
Date MSDS Prepared: 01/01/1985
Date MSDS Reviewed: 09/05/1986
MFN: 09/05/1986
Submitter: N TN
Status Code: C

Container Information
- **Unit of Issue:**
- **Container Quantity:**
- **Type of Container:** BOTTLE,GLASS
- **Net Unit Weight:**

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: BENZENE
DOT PSN Code: BRS
Symbols:
DOT PSN Modifier:
Hazard Class: 3
UN ID Number: UN1114
DOT Packaging Group: II
Label: FLAMMABLE LIQUID
Special Provision(s): B101,T8
Packaging Exception: 150
Non Bulk Packaging: 202
Bulk Packaging: 242
Maximimum Quanity in Passenger Area: 5 L
Maximimum Quanity in Cargo Area: 60 L
Stow in Vessel Requirements: B
Requirements Water/Sp/Other: 40

IMO Detail Information

IMO Proper Shipping Name: BENZENE
IMO PSN Code: BXB
IMO PSN Modifier:
IMDG Page Number: 3185
UN Number: 1114
UN Hazard Class: 3.2
IMO Packaging Group: II
Subsidiary Risk Label: -
EMS Number: 3-03
Medical First Aid Guide Number: 312

IATA Detail Information

IATA Proper Shipping Name: BENZENE
IATA PSN Code: DBA
IATA PSN Modifier:
IATA UN Id Number: 1114
IATA UN Class: 3
Subsidiary Risk Class:
UN Packaging Group: II
IATA Label: FLAMMABLE LIQUID
Packaging Note for Passengers: 305
Maximum Quantity for Passengers: 5L
Packaging Note for Cargo: 307
Maximum Quantity for Cargo: 60L
Exceptions:

AFI Detail Information

AFI Proper Shipping Name: BENZENE
AFI Symbols:
AFI PSN Code: DBA
AFI PSN Modifier:
AFI UN Id Number: UN1114
AFI Hazard Class: 3

AFI Packing Group: II
AFI Label:
Special Provisions: P5
Back Pack Reference: A7.3

HAZCOM Label Information

Product Identification: BENZENE
CAGE: BURDI
Assigned Individual: N
Company Name: BURDICK & JACKSON, INC.
Company PO Box:
Company Street Address1: 1953 S. HARVEY STREET
Company Street Address2: MUSKEGON, MI 49442 US
Health Emergency Telephone: 616-726-3171
Label Required Indicator: Y
Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998
Year Procured: N/K
Organization Code: F
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
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CALIBRATION GAS,2% METHANE IN AIR,456236

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
CALIBRATION GAS,2% METHANE IN AIR,456236

Product Identification: CALIBRATION GAS,2% METHANE IN AIR,456236
Date of MSDS: 03/04/1993 **Technical Review Date:** 11/20/1998
FSC: 6665 **NIIN:** 00-401-8500
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: Y

Manufacturer's Information

Manufacturer's Name: MINE SAFETY APPLIANCES CO
Post Office Box: 426
Manufacturer's Address1:
Manufacturer's Address2: PITTSBURGH, PA 15230
Manufacturer's Country: US
General Information Telephone: 412-967-3000
Emergency Telephone: 412-967-3000
Emergency Telephone: 412-967-3000
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 40912
Special Project Code: N

Item Description

Item Name: CALIBRATION TEST KI
Item Manager: S9G
Specification Number: N/K
Type/Grade/Class: N/K
Unit of Issue: KT
Unit of Issue Quantity: 1
Type of Container: CYLINDER

Contractor Information

Contractor's Name: APPLIANCE PARTS DISTRIBUTOR
Contractor's Address1: UNKNOWN
Contractor's Address2: CROYDON, PA 79020-5406
Contractor's Telephone: 215-785-6282
Contractor's CAGE: 2P336

Contractor Information

Contractor's Name: MINE SAFETY APPLIANCE (REPLACED BY CAGE 55799)
Contractor's Address1: UNKNOWN
Contractor's Address2: PITTSBURGH, PA 15200
Contractor's Telephone: 412-967-3000
Contractor's CAGE: 40912

Contractor Information

Contractor's Name: MINE SAFETY APPLIANCES CO DBA MSA
Contractor's Address1: 3880 MEADOWBROOK RD
Contractor's Address2: MURRYSVILLE, PA 15668-1753
Contractor's Telephone: 724-733-9272
Contractor's CAGE: 55799

Section 2 - Compositon/Information on Ingredients
CALIBRATION GAS,2% METHANE IN AIR,456236

Ingredient Name: AIR, REFRIGERATED LIQUID; AIR COMPRESSED (UN1002, DOT); AIR REFRIGERATED LIQUID (CRYOGENIC LIQUID) (UN1003) (DOT)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: AX5271000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: BALANCE
% Enviromental Weight:
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT ESTABLISHED **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: METHANE
Ingredient CAS Number: 74-82-8 **Ingredient CAS Code:** M
RTECS Number: PA1490000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 2.0
% Enviromental Weight:
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: ASPHYXIANT; 9293 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:

Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
CALIBRATION GAS,2% METHANE IN AIR,456236

Health Hazards Acute & Chronic: ACUTE- METHANE IS A SIMPLE ASPHYXIANT. NO SIGNS OR SYMPTOMS OF EXPOSURE ARE KNOWN FOR 2% METHANE IN AIR. TARGET ORGAN IS LUNG.

Signs & Symptoms of Overexposure:
NOT KNOWN

Medical Conditions Aggravated by Exposure:
NOT KNOWN

LD50 LC50 Mixture: NOT KNOWN

Route of Entry Indicators:
Inhalation: YES
Skin: NO
Ingestion: NO

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: N/P

Section 4 - First Aid Measures
CALIBRATION GAS,2% METHANE IN AIR,456236

First Aid:
FOR INHALATION OVEREXPOSURE REMOVE TO FRESH AIR, PROVIDE CPR/OXYGEN IF NEEDED. GET MEDICAL HELP.

Section 5 - Fire Fighting Measures
CALIBRATION GAS,2% METHANE IN AIR,456236

Fire Fighting Procedures:
EVACUATE ALL PERSONNEL FROM DANGER AREA. IMMEDIATELY DELUGE CONTAINERS WITH WATER SPRAY FROM MAXIMUM DISTANCE UNTIL COOL, THEN MOVE CONTAINERS AWAY IF NO RISK.
Unusual Fire or Explosion Hazard:
GAS UNDER PRESSURE, 115 PSIG AT 70 F. CONTAINERS MAY EXPLODE IN THE HEAT OF FIRE.
Extinguishing Media:
USE WATER FOG, CARBON DIOXIDE, FOAM, OR DRY CHEMICAL FOR SURROUNDING FIRE. THIS CALIBRATION GAS MIXTURE IS NOT FLAMMABL.
Flash Point: Flash Point Text: N/R

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/R
Upper Limit(s): N/R

Section 6 - Accidental Release Measures
CALIBRATION GAS,2% METHANE IN AIR,456236

Spill Release Procedures:
VENTILATE AREA.

Section 7 - Handling and Storage
CALIBRATION GAS,2% METHANE IN AIR,456236

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
CALIBRATION GAS,2% METHANE IN AIR,456236

Repiratory Protection:
DUE TO THE LIMITED AMOUNT OF GAS IN THE CYLINDER AND THE LOW RELEASE RATE EMPLOYED IN INSTRUMENT CALIBRATION, RESPIRATORY PROTECTION IS NOT INDICATED UNDER CONDITIONS OF INTENDED USE.
Ventilation:
MECHANICAL VENTILATION IS SUITABLE.
Protective Gloves:
NO
Eye Protection: SAFETY GLASSES OR GOGGLES RECOMMENDED
Other Protective Equipment: SAFETY SHOES OPTIONAL
Work Hygenic Practices: WASH HANDS THOROUGHLY BEFORE EATING OR DRINKING AND AFTER HANDLING.
Supplemental Health & Safety Information: N/P

Section 9 - Physical & Chemical Properties
CALIBRATION GAS,2% METHANE IN AIR,456236

HCC: G3
NRC/State License Number: N/R
Net Property Weight for Ammo: N/R
Boiling Point: Boiling Point Text: N/R
Melting/Freezing Point: Melting/Freezing Text: N/R
Decomposition Point: Decomposition Text: N/R
Vapor Pressure: N/R **Vapor Density:** <1
Percent Volatile Organic Content:
Specific Gravity: GAS
Volatile Organic Content Pounds per Gallon:
pH: N/R
Volatile Organic Content Grams per Liter:

Viscosity: N/P
Evaporation Weight and Reference: NOT RELEVANT
Solubility in Water: 9ML/100ML @20C CH4
Appearance and Odor: COLORLESS, ODORLESS GAS; COMPRESSED GAS, 115 PSIG AT 70F
Percent Volatiles by Volume: 100
Corrosion Rate: UNKNOWN

Section 10 - Stability & Reactivity Data
CALIBRATION GAS,2% METHANE IN AIR,456236

Stability Indicator: YES
Materials to Avoid:
NONE
Stability Condition to Avoid:
TEMPERATURES ABOVE 120F
Hazardous Decomposition Products:
MAY FORM CARBON MONOXIDE AND CABON DIOXIDE.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT

Section 11 - Toxicological Information
CALIBRATION GAS,2% METHANE IN AIR,456236

Toxicological Information:
N/P

Section 12 - Ecological Information
CALIBRATION GAS,2% METHANE IN AIR,456236

Ecological Information:
N/P

Section 13 - Disposal Considerations
CALIBRATION GAS,2% METHANE IN AIR,456236

Waste Disposal Methods:
DO NOT PUNCTURE OR INCINERATE CYLINDER. BEFORE DISCARDING CYLINDER, SLOWLY RELEASE CONTENTS TO A SAFE EXHAUST.

Section 14 - MSDS Transport Information
CALIBRATION GAS,2% METHANE IN AIR,456236

Transport Information:
N/P

Section 15 - Regulatory Information
CALIBRATION GAS,2% METHANE IN AIR,456236

SARA Title III Information:
N/P
Federal Regulatory Information:

N/P
State Regulatory Information:
N/P

Section 16 - Other Information
CALIBRATION GAS,2% METHANE IN AIR,456236

Other Information:
N/P

HMIS Transportation Information

Product Identification: CALIBRATION GAS,2% METHANE IN AIR,456236
Transporation ID Number: 70674
Responsible Party CAGE: 40912
Date MSDS Prepared: 03/04/1993
Date MSDS Reviewed: 11/20/1998
MFN: 11/20/1998
Submitter: D DG
Status Code: C

Container Information
- **Unit of Issue:** KT
- **Container Quantity:** 1
- **Type of Container:** CYLINDER
- **Net Unit Weight:** 3 L (TS)

Article without MSDS: N
Technical Entry NOS Shipping Number: 2.1% METHANE IN COMPRESSED AIR
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: Y
Review Indicator: Y
Additional Data:
NET WT. 3 L. PRESSURE IS 120 PSIG. MSA PN FOR GAS CYLINDER IS 96329; KIT IS 456236. MAY BE ELIGIBLE FOR LTD QTY IF CONTAINER IS LESS THAN 7.22 IN 3 IAW 173.306(A)(1), PER TECHNICAL SUPPORT. DOES NOT APPLY IF SHIPPED BY AIR.

Department of Transportation Information

DOT Proper Shipping Name: COMPRESSED GASES, N.O.S.
DOT PSN Code: DQQ
Symbols: G
DOT PSN Modifier:
Hazard Class: 2.2
UN ID Number: UN1956

DOT Packaging Group:
Label: NONFLAMMABLE GAS
Special Provision(s): B13
Packaging Exception:
Non Bulk Packaging: 302,305
Bulk Packaging: 314,315
Maximimum Quanity in Passenger Area: 75 KG
Maximimum Quanity in Cargo Area: 150 KG
Stow in Vessel Requirements: A
Requirements Water/Sp/Other:

IMO Detail Information

IMO Proper Shipping Name: COMPRESSED GAS, N.O.S. o
IMO PSN Code: EQH
IMO PSN Modifier:
IMDG Page Number: 2124
UN Number: 1956
UN Hazard Class: 2(2.2)
IMO Packaging Group: -
Subsidiary Risk Label: -
EMS Number: 2-04
Medical First Aid Guide Number: 620

IATA Detail Information

IATA Proper Shipping Name: COMPRESSED GAS, N.O.S. *
IATA PSN Code: HDO
IATA PSN Modifier:
IATA UN Id Number: 1956
IATA UN Class: 2.2
Subsidiary Risk Class:
UN Packaging Group:
IATA Label: NON-FLAMMABLE GAS
Packaging Note for Passengers: 200
Maximum Quantity for Passengers: 75KG
Packaging Note for Cargo: 200
Maximum Quantity for Cargo: 150KG
Exceptions:

AFI Detail Information

AFI Proper Shipping Name: COMPRESSED GAS, N.O.S.
AFI Symbols: *
AFI PSN Code: HDO
AFI PSN Modifier:
AFI UN Id Number: UN1956
AFI Hazard Class: 2.2
AFI Packing Group: N/A
AFI Label:
Special Provisions: P5
Back Pack Reference: A6.3, A6.5,A6.6

HAZCOM Label Information

Product Identification: CALIBRATION GAS,2% METHANE IN AIR,456236
CAGE: 40912
Assigned Individual: N
Company Name: MINE SAFETY APPLIANCE (REPLACED BY CAGE 55799)

Company PO Box:
Company Street Address1: UNKNOWN
Company Street Address2: PITTSBURGH, PA 15200 US
Health Emergency Telephone: 412-967-3000
Label Required Indicator: Y
Date Label Reviewed: 08/02/1994
Status Code: C
Manufacturer's Label Number: NOT APPLICABLE
Date of Label: 08/02/1994
Year Procured: 1991
Organization Code: F
Chronic Hazard Indicator: N
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: CAUTION
Health Hazard: Slight
Contact Hazard: Slight
Fire Hazard: None
Reactivity Hazard: None

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Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

DIESEL FUELS

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
DIESEL FUELS

Product Identification: DIESEL FUELS
Date of MSDS: 05/31/1989 **Technical Review Date:** 12/08/1992
FSC: 9140 **NIIN:** 00-419-0450
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: MOBIL CORP
Manufacturer's Address1: 150 E 42ND ST
Manufacturer's Address2: NEW YORK, NY 10017-5612
Manufacturer's Country: US
General Information Telephone: 212-883-4411
Emergency Telephone: 212-883-4411 / 800-424-9300CHEMTREC
Emergency Telephone: 212-883-4411 / 800-424-9300CHEMTREC
MSDS Preparer's Name: ENVIRONMENTAL AFFAIRS
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 57635
Special Project Code: N

Item Description

Item Name: DIESEL FUEL
Item Manager:
Specification Number: NK
Type/Grade/Class: NK
Unit of Issue: DR **Quantitative Expression:** 00000000475GL
Unit of Issue Quantity: 0
Type of Container:

Contractor Information

Contractor's Name: MOBIL CORP
Contractor's Address1: 150 E 42ND ST
Contractor's Address2: NEW YORK, NY 10017-5612
Contractor's Telephone: 212-883-4242
Contractor's CAGE: 57635

Section 2 - Compositon/Information on Ingredients
DIESEL FUELS

Ingredient Name: PETROLEUM OIL (DIESEL FUEL)
Ingredient CAS Number: 68334-30-5 **Ingredient CAS Code:** M
RTECS Number: RTECS Code: X
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100

% Enviromental Weight:
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT ESTABLISHED **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
DIESEL FUELS

Health Hazards Acute & Chronic: ACUTE EXPOSURES: SLIGHT SKIN IRRITATION, RESPIRATORY IRRITATION, DIZZINESS, NAUSEA, LOSS OF CONSCIOUSNESS. CHRONIC EXPOSURE:THIS PRODUCT MAY CONTAIN TRACE QUANTITIES OF POLYCYCLIC HYDROCARBONS. UNDER CONDITIONS OF POOR PERSONAL HYGIENE AND PROLONGED AND REPEATED CONTACT, SOME HAVE BEEN SUSPECTED OF SKIN CARCINOGENICTY

Signs & Symptoms of Overexposure:
SLIGHT SKIN IRRITATION, RESPIRATORY IRRITATION, DIZZINESS, NAUSEA, LOSS OF CONSCIOUSNESS.

Medical Conditions Aggravated by Exposure:
SUPPLIER DID NOT ADDRESS THIS FIELD.

LD50 LC50 Mixture: ORAL LD50 (RAT) IS UNKNOWN

Route of Entry Indicators:
- **Inhalation:** YES
- **Skin:** YES
- **Ingestion:** YES

Carcenogenicity Indicators
- **NTP:** NO
- **IARC:** NO
- **OSHA:** NO

Carcinogenicity Explanation: SEE HEALTH HAZARDS.

Section 4 - First Aid Measures
DIESEL FUELS

First Aid:
EYE:FLUSH WITH WATER. SKIN:WASH CONTACT AREAS WITH SOAP & WATER. INHALED:REMOVE FROM EXPOSURE. IF UNCONSCIOUSNESS OCCURS SEEK IMMEDIATE MEDICAL ASSISTANCE. IF BREATHING HAS STOPPED, GIVE MOUTH TO MOU TH RESUSCITATION. INGESTED:DO NOT INDUCE VOMITING. ADMINISTER VEGETABLE OIL. GET MEDICAL ASSISTANCE. (PHYSICIAN:IF MATERIAL IS ASPIRATED INTO LUNGS, MAY CAUSE CHEMICAL PNEUMONITIS; TREAT ACCORDINGLY.)

Section 5 - Fire Fighting Measures
DIESEL FUELS

Fire Fighting Procedures:
FOR FIRES IN ENCLOSED AREAS, FIREFIGHTERS MUST USE SELF-CONTAINED BREATHING APPARATUS.
Unusual Fire or Explosion Hazard:
MATERIAL IS COMBUSTABLE.
Extinguishing Media:
USE CARBON DIOXIDE, FOAM, DRY CHEMICAL OR WATER FOG.
Flash Point: Flash Point Text: 100F,38C

Autoignition Temperature:
Autoignition Temperature Text: N/K
Lower Limit(s): UNKNOWN
Upper Limit(s): UNKNOWN

Section 6 - Accidental Release Measures
DIESEL FUELS

Spill Release Procedures:
ABSORB ON FIRE RETARDENT SAWDUST, DIATOMACEOUS EARTH, ETC.. SHOVEL UP AND DISPOSE AT AN APPROPRIATE WASTE DISPOSALFACILITY I/A/W CURRENT FEDERAL, STATE & LOCAL REGULATIONS AT TIME OF DISPOSAL.

Section 7 - Handling and Storage
DIESEL FUELS

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
DIESEL FUELS

Repiratory Protection:
NO SPECIAL REQUIREMENTS UNDER ORDINARY CONDITIONS OF USE WITH ADEQUATE VENTILATION.
Ventilation:
EXPLOSION PROOF LOCAL AND MECHANICAL EXHAUST TO MAINTAIN ADEQUATE VENTILATION IS DESIRABLE.
Protective Gloves:
IMPERVIOUS
Eye Protection: NO SPECIAL EQUIPMENT REQUIRED.
Other Protective Equipment: NO INFORMATION GIVEN BY MFR ON THE MSDS.
Work Hygenic Practices: USE GOOD PERSONAL HYGIENE PRACTICES. AVOID PROLONGED/REPEATED CONTACT.
Supplemental Health & Safety Information: FROM OTHER PRECAUTIONS:EVEN THOUGH NO HUMAN CONNECTION HAS BEEN FOUND, PRUDENCY INDICATES THAT ADEQUATE

VENTILATION AND/OR RESPIRATORS BE USED.

Section 9 - Physical & Chemical Properties
DIESEL FUELS

HCC: F4
NRC/State License Number: NONE
Net Property Weight for Ammo: NONE
Boiling Point: Boiling Point Text: 300F,149C
Melting/Freezing Point: Melting/Freezing Text: UNKNOWN
Decomposition Point: Decomposition Text: UNKNOWN
Vapor Pressure: 0.5MM **Vapor Density:** UNKNOWN
Percent Volatile Organic Content:
Specific Gravity: 0.85
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: 31-40 SUS
Evaporation Weight and Reference: UNKNOWN
Solubility in Water: UNKNOWN
Appearance and Odor: CLEAR TO AMBER LIQUID, HYDROCARBON ODOR
Percent Volatiles by Volume: N/K
Corrosion Rate: UNKNOWN

Section 10 - Stability & Reactivity Data
DIESEL FUELS

Stability Indicator: YES
Materials to Avoid:
HALOGENS, STRONG ACIDS, ALKALINES AND OXIDIZERS
Stability Condition to Avoid:
HEAT, SPARKS, FLAME AND BUILD UP OF STATIC ELECTRICITY
Hazardous Decomposition Products:
CARBON MONOXIDE FROM INCOMPLETE COMBUSTION.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
WILL NOT OCCUR

Section 11 - Toxicological Information
DIESEL FUELS

Toxicological Information:
N/P

Section 12 - Ecological Information
DIESEL FUELS

Ecological Information:
N/P

Section 13 - Disposal Considerations
DIESEL FUELS

Waste Disposal Methods:
PRODUCT IS SUITABLE FOR BURNING FOR FUEL VALUE I/A/W FEDERAL, STATE & LOCAL LAWS AND REGULATIONS.

Section 14 - MSDS Transport Information
DIESEL FUELS

Transport Information:
N/P

Section 15 - Regulatory Information
DIESEL FUELS

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
DIESEL FUELS

Other Information:
N/P

HMIS Transportation Information

Product Identification: DIESEL FUELS
Transporation ID Number: 71458
Responsible Party CAGE: 57635
Date MSDS Prepared: 05/31/1989
Date MSDS Reviewed: 12/08/1992
MFN: 12/08/1992
Submitter: D DG
Status Code: C

Container Information
- **Unit of Issue:** DR
- **Container Quantity:** 0
- **Type of Container:**
- **Net Unit Weight:** 3540 LBS

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity: N/R
Form:
Net Explosive Weight: N/R
Coast Guard Ammunition Code: N/R
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number: N/R

Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:
NOTE: NORMALLY AFR 71-4 WOULD BE LISTED AS NOT REGULATED. HOWEVER THIS IS A 500 GAL DRUM.

Department of Transportation Information

DOT Proper Shipping Name: GAS OIL OR DIESEL FUEL OR HEATING OIL, LIGHT
DOT PSN Code: GTF
Symbols:
DOT PSN Modifier:
Hazard Class: 3
UN ID Number: UN1202
DOT Packaging Group: III
Label: FLAMMABLE LIQUID
Special Provision(s): B1,T7,T30
Packaging Exception: 150
Non Bulk Packaging: 203
Bulk Packaging: 242
Maximimum Quanity in Passenger Area: 60 L
Maximimum Quanity in Cargo Area: 220 L
Stow in Vessel Requirements: A
Requirements Water/Sp/Other:

IMO Detail Information

IMO Proper Shipping Name: GAS OIL
IMO PSN Code: HRR
IMO PSN Modifier:
IMDG Page Number: 3375
UN Number: 1202
UN Hazard Class: 3.3
IMO Packaging Group: III
Subsidiary Risk Label: -
EMS Number: 3-07
Medical First Aid Guide Number: 311

IATA Detail Information

IATA Proper Shipping Name: GAS OIL
IATA PSN Code: MTX
IATA PSN Modifier:
IATA UN Id Number: 1202
IATA UN Class: 3
Subsidiary Risk Class:
UN Packaging Group: III
IATA Label: FLAMMABLE LIQUID
Packaging Note for Passengers: 309
Maximum Quantity for Passengers: 60L
Packaging Note for Cargo: 310
Maximum Quantity for Cargo: 220L
Exceptions: A3

AFI Detail Information

AFI Proper Shipping Name: GAS OIL OR DIESEL FUEL OR HEATING OIL, LIGHT
AFI Symbols:
AFI PSN Code: MTX
AFI PSN Modifier:
AFI UN Id Number: UN1202
AFI Hazard Class: 3
AFI Packing Group: III
AFI Label:
Special Provisions: P5
Back Pack Reference: A7.3

HAZCOM Label Information

Product Identification: DIESEL FUELS
CAGE: 57635
Assigned Individual: N
Company Name: MOBIL CORP
Company PO Box:
Company Street Address1: 150 E 42ND ST
Company Street Address2: NEW YORK, NY 10017-5612 US
Health Emergency Telephone: 212-883-4411 / 800-424-9300CHEMTREC
Label Required Indicator: Y
Date Label Reviewed: 12/08/1992
Status Code: C
Manufacturer's Label Number: NONE
Date of Label: 12/08/1992
Year Procured: 1992
Organization Code: F
Chronic Hazard Indicator: N/P
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: WARNING
Health Hazard: Slight
Contact Hazard: Slight
Fire Hazard: Moderate
Reactivity Hazard: None

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CORNELL

Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

719,ETHYLBENZENE

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
719,ETHYLBENZENE

Product Identification: 719,ETHYLBENZENE
Date of MSDS: 01/01/1985 **Technical Review Date:** 02/18/1983
FSC: 6810 **NIIN: LIIN:** 00K000829
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: EASTMAN KODAK COMPANY
Manufacturer's Address1: 343 STATE STREET
Manufacturer's Address2: ROCHESTER, NY 14650
Manufacturer's Country: US
General Information Telephone: 716-722-5151
Emergency Telephone: 716-722-5151
Emergency Telephone: 716-722-5151
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 19139
Special Project Code: N

Contractor Information

Contractor's Name: EASTMAN KODAK CO GOVERNMENT MARKETS CONTRACTS
Contractor's Address1: 343 STATE ST
Contractor's Address2: ROCHESTER, NY 14650-1115
Contractor's Telephone: 716-722-5151/(800) 242-2424
Contractor's CAGE: 19139

Section 2 - Compositon/Information on Ingredients
719,ETHYLBENZENE

Ingredient Name: ETHYL BENZENE (SARA III)
Ingredient CAS Number: 100-41-4 **Ingredient CAS Code:** M
RTECS Number: DA0700000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100
% Enviromental Weight:
Other REC Limits: N/P
OSHA PEL: 100 PPM/125 STEL **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 100 PPM/125STEL 9192 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1000 LBS
DOT Reporting Quantity: 1000 LBS
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
719,ETHYLBENZENE

Health Hazards Acute & Chronic: N/P

Signs & Symptoms of Overexposure:
VAPORS IRRITAT EYES,RESPIR TRACT AND SKIN.

Medical Conditions Aggravated by Exposure:
N/P

LD50 LC50 Mixture: N/P

Route of Entry Indicators:
Inhalation: N/P
Skin: N/P
Ingestion: N/P

Carcenogenicity Indicators
NTP: N/P
IARC: N/P
OSHA: N/P

Carcinogenicity Explanation: N/P

Section 4 - First Aid Measures
719,ETHYLBENZENE

First Aid:
INHALE:REMOVE TO FRESH AIR,GIVE CPR/O*2 IF NEED.EYES/SKIN:FLUSH WITH LG AMTS H*2O FOR 15 MIN.

Section 5 - Fire Fighting Measures
719,ETHYLBENZENE

Fire Fighting Procedures:
SELF-CNTND BRTHG APP,H*2O SPRAY COOL CONT,KNOCK DOWN VAPOR.
Unusual Fire or Explosion Hazard:
CONT MAY EXPLODE IN HEAT OF FIRE.SPILL/RUNOFF MAY POLLUTE,CAUSE FIRE OR EXPLOSION
Extinguishing Media:
CO*2,DRY CHEMICAL
Flash Point: Flash Point Text: 59F/15C

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): 1.0
Upper Limit(s): UNK

Section 6 - Accidental Release Measures
719,ETHYLBENZENE

Spill Release Procedures:
ELIMINATE IGNITION SOURCES.ABSORB SPILLED MATERIAL W.VERMICULITE.PLACE IN FIBER CARTON.WASH SPILL AREA WELL WITH SOAP & WATER.

Section 7 - Handling and Storage
719,ETHYLBENZENE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
719,ETHYLBENZENE

Repiratory Protection:
CONTROL VAPOR CONC BY LOCAL EXHAUST.
Ventilation:
MECHANICAL/LOCAL FOR CONTROLLING VAPOR TO TLV(100 PPM)
Protective Gloves:
IMPERVIOUS
Eye Protection: SAFETY/CHEM GOGGLES.
Other Protective Equipment: NORMAL FULL CLOTHING COVERING ARMS AND LEGS.
Work Hygenic Practices: N/P
Supplemental Health & Safety Information: N/P

Section 9 - Physical & Chemical Properties
719,ETHYLBENZENE

HCC: F3
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 277F/136C
Melting/Freezing Point: Melting/Freezing Text: N/A
Decomposition Point: Decomposition Text: N/A
Vapor Pressure: 10 **Vapor Density:** 3.66
Percent Volatile Organic Content:
Specific Gravity: 0.866
Volatile Organic Content Pounds per Gallon:
pH: N/P
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: UNKNOWN
Solubility in Water: NEGLIGIBLE
Appearance and Odor: COLORLESS LIQUID,AROMATIC ODOR.
Percent Volatiles by Volume: 100
Corrosion Rate: N/P

Section 10 - Stability & Reactivity Data

719,ETHYLBENZENE

Stability Indicator: YES
Materials to Avoid:
NONE
Stability Condition to Avoid:
NONE
Hazardous Decomposition Products:
CO*2,CO
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
N/P

Section 11 - Toxicological Information
719,ETHYLBENZENE

Toxicological Information:
N/P

Section 12 - Ecological Information
719,ETHYLBENZENE

Ecological Information:
N/P

Section 13 - Disposal Considerations
719,ETHYLBENZENE

Waste Disposal Methods:
MIX WITH FLAMMABLE SOLVENT,SPRAY INTO INCINERATOR EQUIPPED WITH AFTERBURNER AND SCRUBBER.STATE AND LOCAL LAWS TAKE PRECEDENCE.

Section 14 - MSDS Transport Information
719,ETHYLBENZENE

Transport Information:
N/P

Section 15 - Regulatory Information
719,ETHYLBENZENE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
719,ETHYLBENZENE

Other Information:

N/P

HMIS Transportation Information

Product Identification: 719,ETHYLBENZENE
Transporation ID Number: 9874
Responsible Party CAGE: 19139
Date MSDS Prepared: 01/01/1985
Date MSDS Reviewed: 02/18/1983
MFN: 02/18/1983
Submitter: D DG
Status Code: C

Container Information

Unit of Issue: NK
Container Quantity: NK
Type of Container:
Net Unit Weight:

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:
ITEM UNDER CAT #719 IS ALSO AVAILABLE IN 1 KG QUANTITIES.FLASHPOINT METHOD NOT IDENTIFIED.

Department of Transportation Information

DOT Proper Shipping Name: ETHYLBENZENE
DOT PSN Code: FYP
Symbols:
DOT PSN Modifier:
Hazard Class: 3
UN ID Number: UN1175
DOT Packaging Group: II
Label: FLAMMABLE LIQUID
Special Provision(s): T1
Packaging Exception: 150
Non Bulk Packaging: 202
Bulk Packaging: 242
Maximimum Quanity in Passenger Area: 5 L
Maximimum Quanity in Cargo Area: 60 L
Stow in Vessel Requirements: B

Requirements Water/Sp/Other:

IMO Detail Information

IMO Proper Shipping Name: ETHYLBENZENE
IMO PSN Code: GQL
IMO PSN Modifier:
IMDG Page Number: 3222
UN Number: 1175
UN Hazard Class: 3.2
IMO Packaging Group: II
Subsidiary Risk Label: -
EMS Number: 3-07
Medical First Aid Guide Number: 310

IATA Detail Information

IATA Proper Shipping Name: ETHYLBENZENE
IATA PSN Code: LCB
IATA PSN Modifier:
IATA UN Id Number: 1175
IATA UN Class: 3
Subsidiary Risk Class:
UN Packaging Group: II
IATA Label: FLAMMABLE LIQUID
Packaging Note for Passengers: 305
Maximum Quantity for Passengers: 5L
Packaging Note for Cargo: 307
Maximum Quantity for Cargo: 60L
Exceptions:

AFI Detail Information

AFI Proper Shipping Name: ETHYLBENZENE
AFI Symbols:
AFI PSN Code: LCB
AFI PSN Modifier:
AFI UN Id Number: UN1175
AFI Hazard Class: 3
AFI Packing Group: II
AFI Label:
Special Provisions: P5
Back Pack Reference: A7.3

HAZCOM Label Information

Product Identification: 719,ETHYLBENZENE
CAGE: 19139
Assigned Individual: N
Company Name: EASTMAN KODAK CO GOVERNMENT MARKETS CONTRACTS
Company PO Box:
Company Street Address1: 343 STATE ST
Company Street Address2: ROCHESTER, NY 14650-1115 US
Health Emergency Telephone: 716-722-5151
Label Required Indicator: Y
Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998

Year Procured: N/K
Organization Code: F
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

FUEL OIL, 008102

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
FUEL OIL, 008102

Product Identification: FUEL OIL, 008102
Date of MSDS: 06/04/1990 **Technical Review Date:** 05/16/1995
FSC: 9140 **NIIN: LIIN:** 00N017173
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: B P AUSTRALIA LIMITED
Manufacturer's Address1: 1 ALBERT RD
Manufacturer's Address2: MELBORNE, NK 00000
Manufacturer's Country: US
General Information Telephone: 03-268-4111
Emergency Telephone: 03-268-4111
Emergency Telephone: 03-268-4111
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 9V308
Special Project Code: N

Contractor Information

Contractor's Name: B P AUSTRALIA LIMITED
Contractor's Address1: 1 ALBERT RD
Contractor's Address2: MELBORNE, NK 00000
Contractor's Telephone: 03-268-4111
Contractor's CAGE: 9V308

Section 2 - Compositon/Information on Ingredients
FUEL OIL, 008102

Ingredient Name: DIESEL FUELS;(PETROLEUM HYDROCARBON COMPOUNDS)
Ingredient CAS Number: 68334-30-5 **Ingredient CAS Code:** M
RTECS Number: HZ1800000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: >99
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Ingredient Name: EFTS OF OVEREXP:PNEUMIT. NOTE TO MD:1:FUEL INJECTION THROUGH SKIN FROM CONTACT W/HIGH PRESS/VELOCITY FUEL (SEE ING 5)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: FIRST AID PROC:TO THE NOSE, THROAT OR COUGHING, REMOVE TO FRESH AIR. GET MD IF SYMPS PERSIST. IF CASUALTY IS(SEE ING 13)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 10:ASPIRATION, GASTRIC LAVAGE SHOULD BE AVOIDED-IF

DEEMED NECESSARY INDERTAKE ONLY AFTER ENDOTRACHEAL INTUBATION.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 11:UNCON BUT BRTHG, PLACE IN UNCON (RECOVERY) POSITION. IF NOT BRTHG, GIVE MOUTH-TO-MOUTH VENT & (SEE ING 14)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 13:EXTERNAL CARDIAC MASSAGE AS NECESSARY.
Ingredient CAS Number: Ingredient CAS Code: X

RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: UNKNOWN
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 4:SPRAYS ARE SERIOUS MED EMERGENCIES. INJURIES MAY NOT APPEAR SERIOUS AT FIRST BUT WITHIN A FEW HOURS (SEE ING 6)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 5:TISSUE BECOMES SWOLLEN, DISCOLOURED & EXTREMELY PAINFUL W/EXTENSIVE SUBCULTANEOUS NECROSIS. EMERGENCY (SEE ING 7)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M

=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 6:SURGICAL EXPLORATION & THORO CLEANSING OF WOUND & UNDERLYING TISSUES IS NECESSARY TO MINIMIZE NECROSIS (SEE ING 8)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 7:AND TISSUE LOSS. NOTE:HIGH PRESS MAY FORCE FLUID CONSIDERABLY LONG DISTANCES ALONG TISSUE PLANES. 2: (SEE ING 9)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:

=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 8:OIL CAN BE ASPIRATED FOLLOWING REGURGITIATION OF STOMACH CONTENTS & CAN CAUSE SEVERE/POTENTIALLY FATAL(SEE ING 10)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 9:CHEM PNEUMIT, WHICH MAY REQUIRE TREATMENT W/ANTIBIOTIC & CORTICOSTEROID THERAPY. BECAUSE OF RISK OF (SEE ING 11)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:

>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: OTHER PREC:STANDING BY OUTSIDE THE TANK WITH NIOSH/MSHA APPROVED SCBA & APPROPRIATE EQUIP TO EFFECT A QUICK RESCUE.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: POLYCYCLIC AROMATIC HYDROCARBONS
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: RTECS Code: X
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:

<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: SUPP DATA:CAN CREATE A FLAMMABILITY OR EXPLOSION HAZARD.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Section 3 - Hazards Identification, Including Emergency Overview
FUEL OIL, 008102

Health Hazards Acute & Chronic: INGEST:UNLIKELY TO CAUSE HARM IF ACCIDENTALLY SWALLOWED ALTHOUGH INGESTION OF LARGE AMOUNTS MAY CAUSE GI EFTS SUCH AS DISCOMFORT, VOMIT AND DIARRHEA. EYE:MAY BE IRRIT TO EYES IF EXPOSED TO VAPS, MISTS OR FUMES. SKIN:ON RPTD/PRLNGD CONTACT MAY CAUSE DERM AND SERIOUS IRREVERSIBLE SKIN DISORDERS. (EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:
HLTH HAZ:UNLIKELY TO CAUSE SKIN SENSIT. CRACKED COMPONENTS CONTAINING POLYCYCLIC AROMATIC HYDROCARBON COMPOUNDS MAY BE PRESENT, SOME OF WHICH HAVE BEEN SHOWN TO INDUCE SKIN CANCER IN LAB ANIMALS. INHA L:VAPORS/MIST MAY CAUSE IRRIT TO NOSE &THROAT. ASPIRATION OF LIQ INTO LUNGS CAN CAUSE SERIOUS (EVEN FATAL) (SEE ING 4)

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route of Entry Indicators:
Inhalation: YES
Skin: NO
Ingestion: YES

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NOT RELEVANT.

Section 4 - First Aid Measures
FUEL OIL, 008102

First Aid:
INGEST:CONTACT MD OR POIS CTL CTR. DO NOT INDUCE VOMIT. GIVE A GLASS OF WATER. IF ANY SUSPICION OF ASPIRATION INTO LUNGS (E.G. DURING VOMITING) OBTAIN MD IMMEDIATELY. EYE:IRRIGATE WITH COPIOUS QUANTIT IES OF WATER. IF SORENESS OR REDNESS PERSISTS, GET MD. SKIN:WASH OFF WITH SOAP AND WATER. REMOVE CONTAM CLTHG & LAUNDER BEFORE RE-USE. INHAL:IF INHAL OF MISTS, FUMES OR VAPS CAUSES IRRIT (SEE ING 12)

Section 5 - Fire Fighting Measures
FUEL OIL, 008102

Fire Fighting Procedures:
WEAR NIOSH/MSHA APPROVED SCBA & FULL PROT EQUIP (FP N). USE WATER SPRAY TO COOL FIRE EXPOSED SURFACES & ANY ADJACENT STORAGE VESSELS. IF SAFE, SHUT OFF(SUPDAT)
Unusual Fire or Explosion Hazard:
COMBUSTIBLE. AVOID HEAT/SOURCES OF IGNIT. HOSES SHOULD BE ELEC CONTINUOUS & CONTAINERS BONDED TO AVOID STATIC CHARGE BUILD-UP. WILL PRESENT FLAMM HAZ(SUPP DATA)
Extinguishing Media:
USE FOAM, CO*2, POWDER OR BCF FIRE EXTINGUISHERS.
Flash Point: Flash Point Text: >142F,61C

Autoignition Temperature:

Autoignition Temperature Text: N/A
Lower Limit(s): 0.7%
Upper Limit(s): 5%

Section 6 - Accidental Release Measures
FUEL OIL, 008102

Spill Release Procedures:
KEEP PUBLIC AWAY. EXTINGUISH ALL IGNITION SOURCES. FOR MAJOR SPILLS, DAM & RECOVER. PREVENT ENTRY INTO DRAINAGE SYSTEMS, RIVERS, ETC. COLLECT W/ABSORBENT MATL SUCH AS SAND EARTH OR SAWDUST. WARN OCCUP ANTS DOWNWIND.

Section 7 - Handling and Storage
FUEL OIL, 008102

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
FUEL OIL, 008102

Repiratory Protection:
DO NOT ENTER STORAGE TANKS WITHOUT NIOSH/MSHA APPROVED SCBA UNLESS TANK HAS BEEN WELL VENTILATED & TANK ATMOSPHERE HAS BEEN SHOWN TO CONTAIN HYDROCARBON VAPOR CONC OF LESS THAN 1% OF THE LOWER FLAMM L IMIT & O*2 CONC OF AT LEAST 20% VOLUME.
Ventilation:
NONE SPECIFIED BY MANUFACTURER.
Protective Gloves:
PVC GLOVES.
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).
Other Protective Equipment: PROTECTIVE CLOTHING AS NECESSARY TO PREVENT SKIN CONTACT.
Work Hygenic Practices: AVOID CONTACT WITH SKIN AND OBSERVE GOOD PERSONAL HYGIENE.
Supplemental Health & Safety Information: FIRE FIGHT PROC:SOURCE OF PROD. REMOVE SOURCES OF RE-IGNITION. EXPLO HAZ:HEATED ABOVE FLASH POINT, (NOTE:FLASH POINT MUST NOT BE REGARDED AS RELIABLE INDICATOR OF POTNTL FLAMM OF VAP IN FUEL TANK HEAD SPACES). IF FUEL CONTACTS HOT SURFS OR LEAKS FROM HIGH PRESS FUEL PIPES, VAPS/MISTS CAN BE GENERATED WHICH (SEE ING 3)

Section 9 - Physical & Chemical Properties
FUEL OIL, 008102

HCC: V4
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 356F,180C

Melting/Freezing Point: Melting/Freezing Text: N/K
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: >0.1 KPA **Vapor Density:** N/K
Percent Volatile Organic Content:
Specific Gravity: N/K
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/K
Solubility in Water: <0.1% MASS @20C
Appearance and Odor: PALE YELLOW/ORANGE LIQUID
Percent Volatiles by Volume: >90%
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
FUEL OIL, 008102

Stability Indicator: N/P
Materials to Avoid:
NONE SPECIFIED BY MANUFACTURER.
Stability Condition to Avoid:
NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:
OXIDES OF CARBON, NITROGEN AND SULPHUR.
Hazardous Polymerization Indicator: N/P
Conditions to Avoid Polymerization:
NONE SPECIFIED BY MANUFACTURER.

Section 11 - Toxicological Information
FUEL OIL, 008102

Toxicological Information:
N/P

Section 12 - Ecological Information
FUEL OIL, 008102

Ecological Information:
N/P

Section 13 - Disposal Considerations
FUEL OIL, 008102

Waste Disposal Methods:
ADVISE AUTHORITIES. ENSURE WASTE DISP CONFORMS W/LOCAL WASTE DISP REGULATIONS. AFTER RECOVERY AND EVAPORATION REMAINING SOIL MAY BE DISPOSED OF TO APPROVED LANDFILL, OR IF APPROVED, ALLOWED TO DEGRADE INSITU. MODERATELY TOXIC TO AQUATIC LIFE.

Section 14 - MSDS Transport Information
FUEL OIL, 008102

Transport Information:
N/P

Section 15 - Regulatory Information
FUEL OIL, 008102

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
FUEL OIL, 008102

Other Information:
N/P

HMIS Transportation Information

Product Identification: FUEL OIL, 008102
Transporation ID Number: 21795
Responsible Party CAGE: 9V308
Date MSDS Prepared: 06/04/1990
Date MSDS Reviewed: 11/04/1991
MFN: 11/04/1991
Submitter: N TN
Status Code: C

Container Information
- **Unit of Issue:** NK
- **Container Quantity:** NK
- **Type of Container:**
- **Net Unit Weight:**

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:
NOT REGULATED FOR TRANSPORTATION

Department of Transportation Information

DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
DOT PSN Code: ZZZ
Symbols: N/R
DOT PSN Modifier:
Hazard Class: N/R
UN ID Number: N/R
DOT Packaging Group: N/R
Label: N/R
Special Provision(s): N/R
Packaging Exception: N/R
Non Bulk Packaging: N/R
Bulk Packaging: N/R
Maximimum Quanity in Passenger Area: N/R
Maximimum Quanity in Cargo Area: N/R
Stow in Vessel Requirements: N/R
Requirements Water/Sp/Other: N/R

IMO Detail Information

IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION
IMO PSN Code: ZZZ
IMO PSN Modifier:
IMDG Page Number: N/R
UN Number: N/R
UN Hazard Class: N/R
IMO Packaging Group: N/R
Subsidiary Risk Label: N/R
EMS Number: N/R
Medical First Aid Guide Number: N/R

IATA Detail Information

IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
IATA PSN Code: ZZZ
IATA PSN Modifier:
IATA UN Id Number: N/R
IATA UN Class: N/R
Subsidiary Risk Class: N/R
UN Packaging Group: N/R
IATA Label: N/R
Packaging Note for Passengers: N/R
Maximum Quantity for Passengers: N/R
Packaging Note for Cargo: N/R
Maximum Quantity for Cargo: N/R
Exceptions: N/R

AFI Detail Information

AFI Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
AFI Symbols:
AFI PSN Code: ZZZ
AFI PSN Modifier:
AFI UN Id Number: N/R
AFI Hazard Class: N/R
AFI Packing Group: N/R

AFI Label: N/R
Special Provisions: N/A
Back Pack Reference: N/A

HAZCOM Label Information

Product Identification: FUEL OIL, 008102
CAGE: 9V308
Assigned Individual: N
Company Name: B P AUSTRALIA LIMITED
Company PO Box:
Company Street Address1: 1 ALBERT RD
Company Street Address2: MELBORNE, NK 00000 US
Health Emergency Telephone: 03-268-4111
Label Required Indicator: Y
Date Label Reviewed: 08/06/1991
Status Code: C
Manufacturer's Label Number:
Date of Label: 08/06/1991
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: WARNING
Health Hazard: Moderate
Contact Hazard: Slight
Fire Hazard: Moderate
Reactivity Hazard: None

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CORNELL

Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

100 PPM ISOBUTYLENE IN AIR

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
100 PPM ISOBUTYLENE IN AIR

Product Identification: 100 PPM ISOBUTYLENE IN AIR
Date of MSDS: 06/04/1989 **Technical Review Date:** 07/28/2000
FSC: NIIN: EMPTY
Submitter: D DG
Status Code: A
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: LIQUID AIR CORP ALPHAGAZ DIVISION
Manufacturer's Address1: 2121 N CALIFORNIA BLVD
Manufacturer's Address2: WALNUT CREEK, CA 94596
Manufacturer's Country: US
General Information Telephone: 510-977-6500
Emergency Telephone: 800-231-1366
Emergency Telephone: 800-231-1366
MSDS Preparer's Name: N/P
Chemtec Telephone: (800)424-9300
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 42568

Contractor Information

Contractor's Name: LIQUID AIR CORP ALPHAGAZ DIVISION
Contractor's Address1: 2121 N CALIFORNIA BLVD
Contractor's Address2: WALNUT CREEK, CA 94596
Contractor's Telephone: 510-977-6500
Contractor's CAGE: 42568

Section 2 - Compositon/Information on Ingredients
100 PPM ISOBUTYLENE IN AIR

Ingredient Name: AIR
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: RTECS Code: X
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: UNK
% Enviromental Weight:
Other REC Limits: N/P
OSHA PEL: N/P **OSHA PEL Code:**
OSHA STEL: N/P **OSHA STEL Code:**
ACGIH TLV: N/P **ACGIH TLV Code:**
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ISOBUTYLENE
Ingredient CAS Number: 115-11-7 **Ingredient CAS Code:** T
RTECS Number: UD0890000 **RTECS Code:** T
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100 PPM
% Enviromental Weight:
Other REC Limits: N/P
OSHA PEL: N/P **OSHA PEL Code:**
OSHA STEL: N/P **OSHA STEL Code:**
ACGIH TLV: N/P **ACGIH TLV Code:**
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
100 PPM ISOBUTYLENE IN AIR

Health Hazards Acute & Chronic: AMOUNT OF ISO-BUTYLENE IN MIXTURE SHOULDN'T PRESENT ANY SYMPTOMS OF TOXICITY IF THIS MIXTURE IS BREATHED.AIR IS NONTOXIC & NECESSARY TO SUPPORT LIFE.INHALATION OF AIR IN HIGH PRESSURE ENVIRO-MEN SUCH AS UNDERWATER DIVING,CAISSONS OR HYPERBARIC CHAMBERS CAN RESULT IN SYMPTOMS SIMILAR TO OVEREXPO TO PURE OXYGEN.THESE INCLUDE TINGLING OF FINGERS & TOES,ABNORMAL SENSA-TIONS,IMPAIRED COORDINATION & CON FUSION.DECOMPRESSION SICKNESS PAINS OR BENDS ARE POSSIBLE FOLLOWING RAPID DECOMPRESION.HI PRESSURE EFFECTS(GREATER THAN 2 ATOMOSPHERES OF OXYGEN) ARE ON CENTRAL NERVOUS SYSTEM.IMPROPER DECOMPRESSION R ESULT IN ACCUMU OF NITROGEN IN BLOOD.

Signs & Symptoms of Overexposure:
INHALATION OF AIR IN HIGH PRESSURE ENVIRONMENT SUCH AS UNDERWATER DIVING, CAISSONS OR HYPERBARIC CHAMBERS CAN RESULT IN SYMPTOMS SIMILAR TO OVEREXPOSURE TO PURE OXYGEN. THESE INCLUDE TINGLING OF FINGE RS AND TOES, ABNORMAL SENSATIONS, IMPAIRED COORDINATION & CONFUSION. DECOMPRESSION SICKNESS PAINS OR BENDS ARE POSSIBLE FOLLOIWNG RAPID DECOMPRESSION.

Medical Conditions Aggravated by Exposure:
N/P

LD50 LC50 Mixture: N/P

Route of Entry Indicators:
Inhalation: YES
Skin: N/P
Ingestion: N/P

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NEITHER ISOBUTYLENE OR AIR ARE LISTED IN IARC, NTP, OR BY OSHA AS A CARCINOGEN OR POTENTIAL CARCINOGEN.

Section 4 - First Aid Measures
100 PPM ISOBUTYLENE IN AIR

First Aid:
FACILITIES OR PRACTICES AT WHICH AIR IS BREATHED IN A HIGH PRESSURE ENVIRONMENT SHOULD BE PREPARED TO DEAL WITH THE ILLNESSES ASSOCIATED WITH DECOMPRESSION (BENDS OR CAISSON DISEASE). DECOMPRESSION EQ UIPMENT MAY BE REQUIRED.

Section 5 - Fire Fighting Measures
100 PPM ISOBUTYLENE IN AIR

Fire Fighting Procedures:
N/A
Unusual Fire or Explosion Hazard:
COMPRESSED AIR AT HIGH PRESSURES WILL ACCELERATE THE BURNING OF MATERIALS TO A GREATER RATE THAN THEY BURN AT ATMOSPHERIC PRESSURE.
Extinguishing Media:
NONFLAMMABLE GAS.
Flash Point: Flash Point Text: N/A

Autoignition Temperature:
Autoignition Temperature Text: N/P
Lower Limit(s): N/A
Upper Limit(s): N/A

Section 6 - Accidental Release Measures
100 PPM ISOBUTYLENE IN AIR

Spill Release Procedures:
N/A

Section 7 - Handling and Storage
100 PPM ISOBUTYLENE IN AIR

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
100 PPM ISOBUTYLENE IN AIR

Repiratory Protection:
N/A
Ventilation:
N/A
Protective Gloves:
ANY MATERIAL.
Eye Protection: SAFETY GOGGLES OR GLASSES
Other Protective Equipment: SAFETY SHOES.
Work Hygenic Practices: N/P
Supplemental Health & Safety Information: CONTD OTHER INFO:(RUST FORMATION).CONC OF SO2,CL2,SALT,ETC IN THE MOISTURE ENHANCES THE RUSTING OF METALS IN THIS MIXTURE.ADDN RECOMMENDATIONS CONSULT L'AIR LIQUIDE'S ENCYLOPEDIA DE GAZ OR COMPRESSED GAS ASSOC PAMPHLET P-1.

Section 9 - Physical & Chemical Properties
100 PPM ISOBUTYLENE IN AIR

HCC: G3
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: =-194.4C, -317.9F **Boiling Point Text:**
Melting/Freezing Point: Melting/Freezing Text: N/A
Decomposition Point: Decomposition Text: N/P
Vapor Pressure: >-220.4F **Vapor Density:** 1.200KG/M3
Percent Volatile Organic Content:
Specific Gravity: N/P
Volatile Organic Content Pounds per Gallon:
pH: N/P
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/P
Solubility in Water: BUNSEN COEFF=.0183
Appearance and Odor: COLORLESS GAS WITH POSSIBLE VERY SLIGHT OLEFINIC ODOR
Percent Volatiles by Volume: N/P
Corrosion Rate: N/P

Section 10 - Stability & Reactivity Data
100 PPM ISOBUTYLENE IN AIR

Stability Indicator: YES
Materials to Avoid:
NONE
Stability Condition to Avoid:
N/A
Hazardous Decomposition Products:
NONE

Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
N/A

Section 11 - Toxicological Information
100 PPM ISOBUTYLENE IN AIR

Toxicological Information:
HIGH PRESSURE EFFECTS (GREATER THAN 2 ATMOSPHERES OF OXYGEN) ARE ON THE CENTRAL NERVOUS SYSTEM. IMPROPER DECOMPRESSION RESULTS IN THE ACCUMULATIONOF NITROGEN IN THE BLOOD. LIQUID DENSITY AT BOILING PO INT:54.70LB/FT3 (876.21 KG/M3). FREEZING POINT:N/A, BUBBLE POINT AT 1 ATM.=-317.8F (-194.35C).

Section 12 - Ecological Information
100 PPM ISOBUTYLENE IN AIR

Ecological Information:
N/P

Section 13 - Disposal Considerations
100 PPM ISOBUTYLENE IN AIR

Waste Disposal Methods:
N/A

Section 14 - MSDS Transport Information
100 PPM ISOBUTYLENE IN AIR

Transport Information:
COMPRESSED GAS, N.O.S., NONFLAMMABLE GAS, UN 1956.

Section 15 - Regulatory Information
100 PPM ISOBUTYLENE IN AIR

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
100 PPM ISOBUTYLENE IN AIR

Other Information:
CONTD OTHER PRECAUT:PROTECT CYL FROM PHYSICAL DMG.STORE IN COOL DRY WELL-VENTILATED AREA AWAY FROM HEAVILY TRAFFICKED AREAS & EMERGENCY EXITS.DON'T ALLOW TEMP WHERE CYL STORED TO EXCEED 130F(53C).CYL SHOULD BE STORED UPRIGHT & FIRMLY SECURED TO PREVENT FALLING OR BEING KNOCKED OVER.FULL & EMPTY CYL SHOULD BE SEGREGATED.USE A 1ST IN-1ST OUT INVENTORY SYSTEM TO PREVENT FULL CYL BEING STORED FOR EXCE SSIVE PERIODS OF TIME.IF

MIXTURE IS DRY ITS NONCORROSIVE & MAY BE USED W/ALL MATLS OF CONSTRUCTION.MOISTURE CAUSES METAL OXIDES WHICH ARE FORMED W/AIR TO BE HYDRATED SO THAT THEY INCR IN VOLUME &LOSE THEIR PROTECTIVE ROLE(CONTD SUPPLEMENT

HMIS Transportation Information

Product Identification: 100 PPM ISOBUTYLENE IN AIR
Transporation ID Number: 154224
Responsible Party CAGE: 42568
Date MSDS Prepared: 06/04/1989
Date MSDS Reviewed: 07/28/2000
MFN: 07/28/2000
Submitter: D DG
Status Code: A

Container Information

Unit of Issue: NK
Container Quantity: NK
Type of Container:
Net Unit Weight: UNK

Article without MSDS: N
Technical Entry NOS Shipping Number: 100PPM ISOBUTYLENE IN AIR.
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism:
AF MMAC Code:
DOD Exemption Number: N/A
Limited Quantity Indicator: N
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: N
Additional Data:
PER MSDS:COMPRESSED GAS N.O.S, NONFLAMMABLE GAS, UN 1956.

Department of Transportation Information

DOT Proper Shipping Name: COMPRESSED GASES, N.O.S.
DOT PSN Code: DQQ
Symbols: G
DOT PSN Modifier:
Hazard Class: 2.2
UN ID Number: UN1956
DOT Packaging Group:
Label: NONFLAMMABLE GAS
Special Provision(s): B13
Packaging Exception:
Non Bulk Packaging: 302,305
Bulk Packaging: 314,315
Maximimum Quanity in Passenger Area: 75 KG

Maximimum Quanity in Cargo Area: 150 KG
Stow in Vessel Requirements: A
Requirements Water/Sp/Other:

IMO Detail Information

IMO Proper Shipping Name: COMPRESSED GAS, N.O.S. o
IMO PSN Code: EQH
IMO PSN Modifier:
IMDG Page Number: 2124
UN Number: 1956
UN Hazard Class: 2(2.2)
IMO Packaging Group: -
Subsidiary Risk Label: -
EMS Number: 2-04
Medical First Aid Guide Number: 620

IATA Detail Information

IATA Proper Shipping Name: COMPRESSED GAS, N.O.S. *
IATA PSN Code: HDO
IATA PSN Modifier:
IATA UN Id Number: 1956
IATA UN Class: 2.2
Subsidiary Risk Class:
UN Packaging Group:
IATA Label: NON-FLAMMABLE GAS
Packaging Note for Passengers: 200
Maximum Quantity for Passengers: 75KG
Packaging Note for Cargo: 200
Maximum Quantity for Cargo: 150KG
Exceptions:

AFI Detail Information

AFI Proper Shipping Name: COMPRESSED GAS, N.O.S.
AFI Symbols: *
AFI PSN Code: HDO
AFI PSN Modifier:
AFI UN Id Number: UN1956
AFI Hazard Class: 2.2
AFI Packing Group: N/A
AFI Label:
Special Provisions: P5
Back Pack Reference: A6.3, A6.5,A6.6

HAZCOM Label Information

Product Identification: 100 PPM ISOBUTYLENE IN AIR
CAGE: 42568
Assigned Individual: N
Company Name: LIQUID AIR CORP ALPHAGAZ DIVISION
Company PO Box:
Company Street Address1: 2121 N CALIFORNIA BLVD
Company Street Address2: WALNUT CREEK, CA 94596 US
Health Emergency Telephone: 800-231-1366
Label Required Indicator: Y
Date Label Reviewed: 07/28/2000
Status Code: A

Manufacturer's Label Number:
Date of Label:
Year Procured: N/K
Organization Code: F
Chronic Hazard Indicator: N
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: NO
Signal Word: CAUTION
Health Hazard: Slight
Contact Hazard: None
Fire Hazard: None
Reactivity Hazard: None

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Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

LEAD

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
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Section 1 - Product and Company Identification
LEAD

Product Identification: LEAD
Date of MSDS: 08/03/1989 **Technical Review Date:** 04/15/1998
FSC: 3439 **NIIN: LIIN:** 00N084991
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: BELMONT METALS INC
Manufacturer's Address1: 330 BELMONT AVE
Manufacturer's Address2: BROOKLYN, NY 11207
Manufacturer's Country: US
General Information Telephone: 718-342-4900
Emergency Telephone: 718-342-4900
Emergency Telephone: 718-342-4900
MSDS Preparer's Name: BRUCE N REED
Proprietary: N
Reviewed: N
Published: Y
CAGE: 70774
Special Project Code: N

Contractor Information

Contractor's Name: BELMONT METALS INC
Contractor's Address1: 330 BELMONT AVE
Contractor's Address2: BROOKLYN, NY 11207
Contractor's Telephone: 718-342-4900
Contractor's CAGE: 70774

Section 2 - Compositon/Information on Ingredients
LEAD

Ingredient Name: LEAD (SARA 313) (CERCLA)
Ingredient CAS Number: 7439-92-1 **Ingredient CAS Code:** M
RTECS Number: OF7525000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 99.99
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: SEE 1910.1025 **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 0.15 MG/M3 DUST **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1 LB
DOT Reporting Quantity: 1 LB
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
LEAD

Health Hazards Acute & Chronic: ACUTE: INHAL: LEAD INTOXICATION MAY RESULT FROM CHRONIC HIGH LEAD EXPOSURES W/SYMPS OF ANEMIA, INSOMNIA, WEAK, CONSTIPATION & GI DISORDER. INGESTION OF LEAD MAY CAUSE LEAD INTOXICATION W/ACCOMPANYING SYMPS OF NAUS & ABDOM PAIN. EYE: MECH IRRIT. SKIN: POSS MECH IRRIT OF SKIN. SIGNS & SYMPS ASSOC W/EXPOS(EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:
HLTH HAZ: OVER TLV: DISEASES OF BLOOD & BLOOD FORMING ORGANS, KIDNEYS, NERV & POSSIBLY REPRODUCTIVE SYSTEMS. LEAD APPEARS ON THE NAVY LISTING OF OCCUP CHEM REPROD HAZARDS. SEEK CONSULTATION FROM APPRO P HLTH PROFESSIONALS CONCERNING LATEST HAZARD LIST INFO & SAFE HNDLG & EXPOS INFO (FP N).

Medical Conditions Aggravated by Exposure:
NOT APPLICABLE.

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route of Entry Indicators:
- **Inhalation:** YES
- **Skin:** YES
- **Ingestion:** YES

Carcenogenicity Indicators
- **NTP:** NO
- **IARC:** NO
- **OSHA:** NO

Carcinogenicity Explanation: NOT RELEVANT.

Section 4 - First Aid Measures
LEAD

First Aid:
INHAL: REMOVE FROM EXPOSURE. GET IMMEDIATE MEDICAL ATTENTION. INGEST: GET IMMEDIATE MEDICAL ATTENTION. EYE CONT: FLUSH WITH COPIOUS QUANTITIES OF WATER FOR @ LST 15 MINS. GET IMMEDIATE MEDICAL ATTENTI ON. SKIN CONT: WASH THOROUGHLY WITH SOAP AND WATER.

Section 5 - Fire Fighting Measures
LEAD

Fire Fighting Procedures:
WEAR NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire or Explosion Hazard:
MOLTEN METALS PRODUCE FUME, VAPOR AND/OR DUST THAT MAY BE TOXIC AND OR RESPIRATORY IRRITANTS. WILL REACT WITH STRONG OXIDIZERS.

Extinguishing Media:
CHEMICAL OR CARBON DIOXIDE SHOULD BE USED ON SURROUNDING FIRE. DO NOT USE WATER ON FIRES WHERE MOLTEN METAL IS PRESENT.
Flash Point: Flash Point Text: NON FLAMMABLE

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/A
Upper Limit(s): N/A

Section 6 - Accidental Release Measures
LEAD

Spill Release Procedures:
DUST MATERIAL SHOULD BE VACUUMED OR WET SWEPT WHERE VACUUMING IS NOT FEASIBLE. PARTICULATE MATTER SHOULD BE STORED IN DRY CONTAINERS FOR LATER DISPOSAL. DO NOT USE COMPRESSED AIR OR DRY SWEEPING AS A MEANS OF CLEANING.

Section 7 - Handling and Storage
LEAD

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
LEAD

Repiratory Protection:
NIOSH APPROVED RESPIRATOR.
Ventilation:
NONE SPECIFIED BY MANUFACTURER.
Protective Gloves:
IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPRVD CHEM WORKERS GOGGLES (FP N).
Other Protective Equipment: ANSI APPRVD EYE WASH & DELUGE SHOWER (FP N). COVERALLS OR FULL BODY CLOTHING SHOULD BE WORN DURING PROD & USE (SUPDAT)
Work Hygenic Practices: NONE SPECIFIED BY MANUFACTURER.
Supplemental Health & Safety Information: OTHER PROT EQUIP: AND PROPERLY LAUNDERED AFTER USE.

Section 9 - Physical & Chemical Properties
LEAD

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: N/A

Melting/Freezing Point: Melting/Freezing Text: 631F,333C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: N/A **Vapor Density:** N/A
Percent Volatile Organic Content:
Specific Gravity: 11.34
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: NOT APPLICABLE
Solubility in Water: INSOLUBLE
Appearance and Odor: SILVERY GRAY METALLIC. NO ODOR.
Percent Volatiles by Volume: N/A
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
LEAD

Stability Indicator: YES
Materials to Avoid:
STRONG OXIDZERS AND THIS PRODUCT MAY LIBERATE HYDROGEN GAS.
Stability Condition to Avoid:
NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:
HIGH TEMPERATURES MAY PRODUCE HEAVY METAL FUME, VAPOR AND OR DUST.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT.

Section 11 - Toxicological Information
LEAD

Toxicological Information:
N/P

Section 12 - Ecological Information
LEAD

Ecological Information:
N/P

Section 13 - Disposal Considerations
LEAD

Waste Disposal Methods:
DISPOSE OF TOXIC SUBSTANCES IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGUALTIONS.

Section 14 - MSDS Transport Information
LEAD

Transport Information:

N/P

Section 15 - Regulatory Information
LEAD

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
LEAD

Other Information:
N/P

HAZCOM Label Information

Product Identification: LEAD
CAGE: 70774
Assigned Individual: N
Company Name: BELMONT METALS INC
Company PO Box:
Company Street Address1: 330 BELMONT AVE
Company Street Address2: BROOKLYN, NY 11207 NK
Health Emergency Telephone: 718-342-4900
Label Required Indicator: Y
Date Label Reviewed: 04/15/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 04/15/1998
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: WARNING
Health Hazard: Moderate
Contact Hazard: Slight
Fire Hazard: None
Reactivity Hazard: None

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

MERCURY

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
MERCURY

Product Identification: MERCURY
Date of MSDS: 02/15/1986 **Technical Review Date:** 04/10/1999
FSC: 6140 **NIIN:** 00-889-1027
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: FISHER SCIENTIFIC, CHEMICAL DIV.
Manufacturer's Address1: 1 REAGENT LANE
Manufacturer's Address2: FAIR LAWN, NJ 07410
Manufacturer's Country: US
General Information Telephone: 201-796-7100 OR 201-796-7523
Emergency Telephone: 201-796-7100
Emergency Telephone: 201-796-7100
MSDS Preparer's Name: GASTON L. PILLORI
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 1B464
Special Project Code: N

Item Description

Item Name: BATTERY,STORAGE
Item Manager: S9G
Specification Number: NK
Type/Grade/Class: NK
Unit of Issue: EA
Unit of Issue Quantity: 1
Type of Container:

Contractor Information

Contractor's Name: EAGLE PICHER INDUSTRIES
Post Office Box: 130
Contractor's Address1: BETHEL RD
Contractor's Address2: SENECA, MO 64865
Contractor's Telephone: 417-776-2256
Contractor's CAGE: 9H651

Contractor Information

Contractor's Name: FISHER SCIENTIFIC CO. CHEMICAL MFG DIV
Contractor's Address1: 1 REAGENT LANE
Contractor's Address2: FAIR LAWN, NJ 07410-2802
Contractor's Telephone: 201-796-7100
Contractor's CAGE: 1B464

Section 2 - Compositon/Information on Ingredients
MERCURY

Ingredient Name: MERCURY (SARA III)
Ingredient CAS Number: 7439-97-6 **Ingredient CAS Code:** M
RTECS Number: OV4550000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:

>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: UNKNOWN
% Enviromental Weight:
Other REC Limits: NONE RECOMMENDED
OSHA PEL: S, C, 0.1 MG/M3 **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: S, 0.05 MG/M3; 9293 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1 LB
DOT Reporting Quantity: 1 LB
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
MERCURY

Health Hazards Acute & Chronic: INHALATIONS OF HIGH CONCENTRATIONS OF MERCURY CAN CAUSE KIDNEY, LIVER, AND CENTRAL NERVOUS SYSTEM DAMAGE. SKIN ABSORPTION MAY CAUSE SIMILAR DAMAGE. CHRONIC EXPOSURE OVER A LONG TIME CAN CAUSE NERVOUS SYSTEM DAMAGE, KIDNEY AND LIVER DAMAGE.

Signs & Symptoms of Overexposure:
GI TRACT DISTURBANCES, WEAKNESS, COUGH, FEVER, TREMORS, IRRATABILITY AND METALLIC TASTE IN MOUTH. REDNESS AND ITCHING OF SKIN AND EYES.

Medical Conditions Aggravated by Exposure:
PERSONS WITH A CHRONIC DISEASE OR IN POOR HEALTH SHOULD BE EXCLUDED FROM MERCURY WORK AREA.

LD50 LC50 Mixture: 28 MG/M3 IDLH

Route of Entry Indicators:
- **Inhalation:** YES
- **Skin:** YES
- **Ingestion:** YES

Carcenogenicity Indicators
- **NTP:** NO
- **IARC:** NO
- **OSHA:** NO

Carcinogenicity Explanation: MERCURY IS NOT LISTED AS A CARCINOGEN BY NTP, IARC, OR OSHA.

Section 4 - First Aid Measures
MERCURY

First Aid:
EYES: IMMEDIATE AND PROLONGED FLUSHING WITH LOTS OF WATER WHILE HOLDING EYELIDS OPEN. SEE DOCTOR. SKIN: REMOVE CONTAMINATED CLOTHES. WASH AREA WITH LOTS OF SOAP AND WATER. INHALED: REMOVE PERSON TO FR ESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION OR OXYGEN. GET IMMEDIATE MEDICAL ATTENTION. INGESTED: GET IMMEDIATE MEDICAL ATTENTION.

Section 5 - Fire Fighting Measures
MERCURY

Fire Fighting Procedures:
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING. MOVE CONTAINERS FROM FIRE AREA IF POSSIBLE AT NO PERSONAL RISK.
Unusual Fire or Explosion Hazard:
MERCURY IS NOT COMBUSTIBLE, BUT WILL VAPORIZE RAPIDLY WHEN HEATED, CREATING TOXIC FUMES.
Extinguishing Media:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR FOAM.
Flash Point: Flash Point Text: NONFLAMMABLE

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/R
Upper Limit(s): N/R

Section 6 - Accidental Release Measures
MERCURY

Spill Release Procedures:
TAKE UP WITH ABSORBENT MATERIAL AND PLACE IN A CONTAINER FOR LATER DISPOSAL OR RECLAMATION.

Section 7 - Handling and Storage
MERCURY

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
MERCURY

Repiratory Protection:
IF ENGINEERING CONTROLS FAIL OR DURING EMERGENCIES USE NIOSH/MSHA APPROVED RESPIRATOR WITH CARTRIDGE FOR FOR MERCURY VAPOR. IF RESPIRATORS ARE USED; A PROGRAM IN ACCORDANCE WITH 29 CFR 1910.134 MUST B E IMPLEMENTED.

Ventilation:
LOCAL EXHAUST OR ADEQUATE MECHANICAL VENTILATION MUST BE USED.
Protective Gloves:
RUBBER
Eye Protection: SAFETY GLASSES/CHEMICAL SPLASH GOGGLES
Other Protective Equipment: EYE WASH STATION, CLOTHING TO PREVENT PROLONGED OR REPEATED CONTACT.
Work Hygenic Practices: WASH HANDS AFTER USE AND BEFORE EATING, DRINKING, OR SMOKING. LAUNDER CONTAMINATED CLOTHES BEFORE REUSE.
Supplemental Health & Safety Information: HCC BASED ON ITEM OF SUPPLY. MANUFACTURER PROVIDED MSDS FROM EACH PROVIDER OF RAW MATERIALS FOR THEIR MSDS FOR SILVER-ZINC BATTERY. OTHER MSDS FOR THIS BATTERY ARE UNDER THIS NSN AND THE FOLLOWING CAG E CODES: 40057, 56894, 1F136.

Section 9 - Physical & Chemical Properties
MERCURY

HCC: Z7
NRC/State License Number: N/R
Net Property Weight for Ammo: N/R
Boiling Point: =358.C, 676.4F **Boiling Point Text:**
Melting/Freezing Point: =-39.C, -38.2F **Melting/Freezing Text:**
Decomposition Point: Decomposition Text: UNKNOWN
Vapor Pressure: 0.0019 **Vapor Density:** 7.0(AIR=1)
Percent Volatile Organic Content:
Specific Gravity: 13.54
Volatile Organic Content Pounds per Gallon:
pH: N/A
Volatile Organic Content Grams per Liter:
Viscosity: N/R
Evaporation Weight and Reference: UNKNOWN
Solubility in Water: INSOLUBLE
Appearance and Odor: SILVER-WHITE LIQUID METAL;ODORLESS:CONTAINED IN A SILVER-ZINC BATTERY ELECTRODE
Percent Volatiles by Volume: N/K
Corrosion Rate: UNKNOWN

Section 10 - Stability & Reactivity Data
MERCURY

Stability Indicator: YES
Materials to Avoid:
ACETYLENE, AMMONIA, CHLORINE DIOXIDE, AZIDES, CALCIUM, SODIUM CARBIDE, LITHIUM, COPPER, BORON, OXYGEN, OXIDIZERS,
Stability Condition to Avoid:
CONTACT WITH OR STORAGE WITH INCOMPATIBLE MATERIALS AND EXCESSIVE HEAT.
Hazardous Decomposition Products:
MERCURY FUMES
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NONE

Section 11 - Toxicological Information
MERCURY

Toxicological Information:
N/P

Section 12 - Ecological Information
MERCURY

Ecological Information:
N/P

Section 13 - Disposal Considerations
MERCURY

Waste Disposal Methods:
DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS.

Section 14 - MSDS Transport Information
MERCURY

Transport Information:
N/P

Section 15 - Regulatory Information
MERCURY

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
MERCURY

Other Information:
N/P

HMIS Transportation Information

Product Identification: MERCURY
Transporation ID Number: 90111
Responsible Party CAGE: 1B464
Date MSDS Prepared: 02/15/1986
Date MSDS Reviewed: 09/20/1993
MFN: 09/20/1993
Submitter: D DG
Status Code: C

Container Information
Unit of Issue: EA

Container Quantity: 1
Type of Container:
Net Unit Weight: UNKNOWN

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity: N/R
Form:
Net Explosive Weight: N/R
Coast Guard Ammunition Code: N/R
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number: N/R
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:
TRANS SHIPPING NAME BASED ON ITEM OF SUPPLY- SILVER-ZINC BATTERY. MANUFACTURER SENT MSDS FOR ELEMENT AL COMPONENTS UNDER MFR OF EACH COMPONENT.

Department of Transportation Information

DOT Proper Shipping Name: BATTERIES, WET, FILLED WITH ALKALI
DOT PSN Code: BQP
Symbols:
DOT PSN Modifier: ELECTRIC STORAGE
Hazard Class: 8
UN ID Number: UN2795
DOT Packaging Group: III
Label: CORROSIVE
Special Provision(s):
Packaging Exception:
Non Bulk Packaging: 159
Bulk Packaging: 159
Maximimum Quanity in Passenger Area: 30 KG GRO
Maximimum Quanity in Cargo Area: NO LIMIT
Stow in Vessel Requirements: A
Requirements Water/Sp/Other:

IMO Detail Information

IMO Proper Shipping Name: BATTERIES,WET,FILLED WITH ALKALI
IMO PSN Code: BWF
IMO PSN Modifier: ,ELECTRIC STORAGE
IMDG Page Number: 8120
UN Number: 2795
UN Hazard Class: 8
IMO Packaging Group: III
Subsidiary Risk Label: -
EMS Number: 8-10
Medical First Aid Guide Number: 705

IATA Detail Information

IATA Proper Shipping Name: BATTERIES, WET, FILLED WITH ALKALI,
IATA PSN Code: CZR
IATA PSN Modifier: ELECTRIC STORAGE +
IATA UN Id Number: 2795
IATA UN Class: 8
Subsidiary Risk Class:
UN Packaging Group: III
IATA Label: CORROSIVE
Packaging Note for Passengers: 800
Maximum Quantity for Passengers: NO LIMIT
Packaging Note for Cargo: 800
Maximum Quantity for Cargo: NO LIMIT
Exceptions: A51

AFI Detail Information

AFI Proper Shipping Name: BATTERIES, WET, FILLED WITH ALKALI
AFI Symbols:
AFI PSN Code: CZR
AFI PSN Modifier: ,ELECTRIC STORAGE
AFI UN Id Number: UN2795
AFI Hazard Class: 8
AFI Packing Group: III
AFI Label:
Special Provisions: P5
Back Pack Reference: A12.5

HAZCOM Label Information

Product Identification: MERCURY
CAGE: 1B464
Assigned Individual: N
Company Name: FISHER SCIENTIFIC CO. CHEMICAL MFG DIV
Company PO Box:
Company Street Address1: 1 REAGENT LANE
Company Street Address2: FAIR LAWN, NJ 07410-2802 US
Health Emergency Telephone: 417-776-2256
Label Required Indicator: Y
Date Label Reviewed: 09/20/1993
Status Code: C
Manufacturer's Label Number: N/R
Date of Label: 09/20/1993
Year Procured: N/K
Organization Code: F
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: WARNING
Health Hazard: Moderate
Contact Hazard: None
Fire Hazard: None
Reactivity Hazard: None

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

METHANOL

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
METHANOL

Product Identification: METHANOL
Date of MSDS: 01/01/1987 **Technical Review Date:** 05/18/1999
FSC: 6810 **NIIN:** 00-275-6010
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: AIR PRODUCT AND CHEMICALS,INC
Manufacturer's Address1: 7201 HAMILTON BLVD
Manufacturer's Address2: ALLENTOWN, PA 18195-1501
Manufacturer's Country: US
General Information Telephone:
Emergency Telephone: 800-523-9374
Emergency Telephone: 800-523-9374
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 00742
Special Project Code: N

Item Description

Item Name: METHANOL,TECHNICAL
Item Manager: S9G
Specification Number: O-M-232
Type/Grade/Class: GRADE A
Unit of Issue: CN **Quantitative Expression:** 00000000005GL
Unit of Issue Quantity: 1
Type of Container: CAN

Contractor Information

Contractor's Name: AIR PRODUCTS AND CHEMICALS INC
Contractor's Address1: 7201 HAMILTON BLVD
Contractor's Address2: ALLENTOWN, PA 18195-1501
Contractor's Telephone: 800-345-3148/610-481-4911
Contractor's CAGE: 00742

Section 2 - Compositon/Information on Ingredients
METHANOL

Ingredient Name: METHYL ALCOHOL (METHANOL) (SARA III)
Ingredient CAS Number: 67-56-1 **Ingredient CAS Code:** M
RTECS Number: PC1400000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 99.8

% Enviromental Weight:
Other REC Limits: N/P
OSHA PEL: S,200PPM/250STEL **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: S,200PPM/250STEL; 93 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 5000 LBS
DOT Reporting Quantity: 5000 LBS
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
METHANOL

Health Hazards Acute & Chronic: N/P

Signs & Symptoms of Overexposure:
EYES:BURNS VISION FAILURE.SKIN:IRRITANT,DEFATTING AGENT.INHAL:IRRIT SKIN,MUCOUS,RESP SYS,HEADACHE

Medical Conditions Aggravated by Exposure:
N/P

LD50 LC50 Mixture: N/P

Route of Entry Indicators:
Inhalation: N/P
Skin: N/P
Ingestion: N/P

Carcenogenicity Indicators
NTP: N/P
IARC: N/P
OSHA: N/P

Carcinogenicity Explanation: N/P

Section 4 - First Aid Measures
METHANOL

First Aid:
INHALE:REMOVE TO FRESH AIR, GIVE CPR/O*2 IF NEED;EYES/SKIN:FLUSH W LG AMTS H*2O FOR 15 MIN;INGEST:RINSE MOUTH; GET MEDICAL ATTENTION FOR EYES, BREATHING DIFFICULTY, OR OTHER SYMPTOMS OF OVEREXPOSURE.

Section 5 - Fire Fighting Measures
METHANOL

Fire Fighting Procedures:
USE NIOSH APPROVED SCBA WITH FULL PROTECTION FOR FIREFIGHTNG
Unusual Fire or Explosion Hazard:

VAPORS ARE TOXIC,EXPLOSIVELY IGNITED WITHIN EXPLOSIVE LIMITS
Extinguishing Media:
CO*2,DRY CHEMICAL,WATER FOG
Flash Point: Flash Point Text: 53.6/12C (C.C.)

Autoignition Temperature:
Autoignition Temperature Text: 725F
Lower Limit(s): 6.7
Upper Limit(s): 36.0

Section 6 - Accidental Release Measures
METHANOL

Spill Release Procedures:
USE PERSONAL PROTECTIVE EQUIPMENT.ELIMINATE SOURCE OF IGNITION.COVER THE MATERIAL WITH ALCOHOL FOAM.PUMP LIQUID INTO DRUM.FOR INFO,NOTIFY THE AUTHORITIES IF NECESSARY.

Section 7 - Handling and Storage
METHANOL

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
METHANOL

Repiratory Protection:
USE NIOSH APPROVED RESPIRATOR FOR METHANOL OR SCBA.
Ventilation:
PROVIDE MECHAN(GEN/LOCAL EXHAUST)VENT TO MAINTN **Protective Gloves:** PV/RUBBER
Eye Protection: GOGGLES/FACE SHIELD
Other Protective Equipment: FULL PROTECTIVE CLOTHING,SAFETY SHOWER,EYE WASH STATION
Work Hygenic Practices: N/P
Supplemental Health & Safety Information: MAY 1,1985 IS DATED ON MSDS.

Section 9 - Physical & Chemical Properties
METHANOL

HCC: F2
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 148.5/64.7C
Melting/Freezing Point: Melting/Freezing Text: N/A
Decomposition Point: Decomposition Text: N/A
Vapor Pressure: 100 **Vapor Density:** 1.11
Percent Volatile Organic Content:

Specific Gravity: 0.590
Volatile Organic Content Pounds per Gallon:
pH: N/P
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: 12 (BUT ACETAT=1)
Solubility in Water: MISCIBLE
Appearance and Odor: CLEAR,COLORLESS,FLAMMABLE,MOBILE,HIGHLY POLAR LIQ.
Percent Volatiles by Volume: 100
Corrosion Rate: N/P

Section 10 - Stability & Reactivity Data
METHANOL

Stability Indicator: YES
Materials to Avoid:
STRONG OXIDIZING MATERIALS,CHROMIC ANHYDRIDES,PER CHLORIC AC
Stability Condition to Avoid:
SPARKS,FLAMES
Hazardous Decomposition Products:
FORMALDEHYDE,CO,FORMIC ACID
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NONE SPECIFIED

Section 11 - Toxicological Information
METHANOL

Toxicological Information:
N/P

Section 12 - Ecological Information
METHANOL

Ecological Information:
N/P

Section 13 - Disposal Considerations
METHANOL

Waste Disposal Methods:
CONSULT LOCAL AUTHORITIES.INCINERATION OR DISPOSAL MUST BE IN ACCORDANCE WITH LOCAL,STATE AND FEDERAL REGULATIONS.

Section 14 - MSDS Transport Information
METHANOL

Transport Information:
N/P

Section 15 - Regulatory Information
METHANOL

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
METHANOL

Other Information:
N/P

HMIS Transportation Information

Product Identification: METHANOL
Transporation ID Number: 65164
Responsible Party CAGE: 00742
Date MSDS Prepared: 01/01/1987
Date MSDS Reviewed: 02/29/1996
MFN: 02/29/1996
Submitter: D DG
Status Code: C

Container Information
- **Unit of Issue:** CN
- **Container Quantity:** 1
- **Type of Container:** CAN
- **Net Unit Weight:** 24.6 LBS

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: METHANOL
DOT PSN Code: JEZ
Symbols: I
DOT PSN Modifier: METHYL ALCOHOL SEE METHANOL

Hazard Class: 3
UN ID Number: UN1230
DOT Packaging Group: II
Label: FLAMMABLE LIQUID, POISON
Special Provision(s): T8
Packaging Exception:
Non Bulk Packaging: 202
Bulk Packaging: 242
Maximimum Quanity in Passenger Area: 1 L
Maximimum Quanity in Cargo Area: 60 L
Stow in Vessel Requirements: B
Requirements Water/Sp/Other: 40

IMO Detail Information

IMO Proper Shipping Name: METHANOL
IMO PSN Code: JPB
IMO PSN Modifier:
IMDG Page Number: 3251
UN Number: 1230
UN Hazard Class: 3.2
IMO Packaging Group: II
Subsidiary Risk Label: TOXIC
EMS Number: 3-06
Medical First Aid Guide Number: 306

IATA Detail Information

IATA Proper Shipping Name: METHANOL
IATA PSN Code: QHQ
IATA PSN Modifier:
IATA UN Id Number: 1230
IATA UN Class: 3
Subsidiary Risk Class: 6.1
UN Packaging Group: II
IATA Label: FLAMM. LIQ. & TOXIC
Packaging Note for Passengers: 305
Maximum Quantity for Passengers: 1L
Packaging Note for Cargo: 307
Maximum Quantity for Cargo: 60L
Exceptions: A104, A113

AFI Detail Information

AFI Proper Shipping Name: METHANOL OR METHYL ALCOHOL
AFI Symbols:
AFI PSN Code: QHQ
AFI PSN Modifier:
AFI UN Id Number: UN1230
AFI Hazard Class: 3
AFI Packing Group: II
AFI Label: 6.1
Special Provisions: P4
Back Pack Reference: A7.3

HAZCOM Label Information

Product Identification: METHANOL
CAGE: 00742

Assigned Individual: N
Company Name: AIR PRODUCTS AND CHEMICALS INC
Company PO Box:
Company Street Address1: 7201 HAMILTON BLVD
Company Street Address2: ALLENTOWN, PA 18195-1501 US
Health Emergency Telephone:
Label Required Indicator: Y
Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998
Year Procured: N/K
Organization Code: F
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
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EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
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Section 1 - Product and Company Identification
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Product Identification: EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)
Date of MSDS: 12/04/1989 **Technical Review Date:** 01/30/1995
FSC: 6810 **NIIN: LIIN:** 00N057170
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: EM SCIENCE
Post Office Box: 70
Manufacturer's Address1: 480 DEMOCRAT RD
Manufacturer's Address2: GIBBSTOWN, NJ 08027
Manufacturer's Country: US
General Information Telephone: 609-354-9200
Emergency Telephone: 800-424-9300 (CHEMTREC)
Emergency Telephone: 800-424-9300 (CHEMTREC)
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: DO242
Special Project Code: N

Contractor Information

Contractor's Name: E M SCIENCE DIV OF E M INDUSTRIES INC
Post Office Box: 70
Contractor's Address1: 480 DEMOCRAT ROAD
Contractor's Address2: GIBBSTOWN, NJ 08027
Contractor's Telephone: 800-222-0342/609-423-6300
Contractor's CAGE: 63612

Contractor Information

Contractor's Name: EM SCIENCE
Post Office Box: N/K
Contractor's Address1: 480 DEMOCRAT RD
Contractor's Address2: GIBBSTOWN, NJ 08927
Contractor's Telephone: 800-424-9300 (CHEMTREC)
Contractor's CAGE: DO242

Section 2 - Compositon/Information on Ingredients
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Ingredient Name: HEXANE; (N-HEXANE) (CERCLA)
Ingredient CAS Number: 110-54-3 **Ingredient CAS Code:** M
RTECS Number: MN9275000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:

% Text: 99.9
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: 500 PPM **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 50 PPM **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1 LB
DOT Reporting Quantity: 1 LB
Ozone Depleting Chemical: N

Ingredient Name: POLYCHLORINATED BIPHENYL (AROCHLOR 1254); (PCB 1254) SARA 313 (CERCLA)
Ingredient CAS Number: 11097-69-1 **Ingredient CAS Code:** M
RTECS Number: TQ1360000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 0.1
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: S, 0.5 MG/M3 **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: S, 0.5 MG/M3 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1 LB
DOT Reporting Quantity: 1 LB
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Health Hazards Acute & Chronic: TOXIC BY INGESTION AND INHALATION. VAPOR INHALATION CAUSES IRRITATION OF NASAL AND RESPIRATORY PASSAGES, HEADACHE, DIZZINESS, NAUSEA, CENTRAL NERVOUS SYSTEM DEPRESSION. CHRONIC OVEREXPOSURE CAN CAUSE SEVERE NERVE DAMAGE. MAY CAUSE IRRITATION ON CONTACT WITH SKIN OR EYES. MAY CAUSE DAMAGE TO KIDNEYS AND LIVER.

Signs & Symptoms of Overexposure:
SEE HEALTH HAZARDS.

Medical Conditions Aggravated by Exposure:
KIDNEY, LIVER, RESPIRATORY AND CNS CONDITIONS.

LD50 LC50 Mixture: LD50:(ORAL,RAT)28710 MG/KG

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES

Carcenogenicity Indicators
NTP: YES
IARC: YES
OSHA: NO

Carcinogenicity Explanation: AROCLOR 1254:IARC MONO, SUPP, V7, P322, 1987:GROUP 2A. NTP 7TH ANN RPT ON CARCIN, 1994:ANTIC TO BE CARCIN. ANIMAL:LIVER.

Section 4 - First Aid Measures
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE. SKIN:WASH THORO W/SOAP & WATER. EYES:IMMED FLUSH THORO W/WATER FOR @ LEAST 15 MINS. INHAL:REMOVE TO FRESH AIR; GIVE ARTF RESP IF BRTHG HAS STOPPED . INGEST:DO NOT INDUCE VOMIT; GET MED ATTN. REMOVE CONTAMD CLTHG & WASH BEFORE REUSE.

Section 5 - Fire Fighting Measures
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Fire Fighting Procedures:
USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire or Explosion Hazard:
DANGEROUS FIRE AND EXPLOSION HAZARD. VAPOR CAN TRAVEL DISTANCES TO IGNIT SOURCE & FLASH BACK.
Extinguishing Media:
CARBON DIOXIDE, DRY CHEMICAL, FOAM.
Flash Point: Flash Point Text: -7F,-22C

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): 1.2%
Upper Limit(s): 7.5%

Section 6 - Accidental Release Measures
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Spill Release Procedures:
CAUTION:PROD CONTAINS PCB'S (POLYCHLORINATED BIPHENYLS), TOX ENVIRON CONTAMINANT REQUIRING SPEC HNDLG & DISP I/A/W U.S. ENVIRON PROT AGENCY REGS 40 CFR 761. IN CASE OF ACCIDENT/SPILL, CALL TOLL FREE U .S. COAST GUARD

NATL RESPONSE CTR:800-424-8802.

Section 7 - Handling and Storage
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Repiratory Protection:
IF WORKPLACE EXPOS LIM(S) OF PROD/ANY COMPONENT IS EXCEEDED (SEE TLV/PEL), NIOSH/MSHA APPRVD AIR SUPPLIED RESP IS ADVISED IN ABSENCE OF PROPER ENVIRON CONTROL. OSHA REGS ALSO PERMIT OTHER NIOSH/MSHA R ESPS (NEGATIVE PRESS TYPE) (SUPDAT)
Ventilation:
MATL MUST BE HANDLED/TRANSFERRED IN APPRVD FUME HOOD OR W/ADEQ VENTILATION.
Protective Gloves:
NITRILE GLOVES.
Eye Protection: ANSI APPROVED CHEM SAFETY GOGGLES (FP N)
Other Protective Equipment: IMPERVIOUS PROTECT CLOTHING SHOULD BE WORN TO PVNT SKIN CONTACT.
Work Hygenic Practices: WASH THORO AFTER HANDLING. DO NOT TAKE INTERNALLY. EYE WASH & SFTY EQUIP SHOULD BE READILY AVAILABLE.
Supplemental Health & Safety Information: MFG TRADE NAME AND PART NO:1254 STANDARD. RESP PROT:UNDER SPECIFIED CNDTNS (SEE YOUR SFTY EQUIP SUPPLIER). ENGINEERING AND/OR ADMINISTRATIVE CONTROLS SHOULD BE IMPLEMENTED TO REDUCE EXPOSURE.

Section 9 - Physical & Chemical Properties
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 149F,65C
Melting/Freezing Point: Melting/Freezing Text: -139F,-95C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 125 @ 20C **Vapor Density:** 3.0
Percent Volatile Organic Content:
Specific Gravity: N/K
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: 9.0 (BUAC = 1)
Solubility in Water: SLIGHT
Appearance and Odor: LIQUID

Percent Volatiles by Volume: 100
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Stability Indicator: YES
Materials to Avoid:
OXIDIZERS.
Stability Condition to Avoid:
HEAT; CONTACT WITH IGNITION SOURCES.
Hazardous Decomposition Products:
CO*X.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT.

Section 11 - Toxicological Information
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Toxicological Information:
N/P

Section 12 - Ecological Information
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Ecological Information:
N/P

Section 13 - Disposal Considerations
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Waste Disposal Methods:
FOR PROPER DISP INFO, CONTACT NEAREST U.S. ENVIRONMENTAL AGENCY OFFICE. DISPOSAL MUST BE I/A/W FEDERAL, STATE & LOCAL REGULATIONS (FP N).

Section 14 - MSDS Transport Information
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Transport Information:
N/P

Section 15 - Regulatory Information
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)

Other Information:
N/P

HAZCOM Label Information

Product Identification: EP80805, POLYCHLORINATED BIPHENYL, PCB (SUPDAT)
CAGE: DO242
Assigned Individual: Y
Company Name: EM SCIENCE
Company PO Box: N/K
Company Street Address1: 480 DEMOCRAT RD
Company Street Address2: GIBBSTOWN, NJ 08927 NK
Health Emergency Telephone: 800-424-9300 (CHEMTREC)
Label Required Indicator: Y
Date Label Reviewed: 01/30/1995
Status Code: C
Manufacturer's Label Number:
Date of Label: 01/30/1995
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Moderate
Contact Hazard: Slight
Fire Hazard: Severe
Reactivity Hazard: None

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
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TETRACHLOROETHENE, 0-663

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
TETRACHLOROETHENE, 0-663

Product Identification: TETRACHLOROETHENE, 0-663
Date of MSDS: 07/01/1988 **Technical Review Date:** 11/03/1994
FSC: 6810 **NIIN: LIIN:** 00N054677
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: CHEM SERVICE INC
Post Office Box: 3108
Manufacturer's Address1:
Manufacturer's Address2: WEST CHESTER, PA 19381
Manufacturer's Country: US
General Information Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 84898
Special Project Code: N

Contractor Information

Contractor's Name: CHEM SERVICE INC
Post Office Box: 3108
Contractor's Address1: N/K
Contractor's Address2: WEST CHESTER, PA 19381
Contractor's Telephone: 215-692-3026
Contractor's CAGE: 84898

Contractor Information

Contractor's Name: CHEM SERVICE, INC
Post Office Box: 599
Contractor's Address1: 660 TOWER LN
Contractor's Address2: WEST CHESTER, PA 19301-9650
Contractor's Telephone: 610-692-3026
Contractor's CAGE: 8Y898

Section 2 - Compositon/Information on Ingredients
TETRACHLOROETHENE, 0-663

Ingredient Name: ETHYLENE, TETRACHLORO-; (TETRACHLOROETHYLENE) (SARA III)
Ingredient CAS Number: 127-18-4 **Ingredient CAS Code:** M
RTECS Number: KX3850000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:

% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: 25 PPM **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 25 PPM;100 PPM STEL **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 100 LBS
DOT Reporting Quantity: 100 LBS
Ozone Depleting Chemical: N

Ingredient Name: EYE PROTECTION: FULL LENGTH FACESHIELD (FP N).
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 2: ARRIVED. INGESTION: CALL MD IMMEDIATELY (FP N).
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K

OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: SUPP DATA: RESPS. IF PATIENT IS IN CARD ARREST ADMIN CPR. CONTINUE LIFE SUPPORTING MEASURES UNTIL MED ASSIST HAS (ING 3)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Section 3 - Hazards Identification, Including Emergency Overview
TETRACHLOROETHENE, 0-663

Health Hazards Acute & Chronic: CONT LENSES SHOULD NOT BE WORN IN LAB. ALL CHEMS SHOULD BE CONSIDERED HAZ-AVOID DIRECT PHYS CONT! CAN BE HARMFUL IF ABSORB THRU SKIN. CAN BE HARMFUL IF INHALED. CAN BE FATAL IF ABSORB THRU SKIN! CAN B E FATAL IF INHALED! MAY BE FATAL IF SWALLOWED! SUSPECTED CARCIN-MAY PRDCE CANCER. LACHRYMATOR-CAUSES (EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:
HLTH HAZ: SEV EYE IRRIT. VAPS &/OR DIRECT EYE CONT CAN CAUSE SEV EYE BURNS. CAN CAUSE EYE IRRIT. VAPS &/OR DIRECT EYE CONT CAN CAUSE SEV EYE BURNS. CAN CAUSE EYE IRRIT. CAN CAUSE SKIN IRRIT. CAN CAUSE SKIN BURNS. CAN CAUSE SEV SKIN BURNS. CAN BE HARMFUL IF SWALLOWED. CAN CAUSE LIVER INJ. CAN CAUSE KIDNEY INJ. (SUPDAT)

Medical Conditions Aggravated by Exposure:

NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: LD50 (ORAL,RAT): 8850 MG/KG.

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES

Carcenogenicity Indicators
NTP: YES
IARC: YES
OSHA: NO

Carcinogenicity Explanation: TETRACHLOROETHYLENE: IARC MONOGRAPHS SUPP, VOL 7, PG 355, 1987: GRP 2B. NTP 7TH ANNUAL REPORT ON CARCINS, 1994: (SUPDAT)

Section 4 - First Aid Measures
TETRACHLOROETHENE, 0-663

First Aid:
AN ANTIDOTE IS SUBSTANCE INTENDED TO COUNTERACT EFT OF POIS. IT SHOULD BE ADMIN ONLY BY PHYS/TRAINED EMER PERS. MED ADVICE CAN BE OBTAINED FROM POIS CNTRL CNTR. EYE: FLUSH CONTINUOUSLY W/WATER FOR AT LST 15-20 MINS. SKIN: FLUSH W/WATER FOR15-20 MINS. IF NO BURNS HAVE OCCURRED-USE SOAP & WATER TO CLEANSE SKIN. INHAL: REMOVE PATIENT TO FRESH AIR. ADMIN OXYGEN IF PATIENT IS HAVING DFCLTY (SUPDAT)

Section 5 - Fire Fighting Measures
TETRACHLOROETHENE, 0-663

Fire Fighting Procedures:
WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire or Explosion Hazard:
NONE SPECIFIED BY MANUFACTURER.
Extinguishing Media:
CARBON DIOXIDE, DRY CHEMICAL POWDER OR SPRAY.
Flash Point: Flash Point Text: NON-FLAMMABLE

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/A
Upper Limit(s): N/A

Section 6 - Accidental Release Measures
TETRACHLOROETHENE, 0-663

Spill Release Procedures:
EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE OR SIMILAR MATERIAL. SWEEP UP AND PLACE IN AN

APPROPRIATE CONTAINER. HOLD FOR DISPOSAL. WASH CONTAMINATE D SURFACES TO REMOVE ANY RESIDUES.

Section 7 - Handling and Storage
TETRACHLOROETHENE, 0-663

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
TETRACHLOROETHENE, 0-663

Repiratory Protection:
WEAR NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).
Ventilation:
CHEMICAL SHOULD BE HANDLED ONLY IN HOOD.
Protective Gloves:
IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPRVD CHEM WORKERS GOGG & (ING 4)
Other Protective Equipment: USE APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.EMER EYEWASH & DELUGE SHOWER WHICH MEET ANSI DESIGN CRITERIA (FP N).
Work Hygenic Practices: NONE SPECIFIED BY MANUFACTURER.
Supplemental Health & Safety Information: EXPLAN OF CARCIN: ANTIC TO BE CARCIN. ANIMAL: LIVER TUMORS. EFTS OF OVEREXP: CAN BE IRRIT TO MUC MEMB. PRLNGD EXPOS MAY CAUSE NAUS/HDCH, DIZZ &/OR EYE DMG. AVOID CONSUMPTION OF ALCOHOL BEFORE & AFTER HNDLG OF CMPD BECAUSE IT WILL INCR TOX OF CMPD. FIRST AID PROC: BRTHG. IF PATIENT HAS STOPPED BRTHG ADMIN ARTF (ING 2)

Section 9 - Physical & Chemical Properties
TETRACHLOROETHENE, 0-663

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 250F,121C
Melting/Freezing Point: Melting/Freezing Text: 71.6F,22C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 14 @ 20C **Vapor Density:** N/A
Percent Volatile Organic Content:
Specific Gravity: 1.623
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: NOT APPLICABLE
Solubility in Water: INSOLUBLE
Appearance and Odor: COLORLESS LIQUID.
Percent Volatiles by Volume: N/K

Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
TETRACHLOROETHENE, 0-663

Stability Indicator: YES
Materials to Avoid:
STRONG BASES, OXIDIZING AGENTS.
Stability Condition to Avoid:
NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:
DECOMPOSITION LIBERATES TOXIC FUMES. DECOMPOSITION PRODUCTS ARE CORROSIVE.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT.

Section 11 - Toxicological Information
TETRACHLOROETHENE, 0-663

Toxicological Information:
N/P

Section 12 - Ecological Information
TETRACHLOROETHENE, 0-663

Ecological Information:
N/P

Section 13 - Disposal Considerations
TETRACHLOROETHENE, 0-663

Waste Disposal Methods:
BURN IN CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER. DISPOSE OF IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS (FP N).

Section 14 - MSDS Transport Information
TETRACHLOROETHENE, 0-663

Transport Information:
N/P

Section 15 - Regulatory Information
TETRACHLOROETHENE, 0-663

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
TETRACHLOROETHENE, 0-663

Other Information:
N/P

HAZCOM Label Information

Product Identification: TETRACHLOROETHENE, 0-663
CAGE: 84898
Assigned Individual: N
Company Name: CHEM SERVICE INC
Company PO Box: 3108
Company Street Address1: N/K
Company Street Address2: WEST CHESTER, PA 19381 US
Health Emergency Telephone: 215-692-3026
Label Required Indicator: Y
Date Label Reviewed: 11/03/1994
Status Code: C
Manufacturer's Label Number:
Date of Label: 11/03/1994
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: WARNING
Health Hazard: Moderate
Contact Hazard: Moderate
Fire Hazard: None
Reactivity Hazard: None

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
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TOLUENE

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
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Section 1 - Product and Company Identification
TOLUENE

Product Identification: TOLUENE
Date of MSDS: 01/01/1985 **Technical Review Date:** 12/02/1998
FSC: 8030 **NIIN:** 00-432-1544
Submitter: F BT
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: ESSEX CHEMICAL CORP PRO-SEAL DIV
Manufacturer's Address1: 19451 SUSANA RD
Manufacturer's Address2: COMPTON, CA 90221-5713
Manufacturer's Country: US
General Information Telephone: 310-537-7600
Emergency Telephone: 310-537-7600
Emergency Telephone: 310-537-7600
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 83527
Special Project Code: N

Item Description

Item Name: SEALING COMPOUND
Item Manager: GSA
Specification Number: MIL-S-8802
Type/Grade/Class: TYPE 2; CLASS C-80
Unit of Issue: KT
Unit of Issue Quantity: 0
Type of Container: METAL

Contractor Information

Contractor's Name: ESSEX CHEMICAL CORP PRO-SEAL DIV
Contractor's Address1: 19451 SUSANA RD
Contractor's Address2: COMPTON, CA 90221-5713
Contractor's Telephone: 310-537-7600
Contractor's CAGE: 83527

Section 2 - Compositon/Information on Ingredients
TOLUENE

Ingredient Name: TOLUENE (SARA III)
Ingredient CAS Number: 108-88-3 **Ingredient CAS Code:** M
RTECS Number: XS5250000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/P

% Enviromental Weight:
Other REC Limits: N/P
OSHA PEL: 200 PPM/150 STEL **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 50 PPM; 9293 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1000 LBS
DOT Reporting Quantity: 1000 LBS
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
TOLUENE

Health Hazards Acute & Chronic: N/P

Signs & Symptoms of Overexposure:
N/P

Medical Conditions Aggravated by Exposure:
N/P

LD50 LC50 Mixture: N/P

Route of Entry Indicators:
- **Inhalation:** N/P
- **Skin:** N/P
- **Ingestion:** N/P

Carcenogenicity Indicators
- **NTP:** N/P
- **IARC:** N/P
- **OSHA:** N/P

Carcinogenicity Explanation: N/P

Section 4 - First Aid Measures
TOLUENE

First Aid:
N/P

Section 5 - Fire Fighting Measures
TOLUENE

Fire Fighting Procedures:
WATER NOT RECOMMENDED
Unusual Fire or Explosion Hazard:
VOLIATILE SOLVENT
Extinguishing Media:
CO2, FOAM, DRY CHEMICAL

Flash Point: Flash Point Text: 66 F CLOSED CUP

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): 1.3
Upper Limit(s): 7

Section 6 - Accidental Release Measures
TOLUENE

Spill Release Procedures:
N/P

Section 7 - Handling and Storage
TOLUENE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
TOLUENE

Repiratory Protection:
N/P
Ventilation:
N/P
Protective Gloves:
N/P
Eye Protection: N/P
Other Protective Equipment: N/P
Work Hygenic Practices: N/P
Supplemental Health & Safety Information: ESSEX CHEMICAL CORP., SPECIALTY CHEMICAL DIV. 19451 SUSANA ROAD, COMPTON, CA 90221

Section 9 - Physical & Chemical Properties
TOLUENE

HCC: F2
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 110.7 C
Melting/Freezing Point: Melting/Freezing Text: N/A
Decomposition Point: Decomposition Text: N/A
Vapor Pressure: 36. **Vapor Density:** 3.1
Percent Volatile Organic Content:
Specific Gravity: 0.86
Volatile Organic Content Pounds per Gallon:
pH: N/P
Volatile Organic Content Grams per Liter:

Viscosity: N/P
Evaporation Weight and Reference: 4.5
Solubility in Water: NIL
Appearance and Odor: WHITE PASTE, ORGANIC SULFIDE ODOR
Percent Volatiles by Volume: 14
Corrosion Rate: N/P

Section 10 - Stability & Reactivity Data
TOLUENE

Stability Indicator: N/P
Materials to Avoid:
N/P
Stability Condition to Avoid:
N/P
Hazardous Decomposition Products:
N/P
Hazardous Polymerization Indicator: N/P
Conditions to Avoid Polymerization:
N/P

Section 11 - Toxicological Information
TOLUENE

Toxicological Information:
N/P

Section 12 - Ecological Information
TOLUENE

Ecological Information:
N/P

Section 13 - Disposal Considerations
TOLUENE

Waste Disposal Methods:
N/P

Section 14 - MSDS Transport Information
TOLUENE

Transport Information:
N/P

Section 15 - Regulatory Information
TOLUENE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P

State Regulatory Information:
N/P

Section 16 - Other Information
TOLUENE

Other Information:
N/P

HAZCOM Label Information

Product Identification: TOLUENE
CAGE: 83527
Assigned Individual: N
Company Name: ESSEX CHEMICAL CORP PRO-SEAL DIV
Company PO Box:
Company Street Address1: 19451 SUSANA RD
Company Street Address2: COMPTON, CA 90221-5713 US
Health Emergency Telephone: 213-537-7600
Label Required Indicator: Y
Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

TRICHLOROETHENE, 0-664

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
TRICHLOROETHENE, 0-664

Product Identification: TRICHLOROETHENE, 0-664
Date of MSDS: 01/07/1993 **Technical Review Date:** 10/26/1994
FSC: 6810 **NIIN: LIIN:** 00N054683
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: CHEM SERVICE INC
Post Office Box: 3108
Manufacturer's Address1:
Manufacturer's Address2: WEST CHESTER, PA 19381
Manufacturer's Country: US
General Information Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 84898
Special Project Code: N

Contractor Information

Contractor's Name: CHEM SERVICE INC
Post Office Box: 3108
Contractor's Address1: N/K
Contractor's Address2: WEST CHESTER, PA 19381
Contractor's Telephone: 215-692-3026
Contractor's CAGE: 84898

Contractor Information

Contractor's Name: CHEM SERVICE, INC
Post Office Box: 599
Contractor's Address1: 660 TOWER LN
Contractor's Address2: WEST CHESTER, PA 19301-9650
Contractor's Telephone: 610-692-3026
Contractor's CAGE: 8Y898

Section 2 - Compositon/Information on Ingredients
TRICHLOROETHENE, 0-664

Ingredient Name: ETHYLENE, TRICHLORO-; (TRICHLOROETHYLENE) (SARA III). LD50: (ORAL,RAT) 4920 MG/KG.
Ingredient CAS Number: 79-01-6 **Ingredient CAS Code:** M
RTECS Number: KX4550000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:

% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: 100 PPM **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 50 PPM;100 STEL **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 100 LBS
DOT Reporting Quantity: 100 LBS
Ozone Depleting Chemical: N

Ingredient Name: OTHER PREC:CAUSE THE FORMATION OF HCL &/OR PHOSGENE (FP N).
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: SUPDAT:BY MD/TRAINED EMERGENCY PERSONNEL. MEDICAL ADVICE CAN BE OBTAINED FROM A POISON CONTROL CENTER.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K

% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Section 3 - Hazards Identification, Including Emergency Overview
TRICHLOROETHENE, 0-664

Health Hazards Acute & Chronic: ALL CHEMS SHOULD BE CONSIDERED HAZ - AVOID DIRECT PHYSICAL CONT! SUSPECTED CARCIN - MAY PRDCE CANCER. MAY BE HARMFUL IF ABSORBED THRU SKIN, INHALED/SWALLOWED. LACHRYMATOR - CAUSES SEV EYE IRRIT. VAPS &/OR DIRECT EYE CONT CAN CAUSE SEV EYE BURNS. CAN CAUSE SKIN/EYE IRRIT. CAUSE CAUSE SKIN BURNS. CAN (EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:
HLTH HAZ:CAUSE SEV SKIN BURNS. EXPOS CAN CAUSE LIVER/KIDNEY DMG. CAN CAUSE GI DISTURBS. CAN BE IRRIT TO MUC MEMBS. PRLNG EXPOS MAY CAUSE NAUS, HDCH, DIZZ &/OR EYE DMG. CAN CAUSE SENSIT BY SKIN CONT. C HLOROCARBON MATLS HAVE PRDCD SENSIT OF MYOCARDIUM TO EPINEPHRINE IN LAB ANIMALS & COULD HAVE SIMILAR EFT IN (SUPP DATA)

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: SEE INGREDIENT.

Route of Entry Indicators:
- **Inhalation:** YES
- **Skin:** YES
- **Ingestion:** YES

Carcenogenicity Indicators
- **NTP:** NO
- **IARC:** NO
- **OSHA:** NO

Carcinogenicity Explanation: NOT RELEVANT

Section 4 - First Aid Measures
TRICHLOROETHENE, 0-664

First Aid:
INGEST:CALL MD IMMED (FP N). EYES:FLUSH CONTINUOUSLY W/WATER FOR AT LST 15-20 MINS. SKIN:FLUSH W/WATER FOR 15-20 MINS. IF NO BURNS HAVE OCCURRED - USE SOAP & WATER TO CLEANSE SKIN. INHAL:REMOVE PATIEN T TO FRESH AIR. ADMIN

OXYGEN IF PATIENTIS HAVING DFCLTY BRTHG. IF PATIENT HAS STOPPED BRTHG ADMIN ARTF RESP. IF PATIENT IS IN CARDIAC ARREST ADMIN CPR. CONTINUE LIFE SUPPORTING MEASURES UNTIL(SUPDAT)

Section 5 - Fire Fighting Measures
TRICHLOROETHENE, 0-664

Fire Fighting Procedures:
USE NIOSH/MSHA APPROVED PRESSURE DEMAND SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire or Explosion Hazard:
THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE HCL & PHOSGENE (FP N).
Extinguishing Media:
CARBON DIOXIDE, DRY CHEMICAL POWDER OR SPRAY.
Flash Point: Flash Point Text: NON-FLAMMABLE

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): 11%
Upper Limit(s): 41%

Section 6 - Accidental Release Measures
TRICHLOROETHENE, 0-664

Spill Release Procedures:
EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE OR SIMILAR MATERIAL. SWEEP UP & PLACE IN AN APPROPRIATE CONTAINER. HOLD FOR DISPOSAL. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.

Section 7 - Handling and Storage
TRICHLOROETHENE, 0-664

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
TRICHLOROETHENE, 0-664

Repiratory Protection:
NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).
Ventilation:
THIS CHEMICAL SHOULD ONLY BE HANDLED IN A HOOD.
Protective Gloves:
IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS (FP N).
Other Protective Equipment: USE APPROPRIATE NIOSH/MSHA APPROVED SAFETY EQUIPMENT.

Work Hygenic Practices: CONTACT LENSES SHOULD NOT BE WORN IN THE LABORATORY. ANSI APPRVD EYE WASH & DELUGE SHOWER (FP N).
Supplemental Health & Safety Information: EFTS OF OVEREXP:HUMANS. ADRENOMIMETICS (E.G., EPINEPRHINE) MAY BE CONTRAINDICATED EXCEPT FOR LIFE-SUSTAINING USES IN HUMANS ACUTELY/CHRONICALLY EXPOS TO CHLOROCARBONS (FP N). FIRST AID PROC:MED ASSIST ANCE HAS ARRIVED. NOTE:AN ANTIDOTE IS ASUBSTANCE INTENDED TO COUNTERACT EFT OF A POIS. IT SHOULD BE ADMIN ONLY (ING 2)

Section 9 - Physical & Chemical Properties
TRICHLOROETHENE, 0-664

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 189F,87C
Melting/Freezing Point: Melting/Freezing Text: -125F,-87C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 58 @ 20C **Vapor Density:** N/K
Percent Volatile Organic Content:
Specific Gravity: 1.462
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/K
Solubility in Water: INSOL (IMMISCIBLE)
Appearance and Odor: COLORLESS LIQUID.
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
TRICHLOROETHENE, 0-664

Stability Indicator: YES
Materials to Avoid:
INCOMPATIBLE W/STRONG BASES, STRONG OXIDIZING AGENTS.
Stability Condition to Avoid:
NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:
DECOMPOSITION LIBERATES TOXIC FUMES. DECOMPOSTION PRODUCTS ARE CORROSIVE. VOLATILE. HCL, PHOSGENE (FP N).
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT

Section 11 - Toxicological Information
TRICHLOROETHENE, 0-664

Toxicological Information:
N/P

Section 12 - Ecological Information

TRICHLOROETHENE, 0-664

Ecological Information:
N/P

Section 13 - Disposal Considerations
TRICHLOROETHENE, 0-664

Waste Disposal Methods:
DISPOSAL MUST BE I/A/W FEDERAL, STATE & LOCAL REGULATIONS (FP N). BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AFTERBURNER & SCRUBBER.

Section 14 - MSDS Transport Information
TRICHLOROETHENE, 0-664

Transport Information:
N/P

Section 15 - Regulatory Information
TRICHLOROETHENE, 0-664

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
TRICHLOROETHENE, 0-664

Other Information:
N/P

HAZCOM Label Information

Product Identification: TRICHLOROETHENE, 0-664
CAGE: 84898
Assigned Individual: N
Company Name: CHEM SERVICE INC
Company PO Box: 3108
Company Street Address1: N/K
Company Street Address2: WEST CHESTER, PA 19381 US
Health Emergency Telephone: 215-692-3026
Label Required Indicator: Y
Date Label Reviewed: 10/26/1994
Status Code: C
Manufacturer's Label Number:
Date of Label: 10/26/1994
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES

Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Moderate
Contact Hazard: Severe
Fire Hazard: None
Reactivity Hazard: None

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
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UNLEADED GASOLINE

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
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Section 1 - Product and Company Identification
UNLEADED GASOLINE

Product Identification: UNLEADED GASOLINE
Date of MSDS: 08/01/1989 **Technical Review Date:** 07/04/1999
FSC: 9130 **NIIN:** 00-148-7102
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: NEWFOUNDLAND DOCKYARD CORP (PROCESSING)
Post Office Box: 97
Manufacturer's Address1: JOBS BRIDGE XING
Manufacturer's Address2: ST. JOHNS, NF 00000
Manufacturer's Country: H5
General Information Telephone: 709-463-8811 (24 HRS) FAX -8058
Emergency Telephone: 709-463-8811 (24 HRS)
Emergency Telephone: 709-463-8811 (24 HRS)
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 0M8E5
Special Project Code: N

Item Description

Item Name: GASOLINE,AUTOMOTIVE
Item Manager:
Specification Number: ASTM D4814
Type/Grade/Class: CL A,B,C,D,E,SPEC GR
Unit of Issue: GL
Unit of Issue Quantity: X
Type of Container: UNKNOWN

Contractor Information

Contractor's Name: NEWFOUNDLAND DOCKYAARD CORP
Post Office Box: 97
Contractor's Address1: JOBS BRIDGE CROSSING
Contractor's Address2: ST JOHNS NEW FOUNDLAND CANADA, NK 00000
Contractor's Telephone: 709-463-8811
Contractor's CAGE: 0M8E5

Section 2 - Compositon/Information on Ingredients
UNLEADED GASOLINE

Ingredient Name: GASOLINE
Ingredient CAS Number: 8006-61-9 **Ingredient CAS Code:** M
RTECS Number: LX3300000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:

% High Volume: % High Volume Code:
% Text: 99
% Enviromental Weight:
Other REC Limits: NONE SPECIFIED
OSHA PEL: 300 PPM/500 STEL **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 300 PPM/500STEL;9192 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
UNLEADED GASOLINE

Health Hazards Acute & Chronic: ACUTE-INHALE:HIGH VAPOR CONCENTRATIONS ARE IRRITATING TO THE EYES,NOSE,THROAT & LUNGS.MAY CAUSE HEADACHE,DIZZINESS,SUFFOCATION,ANESTHETIC & CNS EFFECTS.EYE:IRRITATING.SKIN:FREQUENT/PROLONGED CONTACT M AY IRRITATE & CAUSE RASH.ORAL:HARMFUL/FATAL.IF ASPIRATED INTO THE LUNGS,MAY CAUSE PULMONARY EDEMA.CHRONIC-BLOOD DISORDER

Signs & Symptoms of Overexposure:
HIGH VAPOR CONCENTRATIONS ARE IRRITATING TO THE EYES, NOSE, THROAT & LUNGS. MAY CAUSE HEADACHE, DIZZINESS, SUFFOCATION, ANESTHETIC & CNS EFFECTS. EYE IRRITATING. FREQUENT OR PROLONGED SKIN CONTACT MAY IRRITATE & CAUSE RASH. HARMFUL OR FATALIF INGESTED. IF ASPIRATED INTO THE LUNGS, MAY CAUSE PULMONARY EDEMA.

Medical Conditions Aggravated by Exposure:
PERSONS WITH PRE-EXISTING SKIN DISORDERS OR IMPAIRED LIVER, KIDNEY OR RESPIRATORY FUNCTION MAY BE MORE SUSCEPTIBLE TO THE EFFECTS OF THE SUBSTANCE.

LD50 LC50 Mixture: ORAL LD50 (RAT) IS UNKNOWN

Route of Entry Indicators:
- **Inhalation:** YES
- **Skin:** YES
- **Ingestion:** NO

Carcenogenicity Indicators
- **NTP:** YES
- **IARC:** YES
- **OSHA:** YES

Carcinogenicity Explanation: CONTAINS BENZENE. GASOLINE VAPORS CAUSED KIDNEY CANCER IN RATS AND LIVER CANCER IN MICE.

Section 4 - First Aid Measures

UNLEADED GASOLINE

First Aid:
GET MEDICAL ATTENTION IF SYMPTOMS PERSIST.SKIN:WASH WITH SOAP & WATER.EYE:FLUSH WITH WATER FOR 15 MINUTES,HOLDING EYELIDS OPEN.INHALED:REMOVE TO FRESH AIR & PROVIDE OXYGEN/CPR IF NEEDED.ORAL:DO NOT IN DUCE VOMITING.GET MEDICAL ATTENTION.DO NOT GIVE LIQUID.KEEP AT REST.SMALL AMOUNTS WHICH ACCIDENTALLY ENTER THE MOUTH SHOULD BE RINSED WITH WATER UNTIL TASTE OF GASOLINE IS GONE.

Section 5 - Fire Fighting Measures
UNLEADED GASOLINE

Fire Fighting Procedures:
WEAR FULL PROTECTIVE CLOTHING AND NIOSH-APPROVED SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN THE POSITIVE PRESSURE MODE.
Unusual Fire or Explosion Hazard:
EXTREMELY FLAMMABLE. MATERIAL WILL ACCUMULATE STATIC CHARGE. DISCHARGE MAY CAUSE FIRE. FORMS SMOKE, CARBON MONOXIDE, CARBON DIOXIDE, SULFUR OXIDES.
Extinguishing Media:
USE CARBON DIOXIDE, FOAM/DRY CHEMICAL. WATER SPRAY MAY BE USED TO KEEP FIRE EXPOSED CONTAINERS COOL & FLUSH SPILLS AWAY.
Flash Point: Flash Point Text: -40F,-40C

Autoignition Temperature:
Autoignition Temperature Text: 495F
Lower Limit(s): 1.5
Upper Limit(s): 7.6

Section 6 - Accidental Release Measures
UNLEADED GASOLINE

Spill Release Procedures:
WEAR PROTECTIVE EQUIPMENT. ELIMINATE SOURCES OF IGNITION. VENTILATE THE AREA. CONTAIN THE SPILL. PICK UP LARGE SPILL WITH NON-SPARKING TOOLS; SMALL SPILLS/RESIDUE WITH INERT ABSORBENT MATERIAL. PLACE IN CONTAINERS. PREVENT ENTERING WATERWAYS/SEWERS.

Section 7 - Handling and Storage
UNLEADED GASOLINE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
UNLEADED GASOLINE

Repiratory Protection:
WHERE CONCENTRATIONS IN AIR MAY EXCEED THE OCCUPATIONAL EXPOSURE LIMITS,NIOSH-APPROVED CHEMICAL CARTRIDGE RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE IS RECOMMENDED.AT HIGHER CONCENTRATION,WEAR AN ATMOSPH ERE SUPPLIED AIRLINE BREATHING APPARATUS
Ventilation:
MECHANICAL (GENERAL AND/OR LOCAL EXHAUST, EXPLOSION-PROOF) VENTILATION TO MAINTAIN EXPOSURE BELOW TLV(S).
Protective Gloves:
NEOPRENE, NITRILE, OR POLYVINYL ALCOHOL
Eye Protection: USE CHEMICAL SAFETY GOGGLES & FACESHIELD
Other Protective Equipment: EYE WASH STATION, QUICK DRENCH SHOWER AND IMPERVIOUS CLOTHING
Work Hygenic Practices: DO NOT TAKE INTERNALLY. AVOID EYE AND SKIN CONTACT. DO NOT BREATHE VAPORS.
Supplemental Health & Safety Information: N/P

Section 9 - Physical & Chemical Properties
UNLEADED GASOLINE

HCC: F1
NRC/State License Number: N/R
Net Property Weight for Ammo: N/R
Boiling Point: =25.C, 77.F **Boiling Point Text:**
Melting/Freezing Point: =-60.C, -76.F **Melting/Freezing Text:**
Decomposition Point: Decomposition Text: N/R
Vapor Pressure: 450 **Vapor Density:** 3 - 4
Percent Volatile Organic Content:
Specific Gravity: O.73 - 0.83
Volatile Organic Content Pounds per Gallon:
pH: N/R
Volatile Organic Content Grams per Liter:
Viscosity: N/K
Evaporation Weight and Reference: N/K
Solubility in Water: INSOLUBLE
Appearance and Odor: GREEN COLORED LIQUID WITH HYDROCARBON ODOR
Percent Volatiles by Volume: 100
Corrosion Rate: UNKNOWN

Section 10 - Stability & Reactivity Data
UNLEADED GASOLINE

Stability Indicator: YES
Materials to Avoid:
STRONG OXIDIZING AGENTS, PYROPHORIC MATERIALS
Stability Condition to Avoid:
HEAT, SPARKS, STATIC ELECTRICITY, HOT SURFACES, OPEN FLAMES AND OTHER SOURCES OF IGNITION
Hazardous Decomposition Products:
FUMES, SMOKE, CARBON MONOXIDE, CARBON DIOXIDE AND SULFUR OXIDES
Hazardous Polymerization Indicator: NO

Conditions to Avoid Polymerization:
NOT APPLICABLE

Section 11 - Toxicological Information
UNLEADED GASOLINE

Toxicological Information:
N/P

Section 12 - Ecological Information
UNLEADED GASOLINE

Ecological Information:
N/P

Section 13 - Disposal Considerations
UNLEADED GASOLINE

Waste Disposal Methods:
WASTE MAY BE BURNED IN AN APPROVED INCINERATOR OR DISPOSED OF IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL LAWS AND REGULATIONS.

Section 14 - MSDS Transport Information
UNLEADED GASOLINE

Transport Information:
N/P

Section 15 - Regulatory Information
UNLEADED GASOLINE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
UNLEADED GASOLINE

Other Information:
N/P

HMIS Transportation Information

Product Identification: UNLEADED GASOLINE
Transporation ID Number: 50957
Responsible Party CAGE: 0M8E5
Date MSDS Prepared: 08/01/1989
Date MSDS Reviewed: 06/30/1992
MFN: 06/30/1992
Submitter: D DG

Status Code: C

Container Information
Unit of Issue: GL
Container Quantity: X
Type of Container: UNKNOWN
Net Unit Weight: N/K

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: GASOLINE
DOT PSN Code: GTN
Symbols:
DOT PSN Modifier:
Hazard Class: 3
UN ID Number: UN1203
DOT Packaging Group: II
Label: FLAMMABLE LIQUID
Special Provision(s): B33,B101,T8
Packaging Exception:
Non Bulk Packaging: 202
Bulk Packaging: 242
Maximimum Quanity in Passenger Area: 5 L
Maximimum Quanity in Cargo Area: 60 L
Stow in Vessel Requirements: E
Requirements Water/Sp/Other:

IMO Detail Information

IMO Proper Shipping Name: GASOLINE
IMO PSN Code: HRV
IMO PSN Modifier:
IMDG Page Number: 3141
UN Number: 1203
UN Hazard Class: 3.1
IMO Packaging Group: II
Subsidiary Risk Label: -

EMS Number: 3-07
Medical First Aid Guide Number: 311

IATA Detail Information

IATA Proper Shipping Name: MOTOR SPIRIT
IATA PSN Code: RMF
IATA PSN Modifier:
IATA UN Id Number: 1203
IATA UN Class: 3
Subsidiary Risk Class:
UN Packaging Group: II
IATA Label: FLAMMABLE LIQUID
Packaging Note for Passengers: 305
Maximum Quantity for Passengers: 5L
Packaging Note for Cargo: 307
Maximum Quantity for Cargo: 60L
Exceptions: A100

AFI Detail Information

AFI Proper Shipping Name: GASOLINE
AFI Symbols:
AFI PSN Code: MUC
AFI PSN Modifier:
AFI UN Id Number: UN1203
AFI Hazard Class: 3
AFI Packing Group: II
AFI Label:
Special Provisions: P5
Back Pack Reference: A7.3

HAZCOM Label Information

Product Identification: UNLEADED GASOLINE
CAGE: 0M8E5
Assigned Individual: N
Company Name: NEWFOUNDLAND DOCKYAARD CORP
Company PO Box: 97
Company Street Address1: JOBS BRIDGE CROSSING
Company Street Address2: ST JOHNS NEW FOUNDLAND CANADA, NK 00000 CA
Health Emergency Telephone: 709-463-8811 (24 HRS)
Label Required Indicator: Y
Date Label Reviewed: 06/30/1992
Status Code: C
Manufacturer's Label Number: UNKNOWN
Date of Label: 06/30/1992
Year Procured: N/K
Organization Code: F
Chronic Hazard Indicator: N/P
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Moderate
Contact Hazard: Slight
Fire Hazard: Severe

Reactivity Hazard: None

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CORNELL

Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

XYLENES

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

The information in this document is compiled from information maintained by the United States Department of Defense (DOD). Anyone using this information is solely reponsible for the accuracy and applicability of this information to a particular use or situation.
Cornell University does not in any way warrant or imply the applicability, viability or use of this information to any person or for use in any situation.

Section 1 - Product and Company Identification
XYLENES

Product Identification: XYLENES
Date of MSDS: 02/27/1997 **Technical Review Date:** 10/26/1998
FSC: 6810 **NIIN:** 01-169-7800
Submitter: D DG
Status Code: A
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: FISHER SCIENTIFIC, CHEMICAL DIV.
Manufacturer's Address1: 1 REAGENT LANE
Manufacturer's Address2: FAIR LAWN, NJ 07410
Manufacturer's Country: US
General Information Telephone: 201-796-7100 OR 201-796-7523
Emergency Telephone: 201-796-7100/800-424-9300(CHEMTREC)
Emergency Telephone: 201-796-7100/800-424-9300(CHEMTREC)
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 1B464
Special Project Code: N

Item Description

Item Name: XYLENE,ACS
Item Manager:
Specification Number: N/R
Type/Grade/Class: N/R
Unit of Issue:
Unit of Issue Quantity:
Type of Container: BOTTLE

Contractor Information

Contractor's Name: FISHER SCIENTIFIC CO. CHEMICAL MFG DIV
Contractor's Address1: 1 REAGENT LANE
Contractor's Address2: FAIR LAWN, NJ 07410-2802
Contractor's Telephone: 201-796-7100
Contractor's CAGE: 1B464

Section 2 - Compositon/Information on Ingredients
XYLENES

Ingredient Name: XYLENES (O-,M-,P- ISOMERS) (SARA 313) (CERCLA)
Ingredient CAS Number: 1330-20-7 **Ingredient CAS Code:** M
RTECS Number: ZE2100000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100

% Enviromental Weight:
Other REC Limits: NONE RECOMMENDED
OSHA PEL: 100 PPM **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 100 PPM/150STEL;9596 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1000 LBS
DOT Reporting Quantity: 1000 LBS
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
XYLENES

Health Hazards Acute & Chronic: EYE-CAUSES SEVERE EYE IRRITATION. SKIN-MAY CAUSE IRRITATION. INGESTION-MAY CAUSE CENTRAL NERVOUS SYSTEM EFFECTS. INHALATION-INHALATION OF HIGH CONCENTRATIONS MAY CAUSE CENTRAL NERVOUS SYSTEM EFFECTS. CHRONIC: PERMANENT BRAIN AND NERVOUS SYSTEM DAMAGE.

Signs & Symptoms of Overexposure:
SKIN-REDNESS, DRYNESS & INFLAMMATION. INGESTION-HEADACHE, EXCITEMENT, FATIGUE, NAUSEA, VOMITING, STUPOR & COMA. INHALATION-HEADACHE, DIZZINESS, UNCONSCIOUSNESS & COMA.

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: ORAL LD50 (RAT) IS 13 MG/L/24HRS

Route of Entry Indicators:
- **Inhalation:** YES
- **Skin:** YES
- **Ingestion:** YES

Carcenogenicity Indicators
- **NTP:** NO
- **IARC:** NO
- **OSHA:** NO

Carcinogenicity Explanation: THIS SUBSTANCE HAS CAUSED ADVERSE REPRODUCTIVE & FETAL EFFECTS IN ANIMALS.

Section 4 - First Aid Measures
XYLENES

First Aid:
EYES-IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR 15 MIN, GET MEDICAL AID. SKIN-IMMEDIATELY FLUSH SKIN WITH PLENTY OF SOAP & WATER. GET MEDICAL AID IF IRRITATION DEVELOPS. INGEST-DO NOT INDUCE VOMITING. IF CONSCIOUS & ALERT, GIVE 2-4 CUPS OFMILK OR WATER. GET MEDICAL AID. INHALATIONGET MEDICAL AID

IMMEDIATELY. REMOVE FROM EXPOSURE TO FRESH AIR. PERFORM CPR OR GIVE OXYGEN IF BREATHING IS DIFFICULT.

Section 5 - Fire Fighting Measures
XYLENES

Fire Fighting Procedures:
AS IN ANY FIRE, WEAR A SELF-CONTAINED BREATHING APPARATUS IN PRESSURE-DEMAND. MSHA/NIOSH & FULL PROTECTIVE GEAR.
Unusual Fire or Explosion Hazard:
VAPORS MAY TRAVEL TO A SOURCE OF IGNITION AND FLASH BACK.
Extinguishing Media:
FOR SMALL FIRES, USE DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR ALCOHOL-RESISTANT FOAM. USE WATER TO COOL EXPOSED CONT
Flash Point: Flash Point Text: 76.0F,24.4C

Autoignition Temperature:
Autoignition Temperature Text: 527C
Lower Limit(s): 1.0
Upper Limit(s): 7.0

Section 6 - Accidental Release Measures
XYLENES

Spill Release Procedures:
ABSORB SPILL WITH INERT MATERIAL, THEN PLACE INTO A CHEMICAL WASTE CONTAINER. REMOVE ALL SOURCES OF IGNITION.

Section 7 - Handling and Storage
XYLENES

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
XYLENES

Repiratory Protection:
A NIOSH/MSHA APPROVED AIR PURIFYING RESPIRATOR WITH AN ORGANIC VAPOR CARTRIDGE OR CANISTER MAY BE PERMISSIBLE UNDER CERTAIN CIRCUMSTANCES WHERE AIRBORNE CONCENTRATIONS ARE EXPECTED.
Ventilation:
USE ADEQUATE GENERAL OR LOCAL EXHUAST VENTILATION TO KEEP AIRBORNE CONCENTRATIONS BELOW THE PERMISSIBLE EXPOSURE LIMITS.
Protective Gloves:
WEAR PROTECTIVE GLOVES.
Eye Protection: WEAR SAFETY GLASSES/CHEMICAL GOGGLES.
Other Protective Equipment: WEAR APPROPIATE PROTECTIVE CLOTHING TO MINIMIZE CONTACT WITH SKIN.

Work Hygenic Practices: WASH THOROUGHLY AFTER HANDLING.
Supplemental Health & Safety Information: N/P

Section 9 - Physical & Chemical Properties
XYLENES

HCC: F4
NRC/State License Number: N/R
Net Property Weight for Ammo: N/R
Boiling Point: Boiling Point Text: 282-288F
Melting/Freezing Point: Melting/Freezing Text: -53F,-47C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 21 MMHG **Vapor Density:** 3.66
Percent Volatile Organic Content:
Specific Gravity: 0.864
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/R6 SUS
Evaporation Weight and Reference: 0.6
Solubility in Water: INSOLUBLE
Appearance and Odor: LIQUID. COLORLESS. AROMATIC ODOR.
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
XYLENES

Stability Indicator: YES
Materials to Avoid:
STRONG ACIDS, STRONG OXIDIZERS AND 1,3-DICHLORO-5,5-DIMETHYL-2,4-IMIDAZOLIDINDIONE.
Stability Condition to Avoid:
HIGH TEMPERATURES, INCOMPATIBLE MATERIALS, IGNITION SOURCES.
Hazardous Decomposition Products:
CARBON MONOXIDE, CARBON DIOXIDE.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NONE.

Section 11 - Toxicological Information
XYLENES

Toxicological Information:
N/P

Section 12 - Ecological Information
XYLENES

Ecological Information:
N/P

Section 13 - Disposal Considerations
XYLENES

Waste Disposal Methods:
DISPOSE OF IN A MANNER CONSISTENT WITH LOCAL, STATE AND FEDERAL REGULATIONS. DOT: XYLENES, 3, UN 1307.

Section 14 - MSDS Transport Information
XYLENES

Transport Information:
N/P

Section 15 - Regulatory Information
XYLENES

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
XYLENES

Other Information:
N/P

HMIS Transportation Information

Product Identification: XYLENES
Transporation ID Number: 112761
Responsible Party CAGE: 1B464
Date MSDS Prepared: 02/27/1997
Date MSDS Reviewed: 10/26/1998
MFN: 10/26/1998
Submitter: D DG
Status Code: A

Container Information
- **Unit of Issue:**
- **Container Quantity:**
- **Type of Container:** BOTTLE
- **Net Unit Weight:** 1 LBS

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity: N/R
Form:
Net Explosive Weight: N/R
Coast Guard Ammunition Code: N/R
Magnetism: N/P

AF MMAC Code: NR
DOD Exemption Number: N/R
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: XYLENES
DOT PSN Code: PWS
Symbols:
DOT PSN Modifier:
Hazard Class: 3
UN ID Number: UN1307
DOT Packaging Group: III
Label: FLAMMABLE LIQUID
Special Provision(s): B1,T1
Packaging Exception: 150
Non Bulk Packaging: 203
Bulk Packaging: 242
Maximimum Quanity in Passenger Area: 60 L
Maximimum Quanity in Cargo Area: 220 L
Stow in Vessel Requirements: A
Requirements Water/Sp/Other:

IMO Detail Information

IMO Proper Shipping Name: XYLENES
IMO PSN Code: PPF
IMO PSN Modifier:
IMDG Page Number: 3394
UN Number: 1307
UN Hazard Class: 3.3
IMO Packaging Group: III
Subsidiary Risk Label: -
EMS Number: 3-07
Medical First Aid Guide Number: 310

IATA Detail Information

IATA Proper Shipping Name: XYLENES
IATA PSN Code: ZPL
IATA PSN Modifier:
IATA UN Id Number: 1307
IATA UN Class: 3
Subsidiary Risk Class:
UN Packaging Group: III
IATA Label: FLAMMABLE LIQUID
Packaging Note for Passengers: 309
Maximum Quantity for Passengers: 60L
Packaging Note for Cargo: 310
Maximum Quantity for Cargo: 220L

Exceptions:

AFI Detail Information

AFI Proper Shipping Name: XYLENES
AFI Symbols:
AFI PSN Code: ZPL
AFI PSN Modifier:
AFI UN Id Number: UN1307
AFI Hazard Class: 3
AFI Packing Group: III
AFI Label:
Special Provisions: P5
Back Pack Reference: A7.3

HAZCOM Label Information

Product Identification: XYLENES
CAGE: 1B464
Assigned Individual: N
Company Name: FISHER SCIENTIFIC CO. CHEMICAL MFG DIV
Company PO Box:
Company Street Address1: 1 REAGENT LANE
Company Street Address2: FAIR LAWN, NJ 07410-2802 US
Health Emergency Telephone: 201-796-7100/800-424-9300(CHEMTREC)
Label Required Indicator: Y
Date Label Reviewed: 10/26/1998
Status Code: C
Manufacturer's Label Number: N/R
Date of Label: 10/26/1998
Year Procured: N/K
Organization Code: F
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Severe
Contact Hazard: Slight
Fire Hazard: Moderate
Reactivity Hazard: None

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NORTH WIND, INC.

SAFETY AND HEALTH PLAN

ATTACHMENT 7

APPLICABLE PHYSICAL AGENT DATA SHEETS

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Physical Agent Data Sheet (PADS)

Noise

Description

Sound is created when a vibrating source (like a bell, motor or a stereo speaker) sends sound waves through the air to your ear. Every sound has two aspects: its pitch (frequency) and its loudness (intensity). On a stereo, the bass/treble control determines frequency, while the volume control determines intensity. Noise (unwanted sound) usually consists of many frequencies. The disturbing and harmful effects of noise depend on both its loudness and its frequency.

Loudness is measured in units called decibels (dB). A conversational voice is about 65 dB. A shout is 90 dB or greater.

Frequency is measured in units called Hertz (Hz). The frequency of a locomotive horn is about 250 Hz. The frequency of a table saw is about 4,000 Hz.

Health Effects

Excessive noise can destroy the ability to hear, and may also put stress of other parts of the body, including the heart. Most noise damage has no cure, so prevention of excessive noise exposure is the only way to avoid health damage.

Hearing

The damage done by noise depends mainly on its intensity and on the length of exposure. The frequency or pitch can also have some effect, since high-pitched sounds are more damaging than low-pitched sounds.

Noise may tire out the inner ear, causing temporary hearing loss. After a period of time away from the noise hearing may be restored. Some workers who suffer temporary hearing loss may find that by the time their hearing returns to normal, it is time for another work shift so, in that sense, the problem is "permanent."

With continual noise exposure, the ear will lose its ability to recover from temporary hearing loss, and the damage will become permanent. Permanent hearing loss results from the destruction of cells in the inner ear, cells which can never be replaced or repaired. Such damage can be caused by long-term exposure to loud noise or, in some cases by brief exposures to very loud noises.

Normally, workplace noise first affects the ability to hear high frequency (high-pitched) sounds. This means that even though a person can still hear some noise, speech or other sounds may be unclear or distorted.

Workers suffering from noise-induced hearing loss may also experience continual ringing in their ears, called tinnitus. At this time, there is no cure for tinnitus, although some doctors are experimenting with treatment.

Other Effects

Although research on the effects of noise is not complete, it appears that noise can cause an increased pulse rate, increased blood pressure and a narrowing of the blood vessels over a long period of time. This may place an added burden on the heart.

Noise may also put stress on other parts of the body by causing abnormal hormonal secretion and muscle tension.

Workers exposed to noise sometimes complain of nervousness, sleeplessness and fatigue. Excessive noise exposure also can reduce job performance and may cause high rates of absenteeism.

Permissible Exposure Limit

The action level for noise is an average noise level of 85 dB for an eight-hour day. When employees are exposed to noise levels that exceed the Permissible Exposure Limit, the employer must install or use engineering or administrative controls to lower the noise levels. While these

controls are being designed or installed employees must wear hearing protection. If the controls still do not reduce noise exposures to below 90 dB, employees must continue to wear hearing protection.

Protective Measures

Suitable hearing protectors (earplugs or muffs) must be made available at no cost to employees who are exposed to an average of 85 dB or greater for an eight-hour day. Employees must be given the opportunity to select from three different types of appropriate hearing protectors.

Hearing tests (audiometric exams) must be given to employees who are exposed to an average of 85 dB or greater for an eight-hour day. Hearing tests will demonstrate whether employees are experiencing any hearing losses and illustrate the effectiveness of the hearing protection program. Hearing tests must be given annually.

Employees should also receive training in the effects of noise on hearing, an explanation of the hearing tests, and instruction on the proper fitting and care of earplugs or muffs. Noise away from work can also cause hearing loss. Hearing protectors should be worn when operating noisy equipment or tools such as chainsaws, brush cutters, power lawn mowers, or when using firearms.

Refer to Alaska Administrative Code, Occupational Health and Environmental Control 04.0104 for specific regulations on Noise Exposure and Hearing Conservation Programs.

Source: http://www.labor.state.ak.us/lss/noise.htm

Physical Agent Data Sheet (PADS)

Cold Stress

Exposure to cold can cause the body's internal temperature to drop to a dangerously low level. This is called hypothermia. Exposure to temperatures below freezing can cause frostbite of the hands, feet, and face.

Hypothermia Can Kill

Hypothermia occurs when a person's body loses heat faster than it can be produced. The body's "normal" deep body temperature is 99.6 degrees Fahrenheit. If your body temperature drops to 95 degrees Fahrenheit, uncontrollable shivering occurs. If cooling continues, these other symptoms may occur:

- Vague, slow, slurred speech
- Forgetfulness, memory lapses
- Inability to use hands
- Frequent stumbling
- Drowsiness
- Exhaustion, collapse
- Unconsciousness
- Death

Hypothermia impairs your judgment. You may not be able to make good decisions about your situation. Preventing hypothermia is the best way to avoid being a victim.

Preventing Hypothermia: Be Prepared

Hypothermia can occur at temperatures above freezing. Cold, wet, windy conditions make prime hypothermia weather.

Stay Dry - Avoid Exposure

Wet clothing draws heat very quickly away from the body. Whenever you may be away from shelter or your vehicle, carry waterproof, windproof outer clothing. Put this clothing on before you get wet. Wear inner clothing that retains warmth even when it's wet, such as wool or polypropylene. Avoid cotton clothing. Down clothing is good for cold, dry weather but it loses almost all-insulating value if it gets wet. Wear layers of clothing that may be removed or put back on depending on the degree of physical activity. Being wet from sweat is just as dangerous as being wet from rain or snow.

Terminate Exposure

If you do not have adequate clothing to stay warm and dry, get out of the wind and rain or snow. Return to shelter or make camp while you still have a reserve of energy. Build a fire. Make your camp as secure and as comfortable as possible.

Treatment of Hypothermia

Be able to recognize the symptoms of hypothermia in yourself and others. The victim may deny he/she is in trouble. Even mild symptoms demand attention.

- Get the victim out of wet and windy weather.
- Remove all wet clothing.

If the person is only mildly affected:

- Give warm drinks.
- Put into dry clothing and a warm sleeping bag.

If more seriously affected (very clumsy, confused, unable to shiver):

- Treat very gently.
- Place the victim naked into a warm sleeping bag.
- Place a rescuer, also naked, into the same sleeping bag. If you have a double bag, place the victim between two rescuers. Warmth from skin to skin contact is the safest method of rewarming. Any warm objects such as rocks, hot water bottles, or heat packs should be wrapped in towels or clothing. Arrange for evacuation.

Do not give warm drinks until the victim has regained a clear level of consciousness, the ability to swallow, and is already starting to warm up.

Frostbite

Frostbite is the freezing of some part of the body. Fingers, toes, and even whole arms and legs can be lost as a result of frostbite. Such injuries have happened in cities and villages as well as in more isolated areas of Alaska. Frostbite information was compiled and distributed by the Providence Hospital Thermal Unit.

Protection From the Cold

In extreme cold it is important to prevent heat loss from as many areas of the body as possible. Exposed limbs and head are major areas of heat loss, but keeping enough blood flowing to the hands and feet is the key to preventing frostbite. The trunk and the head, then, should be warm enough so that the brain is able to command the blood vessels in the hands and feet to open up.

Essential Clothing

This includes thermal underwear, insulated footwear or mukluks with liners, double mittens and a parka, preferably down-filled with a good ruff. A parka that can be opened at the neck to allow heat to escape will prevent overheating and sweating. Quilted or skin pants are necessary if no warm shelter is immediately available. Tight clothes, especially tight gloves or tight boots, should not be worn. They interfere with blood flow and reduce insulation against the cold.

Traveling

The traveler, even on a snowmobile, or in a heated automobile, should always be prepared to walk in severe cold. This means carrying along proper clothing and more extensive survival gear. If an accident, mechanical breakdown, or other interruption occurs during travel, the clothes you have must provide enough warmth to sustain life. Hands and feet should be well protected at all times to hinder the development of frostbite until help arrives.

Some Special Warnings

Don't touch cold metal with bare or wet hands. You will freeze to the metal and tear away skin. If necessary, thaw gently with heat, warm water or urine.

Be careful when handling gasoline, kerosene or liquids other than water. Contact at cold temperatures can cause immediate frostbite.

Remember that frostbite is more likely to occur when you are injured, frightened or careless.

Other Factors Leading to Frostbite:

Tall thin persons are more likely to get frostbite than those of stocky build.

People in poor physical condition are more susceptible than those in good health.

Certain diseases slow down the blood flow in the hands and feet, especially in elderly people, and encourage frostbite.

Heavy smokers often have poor circulation in the vital organs and to the arms and legs, and are also susceptible.

Children and elderly people, unable to produce large amounts of body heat for long periods of time, may experience a lowering of deep body temperature and, ultimately, frostbite.

Alcohol causes the blood vessels to dilate (become larger). This lends a sense of warmth, but it also insures a faster loss of body heat. More importantly, people act with poor judgment after drinking.

In short, poor circulation and poor production of body heat will lower resistance to frostbite.

How to Recognize Frostbite

Pain in the hands and feet is felt only when the temperature of the tissue is changing very rapidly. There may be no pain with gradual freezing.

Loss of the sensations of touch, pressure, and pain may occur without awareness of any numbness or other sensation. Therefore, it is important to test these sensations often and to wear clothing that is loose and does not restrict the flow of blood to the limbs.

Exposed parts of the body should be inspected routinely. This is done best by a partner. Just before freezing, the skin, especially the face with its many blood vessels, becomes bright red. Then small patches of white appear, as freezing actually occurs.

The skin also becomes less elastic. This is best noted in the finger pads, which remain pitted when touched or squeezed. Any further cooling will surely result in frostbite.

Serious freezing most often occurs in the feet due to lessened awareness, poor circulation and sensation, and inadequate footgear. Hands are next in order of serious injury. Exposed head parts are less likely to become frostbitten than feet because they are conditioned to exposure and have a better blood supply.

Early Treatment of Frostbite: Proper Re-warming

Next to the extent of freezing, inadequate or improper treatment of a frozen part is the most common cause of serious loss of tissue.

In many cases rewarming cannot be done without the part again becoming frozen. For example, removing clothing from other parts of the body to warm a frozen part may only result in the loss of more body heat, greater extent of injury, and the ultimate refreezing of the afflicted part.

Thawing and refreezing should always be avoided. It is best to continue, even if it means walking on a frozen foot, until shelter is available and rewarming can be done satisfactorily.

Limbs should be rewarmed in stirred water just above normal body temperature (about 100 - 105 degrees Fahrenheit). Using a thermometer is the only accurate way to measure this temperature. Never try to thaw in cold water or snow. Since feeling is lost, never use fires, stoves, exhaust pipes, or other extreme heat source. Serious damage to the tissue could result.

If the major part of the limb is frozen when rewarming is started, deep body temperature will fall as the cooled blood begins to flow throughout the body. To prevent such cooling, give warm liquids to drink. Even total immersion of the body in a warm bath may be necessary.

Rewarming is an acutely painful experience and medication to alleviate pain should be given if available. After thawing, a deep aching pain may persist for several days, depending upon severity of the injury. Pain is actually a good sign, since it indicates that nerve function is still present.

The afflicted part should be moved gently and voluntarily during rewarming.

A dull purple color, swelling or blisters indicate more serious injury and require medical attention. Other means for improving circulation are available but must be administered by medical personnel.

Summary

Most cases of frostbite result from lack of knowledge, careless preparation, unavoidable accident, or the effects of alcohol on judgment. Intelligent forethought can prevent injury.

If freezing does occur, proper re-warming in warm water will give maximum benefit. The injured limb should be handled gently and a medical judgment made of the extent of the injury and the need for further treatment.

Source: http://www.labor.state.ak.us/lss/cold.htm

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NORTH WIND, INC.

SAFETY AND HEALTH PLAN

ATTACHMENT 8

FORT WAINWRIGHT SPILL PREVENTION, CONTROL AND COUNTERMEASURES PLAN

SPILL PREVENTION CONTROL AND COUNTERMEASURE PLANS

FORT WAINWRIGHT, ALASKA

Prepared for the United States Army Alaska
by
The U.S. Army Corps of Engineers, Alaska District

December 1999

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1.0 GENERAL INFORMATION

1.1 Installation Name: U.S. Army Garrison, Fort Wainwright, Alaska

1.2 Installation Location: Fort Wainwright's main cantonment area is partly within the city limits of Fairbanks at approximately 64° 50' N latitude, 147° 37' W longitude, Township 1 South, Range 1 East, Sections 7 and 8, Fairbanks Meridian.

1.3 Installation Owner/Operator: United States Army Alaska

1.4 Spill Prevention Contact: Directorate of Public Works, Environmental Office, 353-6489

1.5 Authority: This Spill Prevention Control and Countermeasure (SPCC) Plan was prepared in accordance with Title 40, Code of Federal Regulations, Part 112 (40 CFR 112) as they pertain to nontransportation-related, nonproduction, onshore storage facilities. This SPCC plan is required because the Fort Wainwright military installation has a total underground fuel storage capacity exceeding 42,000 gallons, total aboveground fuel storage capacity exceeding 1,320 gallons (or has an aboveground tank with a capacity exceeding 660 gallons). Information on the Fort Wainwright Pest Control Facility is not specified in 40 CFR 112; however, it is included in accordance with AR 200-1, chapter 3-3.

This plan documents methods implemented at the installation to prevent oil spills from reaching navigable waters. It includes spill prevention, discovery, and emergency notification procedures. A copy of this plan will be maintained at the Fort Wainwright Public Works office and at each site having an aboveground storage tank with a capacity of 660 gallons or greater. Public Works environmental staff will formally review and, if necessary, amend this plan at least once every three years or within six months after a change in facility design, construction, operation, or maintenance that affects the potential for spill of oil or hazardous substances. Any amendments will be prepared under the direction of, reviewed, and sealed by a registered professional engineer.

This plan requires the documentation of the following activities or events:

- Equipment inspections, tests, and repairs
- Personnel fuel handling and spill response training
- Reportable spills
- Corrective actions to prevent recurring spills
- Investigations (including soil, surface water and/or ground water)

2.0 INSTALLATION DESCRIPTION

Fort Wainwright consists of more than 915,000 acres, including training areas, at the eastern boundary of the city of Fairbanks in interior Alaska (figure 2-1). The 13,530-acre main post cantonment area is east of downtown Fairbanks, partly within the city limits. It is bounded on the north by the Chena River and Birch Hill and on the south by the Richardson Highway and the Tanana River.

Fort Wainwright is in the continental climate zone of interior Alaska, which is characterized as semi-arid, having extreme summer and winter temperatures, and relatively light precipitation. Temperatures range from -60 °F in winter to over 90 °F in summer. Annual average precipitation is 10.4 inches; mean average snowfall in Fairbanks is 66 inches.

Most of Fort Wainwright is in the lowlands of the Tanana River floodplain, which consists of alluvial deposits of sand and gravel, with generally less than 10 percent silt and an overlying fine-grained surface soil up to about 5 feet thick.

The Tanana basin alluvium is the main aquifer in the Fort Wainwright area and ranges from a few feet thick near the base of Birch Hill to approximately 300 feet thick beneath the main cantonment area. The aquifer is considered to be unconfined in areas free of permafrost, and water generally is encountered in the upper 20 feet below the ground surface. The ground water flows generally to the west-northwest, which is similar to the flow of the Chena River. Environmentally sensitive areas on or near the installation include the Chena and Tanana Rivers and the high water table, which would make ground water susceptible to contamination from fuel spills.

Fuel on Fort Wainwright is used to heat buildings and operate vehicles and aircraft. It is distributed directly to post users by private contractor tanker trucks.

The Army owns and operates nine aboveground fuel storage tanks, three of which constitute the Forward Area Refueling Point (FARP), which is the Army's only aboveground bulk fuel storage facility on Fort Wainwright. The remaining six tanks range in capacity from 300 to 1,000 gallons. These six tanks, all transformers, and all underground storage tanks are exempt from 40 CFR 112 because their locations are such that they could not reasonably be expected to discharge oil into or upon navigable waters or adjoining shorelines. Inventories of Fort Wainwright's aboveground and underground fuel storage tanks, including exempt tanks, are in tables 3-1 and 3-2. An inventory of transformers on Fort Wainwright is in table 3-4.

Fort Wainwright has two tenant agencies, the Bureau of Land Management (BLM) and the U.S. Air Force (USAF), that operate fuel storage facilities located on Army land. The tanks are owned and operated by the USAF and BLM and are covered in separate SPCC plans, maintained by the USAF and BLM, respectively. The USAF and BLM tanks on Fort Wainwright are referenced in this plan only to complete Fort Wainwright's inventory.

The BLM operates an Alaska Fire Service (AFS) facility at building 1510 near the airfield. The facility consists five tanks: two 10,000-gallon aboveground storage tanks containing Avgas, two tanks containing Jet A50, 8,000-gallon and 8,600-gallon respectively, and a 350-gallon tank containing gasoline. The four larger tanks are filled only during the fire season and are hauled offsite the remainder of the year. The BLM has an SPCC plan for the AFS fuel storage tanks. A copy of BLM's SPCC plan is on file at the Fort Wainwright Public Works Environmental Office. An inventory of these tanks is in table 3-1.

The Air Force has 31 tanks on Fort Wainwright's Yukon Training Area (figure 2-2). These are operated by the contractor Lockheed Martin. The Air Force operates 13 tanks at Blair Lakes Range, which is located on Fort Wainwright's Tanana Flats Training Area (figures 2-3 and 2-3a). A list of the Air Force Tanks is in table 3-1. Specific information about the Air Force tanks may be found in the *Oil and Hazardous Substance Discharge Prevention and Contingency Plan, Eielson Air Force Base, Alaska*, which is on file in the Fort Wainwright Public Works Environmental Office.

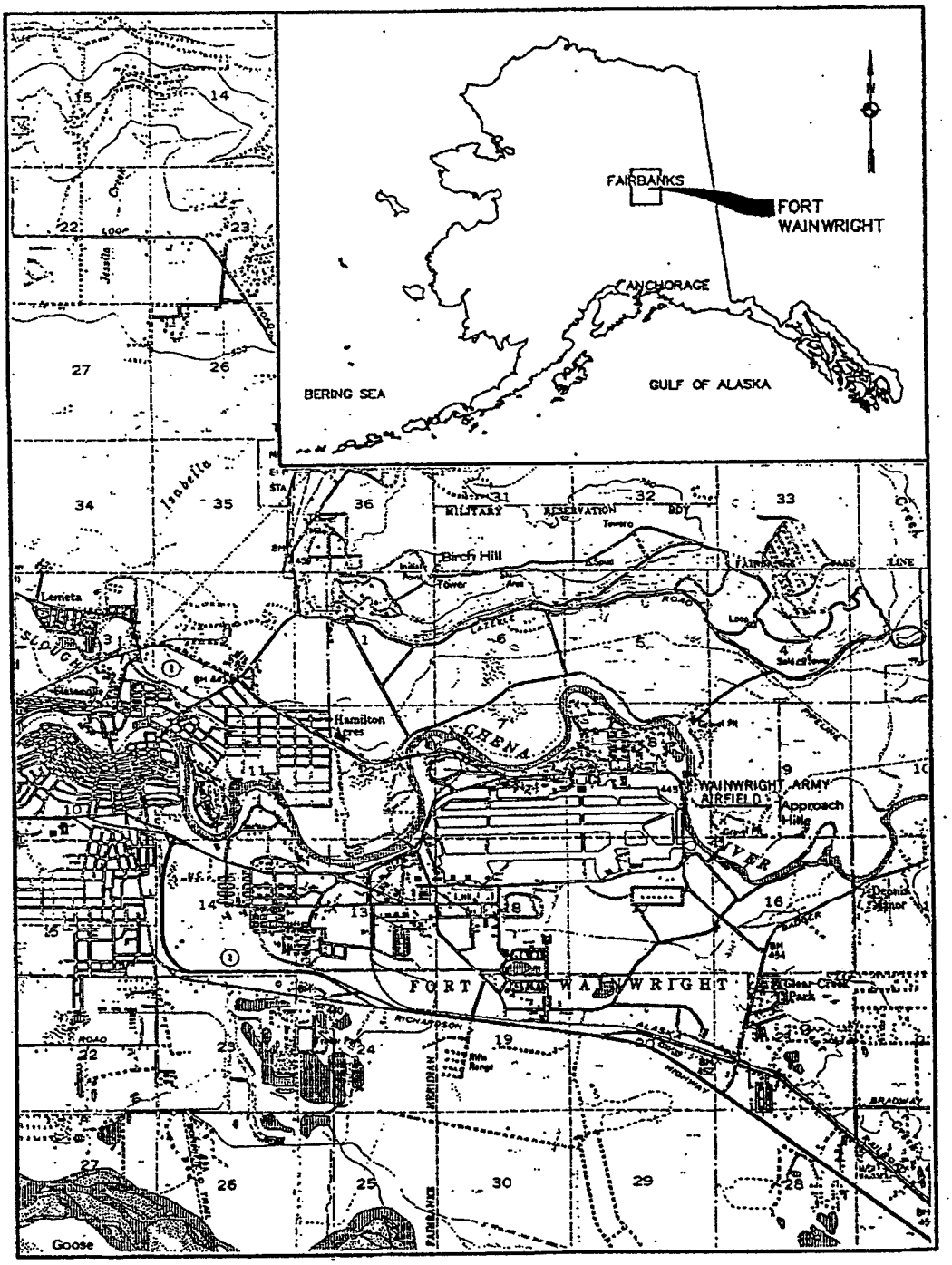
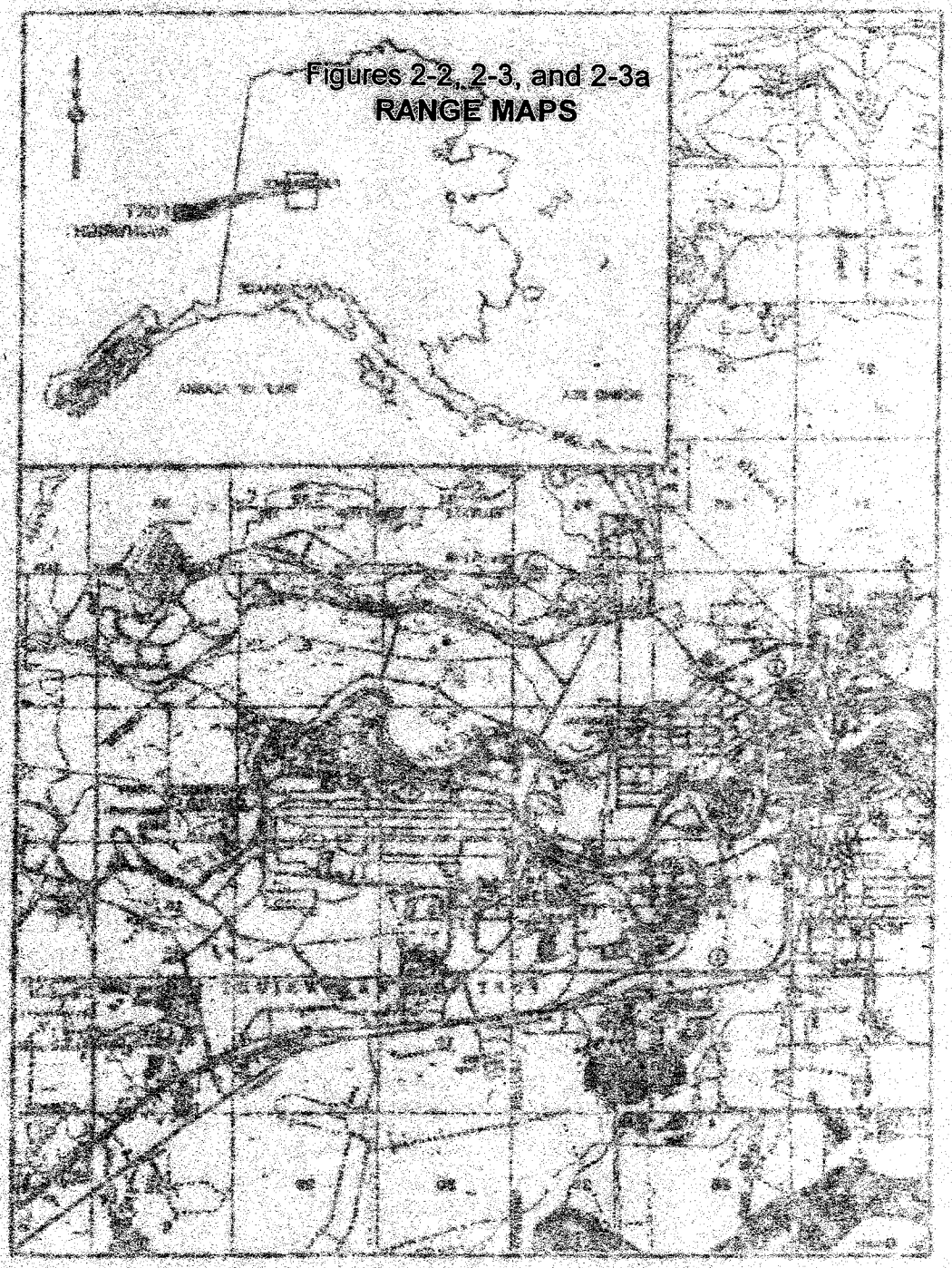


Figure 2-1. Location and Vicinity Map


Figures 2-2, 2-3, and 2-3a
RANGE MAPS

3.0 POTENTIAL SPILL SITES

3.1 Oil Storage Tanks

3.1.1 Aboveground Storage Tanks. Fort Wainwright has 9 aboveground fuel storage tanks with capacities ranging from 300 gallons to 13,000 gallons (table 3-1). These tanks combined can hold 43,100 gallons of fuel.

Forward Area Refueling Point (FARP). The FARP consists of three 13,000-gallon aboveground fuel storage tanks, containing JP-4 fuel for aircraft. The tanks were originally installed at the bulk aviation fuel storage area at Fort Greely in 1948. The tanks are 16 feet tall, approximately 12 feet in diameter, and are constructed from butt-welded steel plates. The FARP tanks have no internal heating coils.

The tanks were relocated in 1995 to the helicopter refueling point at the air field on Fort Wainwright. As part of the installation, the tanks were repaired by Public Works personnel. Repairs included sandblasting the floors of the tanks and applying a thick film of bituminous corrosion control coating. Minor tank nozzle modifications were also made to allow for proper fill and supply connections as well as pressure relief piping. The tanks were also hydrostatically tested with water to confirm suitability for reuse.

Table 3-1. Aboveground fuel tank inventory, March 1999

Tank ID No.	Building	Capacity (gal)	Substance	Secondary Containment	Year Installed
Army					
932	1193	300	Diesel		
958	1537	600	Diesel		
959	1537	700	Gasoline		
966	2078	13,000	JP4	Impermeable dike	1995
967	2078	13,000	JP4	Impermeable dike	1995
968	2078	13,000	JP4	Impermeable dike	1995
	Golf Course Maintenance Facility	1,000	Heating Oil		
1201	3598	1,000	Diesel		

Table 3-1. Aboveground fuel tank inventory, March 1999 (continued)

Tank No.	Building	Capacity (gal)	Substance	Secondary containment	Year Installed
Bureau of Land Management					
961	AFS Storage	350	Gasoline		
962	AFS Storage	10,151	100 LL Avgas	Double-walled	
963	AFS Storage	10,151	100 LL Avgas	Double-walled	
964	AFS Storage	8,000	Jet A50	Double-walled	
965	AFS Storage	8,600	Jet A50	Double-walled	
Air Force					
Quebec	FP-20	1,000	Diesel	Double-walled	1995
Oscar	Helicopter Hill	1,000	Diesel	Double-walled	1994
Papa	FP-17	1,000	Diesel	Double-walled	1994
Juliette	Camera II	1,000	Diesel	Double-walled	1992
Romeo	S-250	1,000	Diesel	Double-walled	1994
Romeo	L. South Fork	1,000	Diesel	Double-walled	1994
Lima	South Fork	1,000	Diesel	Double-walled	1994
Xray	FP-8	1,000	Diesel	Double-walled	1994
Sierra	FP-12	1,000	Diesel	Double-walled	1994
November	Sheet Hill	1,000	Diesel	Double-walled	1995
Kilo	FP-16	1,000	Diesel	Double-walled	1995
Yankee 1	Beaver Creek	1,000	Diesel	Double-walled	1994
Yankee 2	FP-18	1,000	Diesel	Double-walled	1994
Yankee 4	Hill 3265	1,000	Diesel	Double-walled	1994
Yankee 5	FP-14	1,000	Diesel	Double-walled	1995
Pole Hill	Pole Hill	5,000	Diesel	Double-walled	1993
Pole Hill	Pole Hill	10,000	Diesel	Double-walled	1994
Hill 3265	Hill 3265	15,000	Diesel	Double-walled	1994
Hill 3265	Hill 3265	10,000	Diesel	Double-walled	1993
Hill 3265	Hill 3265	1,000	Diesel	Double-walled	1994
Hill 3265	Hill 3265	1,000	Diesel	Double-walled	1994
Old Yankee 5	Old Yankee 5	1,000	Diesel	Double-walled	1996
1948	Camera II	1,000	Propane*	Double-walled	1995

Table 3-1. Aboveground fuel tank inventory, March 1999 (continued)

Tank No.	Building	Capacity (gal)	Substance	Secondary containment	Year Installed
1949	Camera I	1,000	Propane	Double-walled	1995
3560	Camera II	1,000	Propane	Double-walled	1995
3922	Camera I	1,000	Propane	Double-walled	1995
3923	Camera I	1,000	Propane	Double-walled	1995
3486	Camera I	1,000	Propane	Double-walled	1995
3951	Camera II	1,000	Propane	Double-walled	1995
2280	Camera II	1,000	Propane	Double walled	1995
T10G1	Donnelly Dome	10,000	Diesel	Double-walled	1994
T25G1	Far Mountain	2,500	Diesel	Double-walled	
T25G2	Far Mountain	2,500	Diesel	Double-walled	
T25G3	Far Mountain	2,500	Diesel	Double-walled	
0103G	Blair Lake	500	Diesel	Inside bldg. w/concrete curb	1995
0203U	Blair Lake	1,000	Unleaded gas	Double-walled	1994
	Blair Lake	1,000	Unleaded gas	Double-walled	1995
0204D	Blair Lake	15,000	Diesel	Self-contained	1992
0205D	Blair Lake	15,000	Diesel	Self-contained	1992
0206D	Blair Lake	15,000	Diesel	Self-contained	1992
0208D	Blair Lake	25,000	Diesel	Self-contained	1952
0210D	Blair Lake	15,000	Diesel	Self-contained	1994
0211D	Blair Lake	15,000	Diesel	Self-contained	1994
0213D	Blair Lake	15,000	Diesel	Self-contained	1994
0207D	Blair Lake	15,000	Diesel	Self-contained	1992
0209D	Blair Lake	25,000	Diesel	Self-contained	1952
0212	Blair Lake	15,000	Diesel	Self-contained	1994

*Propane capacities are in pounds.

3.1.2 Underground Storage Tanks. Fort Wainwright has 56 underground fuel storage tanks with capacities ranging from 500 to 30,000 gallons (table 3-2). These tanks combined can hold approximately 183,500 gallons of fuel.

Table 3-2. Underground fuel tank inventory, March 1999

Tank ID No.	Building	Capacity (gal)	Substance	Year Installed
208A	1060	1,000	Diesel	1991
210A	1185	8,000	Heating Oil	
214A	1172	3,000	Heating Oil	1989
215A	1171	1,000	Diesel	1991
216A	1171	1,000	Gasoline	1991
219A	1191	1,000	Heating Oil	1995
226A	1537	5,000	Gasoline	
234B	1563	1,000	Diesel	
244A	2062	1,000	Heating Oil	1995
245A	2063	1,000	Heating Oil	1995
247A	2080	500	Gasoline	1990
248B	2080	1,000	Diesel	1990
249A	2092	3,000	Heating Oil	1995
253A	2108	1,000	Diesel	1994
263B	3011	1,000	Diesel	1993
264A	3015	5,000	Diesel	1989
265A	3015	5,000	Gasoline	1989
274A	3479	1,000	Used oil	1993
279A	3562	10,000	Gasoline	1992
281A	3562	10,000	Gasoline	1992
282A	3562	10,000	Diesel	1992
290A	3598	1,000	Used oil	
299	4109	1,000	Gasoline	Unknown
307C	4321	500	Heating	
307D	4322	500	Heating	
313A	5008	2,000	Heating	1991
315B	5003	1,000	Heating	1995
321A	3485	1,000	Used oil	1990
322A	3421	1,000	Used oil	1990
323A	3425	1,000	Used oil	1990
324A	1053	2,000	Used oil	1993
325A	1056	1,000	Diesel	1988
326A	5007	5,000	Heating	Unknown
331A	1580	2,500	Diesel	1986
359	5009	2,000	Heating	

Table 3-2. Underground fuel tank inventory, March 1999 (continued)

Tank ID No.	Building	Capacity (gal)	Substance	Year Installed
360	5010	1,500	Heating	
373A	4065	12,000	Diesel	1994
375A	3407	1,000	Diesel	1994
377	3484	30,000	Diesel	1993
378	3484	30,000	Gasoline	1993
901	3477	1,000	Used oil	1994
902	3480	2,000	Used oil	1989
903	3490	2,000	Used oil	1990
906	3492	1,000	Used oil	1988
907	3492	1,000	Used oil	1988
910	3494	1,000	Used oil	1988
911	3494	1,000	Used oil	1988
914	3496	1,000	Used oil	1988
917	3730	1,000	Used oil	Unknown
919	2295	1,000	Used oil	1990
920	2295	1,000	Used oil	
930	1555	1,000	Diesel	
984	5110	1,000	Heating	
985	1171	1,000	Heating	
986	2092	500	Diesel	
987	2092	500	Gasoline	
Bureau of Land Management				
	AFS	5,000	Unleaded gas	Unknown

3.2 Pest Control Facility

The facility is in building 3026 and consists of two storage rooms and one mixing room. The largest quantity of liquid chemical stored at the facility is 60 gallons of liquid fertilizer. The facility generally uses premixed pesticides. When a pesticide or herbicide must be mixed, only enough is made to complete the job. Only small quantities of chemicals are ordered, roughly a 90-day inventory. Most chemicals are used within 6 to 9 months. The facility is operated in accordance with the guidelines set forth in the Armed Forces Pest Management Board, Technical Information Memorandum #25, "Pesticide Spill Prevention and Management." Pesticides are

visible, and containers are checked at least monthly to ensure lids are tight and containers are not damaged. Following is an inventory of the chemicals stored at the Pest Control facility.

Table 3-3. Annual inventory of chemicals stored at the Pest Control facility

Chemical Name	PKG/Type Material	EPA Registration Number	Quantity
F.V.S. Fogger	6 oz. aerosol can	4758-136	12 cases
PT-565 Plus XLO	23 oz. aerosol can	499-310	12 cases
PT-270 Dursban	20 oz. liquid aerosol	499-147	12 cases
PT-240 Boric Acid Dust	16 oz. aerosol	499-220-AA	12 cases
PT-515 Wasp Freeze	14 oz. aerosol	499-MO-1	1 case
PT-470 Regulator	32 oz. aerosol	499-278	12 cases
Kill Master II	1 gal. container	26693-2	12 cases
Dursban L.O. Liquid	1.35 oz. bottle	464-571	3 cases
Maxforce (Roach Bait)	.05 oz. tray	1730-67	15 cases
Maxforce (Pharaoh Ant Bait)	.05 oz. tray	1730-72	3 cases
Hyvar X-L	1 gal. plastic	352-346	3 cases
Round-up	2.5 gal. plastic	524-308-AA	3 cases
Maxforce Gel Bait	4.2 oz. tubes	64248-5	30 cases
Gentrol Point Source		2724-469	14 cases
Scotts Proturf Liquid Herbicide	1 gal. plastic	228-221-538	20 gals.
Synerol (Pyrethrin)		4816.570	20 gals.

3.3 Transformers

Fort Wainwright has 57 active transformers containing 55 gallons or more of oil. The following table lists the transformers and their location.

Table 3-4. Transformers containing 55 gallons or more of oil, March 1999

Card No.	Manufacturer	Serial No.	Location	KVA	Gallons**
0239	Westinghouse	88A044846	Bldg. 4209	167	84
0416	ITE Power Dist	876000199	Bldg. 3595	750	299(A)
0417	RTE Distribution	861101046	Bldg. 3595	167	84
0418	RTE Distribution	861099351	Bldg. 3595	167	84
0419	ITE Power Dist	876000145	Bldg. 3595	750	299(A)
0420	Westinghouse	7372947	Bldg. 3595	7500	3750
0493	General Electric	B-957343	Bldg. 3595	833	325(A)
0494	General Electric	B-957342	Bldg. 3595	833	325(A)
0495	General Electric	B-957345	Bldg. 3595	833	325(A)
0496	General Electric	B-957341	Bldg. 3595	833	325(A)
0497	General Electric	B-957340	Bldg. 3595	833	325(A)
0498	General Electric	B-957344	Bldg. 3595	833	325(A)
0890	Square D	851163-A1	Bldg. 1004 (pad)	750	340(A)
0891	Square D	851163-A2	Bldg. 1001 (pad)	750	340(A)
0892	Balteau	PUF-0534	Bldg. 3000	300	150
0893	Balteau	PUF-0532	Bldg. 3000	500	250
0897	Balteau	PSL-1019	Bldg. 3728 (pad)	1000	500
0898	Square D	880854-B1	Bldg. 3703 (pad)	750	375
0899	Square D	880854-A1	Bldg. 3703 (pad)	1000	500
0900	Balteau	PSL-1015	Bldg. 1015 (pad)	1000	500
0901	Balteau	PUF-0496	Bldg. 3490 (pad)	1000	500
0902	Balteau	PUF-0482	Bldg. 3480 (pad)	500	250
0903	Square D	890448-A1	Bldg. 3406 (pad)	750	375
0904	Westinghouse	89J423034	Bldg. 3408 (pad)	225	113
0906	Square D	810487-1	Pad Mounted Fenced Area NE of Bldg.	500	250
0907	Square D	810487-2	Pad Mounted Fenced Area NE of Bldg.	500	250
0908	Balteau	PSJ-0811	Bldg. 4024 (pad)	300	150
0924	Square D	881076-A1	Bldg. 1555	750	375
0928	Westinghouse	63H8841	Bldg. 1559	150	75
0931	Wagner	5J35716	North Post 3 Phase Bank N. XForm	167	84
0932	Wagner	F9F1981	North Post 3 Phase Bank C. Xform	167	84

Table 3-4. Transformers containing 55 gallons of oil or more, March 1999 (continued)

Card No.	Manufacturer	Serial No.	Location	KVA	Gallons**
0933	Wagner	5J35715	North Post 3 Phase Bank S. Xform	167	84
0934	Allis Chalmers	2219884	North Post	500	200 (A)
0935	Allis Chalmers	2219885	North Post	500	200 (A)
0936	Allis Chalmers	2219883	North Post	500	200 (A)
0937	Allis Chalmers	2219887	North Post	500	200 (A)
0938	Allis Chalmers	2219886	North Post	500	200 (A)
0939	Allis Chalmers	2219888	North Post	500	200 (A)
0973	Pittsburgh	712869	Bldg. 4564 Old Power Plant Inside Fence	2000	900 (A)
1028	Cooper	926000554	S. Side of Bldg.	2000	1000
1068	Cooper	929003672	Bldg. 3565	500	250
1069	Cooper	929003671	Bldg. 3565	500	250
1086	Cutler-Hammer	959003543	Golf Course Clubhouse	150	75
1113	Square-D	910572-A1	Bldg. 3205	300	150
1131	Cooper	929003340	NW Corner of School	500	250
1137	General Electric	M307008TKNA	Bldg. 1541	750	375
1171	Square-D	920329-A1	Bldg. 1044	750	375
1173	Balteau	PTK-0974	Bldg. 3451	750	375
1192	McGraw-Edison	88ZC514-003	Bldg. 3018	300	150
1235	Dowzer	89DK3445201U3	Bldg. 2295	500	250
1241	Cooper	949002687	Next to Pond at Golf Course	225	113
1267	Square-D	900656-A1	Bldg. 3709	500	250
1308	Square-D	969004302	Bldg. 5008	750	375
1309	Square-D	969004209	Bldg. 5009	150	75
1334	Square-D	969006915	Bldg. 3470	300	150

**(A) indicates actual quantity listed on transformer data plate. All others are estimated at 0.5 gallons per KVA

4.0 SPILL PREVENTION PROCEDURES

This section, in accordance with 40 CFR 112, describes the measures the Army has undertaken, and the inspection, maintenance and other programs in place to prevent oil discharges at Fort Wainwright.

4.1 Prevention Training Programs

All military personnel with the military occupational specialty (MOS) 77F (POL specialist) receive broad fuel handling training at Fort Lee, Virginia. The 3-month training program covers all aspects of safe fuel handling, including fire safety, spill prevention, and spill cleanup methods. Only personnel with the 77 F MOS handle fuel at Fort Wainwright. Once personnel arrive at Fort Wainwright, they receive additional site-specific training. Military personnel acquire additional fuel training as they are promoted.

Public Works civilian personnel (Environmental Office, Heavy Equipment Section, Fire Prevention Division) who respond to oil discharges have, at a minimum, taken the 40-hour Hazardous Operations and Emergency Response course as outlined in 29 CFR 1910 120. Employees with the Fire Prevention Division receive additional specific training, which meets the requirements for the State of Alaska, Fire Fighter I level. The training consists of:

- Hazard communications training and monthly internal safety training for all personnel.
- Toxic gases and explosive mixture training, and quarterly classes on HAZ-MAT first response for select personnel.
- Emergency trauma and EMT training for select personnel.

Copies of job descriptions, documentation of initial and continuing education, and records of completion of required training or job experience are kept by each employee's supervisor.

The installation commander provides an annual spill response exercise to test the effectiveness of this plan, response personnel, and equipment.

All employees of the Alaska Fire Service attend an 8-hour class on chemical management, which covers safety and personal protective measures, Federal

acquisition requirements with regard to pollution prevention, solid and hazardous waste management, emergency response, spill clean up, and contingency plans.

Safety meetings are conducted on a regular basis, and employees are given formal and on-the-job training for the specific safety and hazardous materials issues associated with each of their individual jobs. Employees also are trained in the management, handling, and clean up of small spills of substances used in their daily work activities.

Personnel at the Pest Control Facility are trained in the proper procedures for handling pesticides during receipt, storage, formulation, application, and disposal. They also receive training in spill prevention, emergency response, and containment procedures.

4.2 Routine Fuel Handling

A private contractor transfers and delivers fuel as needed to individual tanks on Fort Wainwright. The list "Contractor Fuel Transfer Procedures" describes the procedures used during each fuel delivery.

With the exception of the FARP, BLM, and USAF facilities, bulk fuel storage tanks on Fort Wainwright are underground. The facilities are small compounds and therefore any fuel spill from overfilling an underground tank would be readily observable. Two people are always in attendance when fuel is transferred; one to monitor the receiving tank and one to monitor the tanker truck dispensing fuel.

4.3 Inspections and Tests

The Public Works Environmental Resources Office conducts quarterly environmental compliance inspections of all units, organizations, and tenant activities on post.

4.3.1 Aboveground Tanks.

FARP. Before the tanks were installed at the Fort Wainwright airfield, they were hydrostatically tested with water in September 1995 to confirm suitability for service. Enterprise Engineering Inc., who conducted the tests, issued a Testament of Suitability for Service, which is kept on file at the Fort Wainwright Public Works Environmental office. A scheduled in-service external inspection of the tanks, in accordance with API 653, is required within 5 years (September 2000). In addition, the tanks' piping, valves, pumps, locks, and hoses are visually inspected daily, and findings are recorded in a log book kept at the facility. Daily procedures also include continuous monitoring of truck loads as they transfer fuel to the tanks and continuous

monitoring of to-aircraft transfers. Inspection logs also are kept for drainage of open top secondary containment systems.

4.3.2 Underground Tanks. Fort Wainwright tests underground storage tanks (regulated and nonregulated) in accordance with the Underground Storage Tank (UST) program developed by the EPA. The Fort Wainwright Environmental Office identifies UST's requiring removal, repair, or replacement due to leaks and age. Existing underground storage facilities comply with Federal UST regulations.

4.3.3 Buried Steel Piping. Work requests were submitted in June 1994 to provide cathodic protection and release detection for buried steel piping on Fort Wainwright. A corrosion survey will be conducted and corrective measures taken as part of this program. If significant repairs are needed, piping will be replaced according to State of Alaska regulations.

CONTRACTOR FUEL TRANSFER PROCEDURES

1. Plan route to receiving tank.
2. Plan entry and parking strategies to reach receiving tank's fill pipe.
3. Drive to receiving tank and position truck.
4. Remove receiving tank's fill pipe lids.
5. Measure fuel in receiving tank with attendant present.
6. Write measurement down on dispatch card.
7. Double check to see that the amount of fuel ordered will fit into the receiving tank.
8. Hook up elbow(s), camlock, connections, etc., needed to receive the tank's fill pipe.
9. Hook up hose to receiving tank.
10. Open camlock caps on truck's dispersing tank and hook up hose.
11. Double check hookups, open bottom tank lever, then API lever.
12. Check sight glass for flow; fill receiving tank to 95% capacity.
13. Change hose hookups on truck tanks until fuel transfer is complete.
14. When fuel has been transferred, unlock truck hose and drain remaining fuel into receiving tank.
15. Remove hose and camlock elbow from receiving tank.
16. Have attendant verify fuel transfer.
17. Record amount of fuel transferred on dispatch card.

4.4 Security Measures

Fort Wainwright is an open post to all vehicle traffic. The entire installation is constantly patrolled by the military police. In the event of a spill, military police will secure the spill site and will coordinate with the installation on-scene coordinator.

FARP. The FARP is enclosed by a security fence and is within the restricted area of the airfield. In addition, all tank valves are locked after duty hours.

5.0 SPILL CONTROLS

5.1 Monitoring Systems

5.1.1 Aboveground Storage Tanks.

FARP. Ground reading float-type gauges have been installed on each tank to allow manual observation of fuel transfers. A high level float also will be installed in the tanks that will produce a visual and audible alarm, as well as stop all fuel transfer pumps to prevent an overfill.

5.1.2 Underground Storage Tanks. In accordance with 40 CFR and State of Alaska regulation 18 AAC 78, underground storage tanks installed after December 22, 1988 must have leak detection. All regulated underground storage tanks on Fort Wainwright have interstitial leak detection systems. All buried piping has secondary containment. Enviroflex is normally used.

5.1.3 Abandoned Fuel Lines. The Haines Canol fuel lines were drained and capped.

5.2 Secondary Containment

According to 40 CFR 112.7, aboveground fuel tanks should have secondary containment.

5.2.1 FARP. The tanks sit on sand pedestals above the bottom of the dike floor. The entire dike, including the area below the tanks, was lined with an impermeable secondary containment liner. The liner goes to the top of the berm. The containment is 5 feet deep and the dike's dimensions are 42.5 by 20 feet, which is of sufficient size to hold 110 percent of the volume of one of the tanks or 14,300 gallons. The tank truck

loading area does not currently meet State regulations, but the following provisions will be implemented in the spring of 2000:

- The existing truck slab will serve as the required secondary containment area. An additional curb will be placed on the east side of the present containment slab to obtain the needed volume of 11,782 gallons.

- A drain outlet valve will remain closed and locked.

5.2.2 Pest Control Facility. A 4-inch curbing surrounds the storage area to contain any spilled chemicals. Floor drains in the two storage rooms and the mixing room funnel to a 500-gallon tank located under the building. Sixty gallons of liquid fertilizer sit on a spill pallet, which helps prevent spills from reaching the floor. The facility also has a spill recovery drum and a submersible pump.

5.3 Potential Discharge Analysis

This section describes the areas on Fort Wainwright that have the greatest spill potential. The main potential spill sites on post are those associated with the storage and transfer of fuels. They can be collectively summarized as aboveground storage tanks, underground storage tanks, tanker truck refueling operations, and portable storage tanks.

The topography of Fort Wainwright's main cantonment area, where most oil storage occurs, is relatively flat. The soils are well-drained, very fine sand and silts overlying stratified gravel and gravelly sand with permeability rates of 5 to 10 inches per hour.

These two characteristics combined would limit the horizontal migration of spilled fuel. Depth to the water table averages between 10 and 20 feet.

Fort Wainwright has discontinuous permafrost and areas with ice lenses. Permafrost-free areas could experience deep contamination, possibly to the water table, during a major oil discharge onto unfrozen ground.

The northernmost section of the post is composed of bedrock with areas of saturated bogs of poorly drained soils, partially due to an impermeable substratum of permafrost. Depth to permafrost is a maximum of 4 feet. The permafrost acts as a confining layer above the aquifer. Oil spills in these areas would be confined above the permafrost area and would migrate laterally downgradient.

Table 5-1 lists oil spills of more than 25 gallons on Fort Wainwright since 1989. Copies of spill reports are kept at the Fort Wainwright Public Works office and at the Public Works Environmental Division office at Fort Richardson.

Table 5-1. Oil spills of more than 25 gallons on Fort Wainwright since 1989

Year	Date	Location	Volume (gal)	Type	Cause	Corrective Action/ Prevention
1999	1 Jan		125	Investigated derived waste	Water overfill	None
1998	NONE REPORTED					
1997	12 Dec	Bldg. 3411	40+	DFA	Uknown	
	11 Dec	Bldg. 1557	50+	JP-4	Unknown	
	28 May	Bldg. 1168	120	DFA	Unknown	
1996	18 Nov	Bldg. 3494	2,500	JP-4	Mechanical failure	None
	21 Oct	Bldg. 1185	50+	Hydraulic fluid	Leaking SMC Snow Cat	Repaired Snow Cat
	18 Oct	Bldg. 2078	100	JP-4	Unknown	
	29 Aug	Bldg. 3477	35+	DFA	Unknown	
	14 May	Bldg. 1372	200	Ethylene glycol	Unknown	
	1 May	Bldg. 3489	80	Oil water separator sludge	Unknown	
1995	5 Oct	FARP	120	JP-4	Leaking valves	Repaired valves
	25 Sep	Hill 3265 YMA	300	Diesel fuel 8	Tank overfill	None
	12 Aug	Yukon Man. Area	805	DFA	TPU roll over	None
	24 May	Bldg. 3480	1,000	Used oil and water	Closed floor drain to oil-water separator	Opened floor drain

Table 5-1. Oil spills of more than 25 gallons on Fort Wainwright since 1989 (continued)

Year	Date	Location	Volume (gal)/Type		Cause	Corrective Action/ Prevention
1994	29 Nov	FARP	250	JP-4	Fuel bladder failure	None
	5 Apr	Bldg. 2111	270	JP-4	Tank overfill	None
1993	9 Dec	Bldg. 2111	100	JP-4	Tank overfill	None
	4 Mar	Bldg. 1565	100	DFA	Dropped blivet	None
1992	12 Dec	Bldg. 3421	150	DFA	Pump failure	Replaced pump
1991	7 Apr	Bldg. 4351	100	Diesel	Unknown	
1990	16 Nov	Bldg. 2111	350	JP-4	Broken flange	Repaired flange
	13 Sep	Bldg. 3595	400	Diesel	Vandalism	None
1989	18 Dec	POL Terminal	250	Diesel	Valve failure	Replaced valve
	20 Nov	Harding Hill	500	JP-4	Emergency landing	
	26 Aug	FWA pipeline	1,500	JP-4	Pipe puncture	Repaired pipe
	21 Jul	Bldg. 1565	250	JP-4	Leaking blivet	Repaired blivet
	22 May	Bldg. 6002	100	Mogas	Leaking tanker	Repaired leak
	11 Apr	Hangar 1	100	Used oil	Unknown	
	22 Feb	Clear Creek	400	Diesel	Dropped blivet	None
	6 Feb	Husky Drop Zone	150	JP-4	Leaking gasket	Replaced gasket
	29 Jan	Army Airfield	850	JP-4/lube	Plane crash	None

5.3.1 Aboveground Storage Tanks.

FARP. The largest spill from the FARP facility would be the entire contents of one of the 13,000-gallon tanks containing JP-4. All three tanks sit in a line dike capable of holding 110 percent of the tank capacity. Any leak from the tank floor most likely would migrate quickly through the sand and be observable on the surface of the pedestal or surface of the dike floor. If the dike needed to be drained, Public Works would issue a contract delivery order to have it pumped. The drain line is currently capped outside the valve. To drain the secondary containment dike, the contractor would uncap the pipe to operate the valve and pump any liquid into a tanker truck. The majority of fuel escaping from a breach in the FARP containment dike would pool in the area immediately northwest of the dike and seep into the ground. For a

catastrophic failure (all three tanks for a 39,000 gallon total, a minor amount (about 0 to 4,000 gallons) would flow west along the north side of Montgomery Road at 200 to 400 gallons per minute, depending on the size and location of the dike breach.

5.3.2. Underground Storage Tanks. Fort Wainwright has 56 underground fuel storage tanks with capacities that range from 500 to 30,000 gallons. A major petroleum spill from tank structural failure or shell rupture is rare; however, either one has the potential to release a large amount of fuel at one of the underground bulk fuel tanks.

Fort Wainwright has two underground bulk fuel storage areas: building 3562, which has three 10,000-gallon tanks of gasoline and building 3484, which has one 30,000-gallon gasoline tank and one 30,000-gallon diesel tank. All underground tanks (regulated and nonregulated) have interstitial leak detection systems.

5.3.3 Tanker Truck Refueling Operations. Spills during tanker truck refueling operations could be caused by leaking trucks, aboveground storage tank bottom valves being left open, improper drop tube connections, tank failure, and overloading. Although all truck drivers are instructed in proper fuel transferring procedures, spills during refueling operations account for 10 percent of all spills larger than 100 gallons on Fort Wainwright since 1985.

5.3.4 Portable Storage Tanks. The Army has several tactical vehicular tankers (HEMETS and truck-mounted tank and pump units [TPUs, which consist of two 500-gallon fuel pods, water separator, and portable pump]) and collapsible rubber blivets for transporting aviation and other fuels to the field for training exercises. The fuel tanks are garaged in building 1565 when not in use. Historically, the collapsible containers have been responsible for a significant number of fuel spills because they are easily ruptured. Since 1996 less than 5 percent of all spills on Fort Wainwright larger than 100 gallons have been associated with portable tanks.

Special precautions are taken with these containers to prevent spills. U.S. Army Alaska Regulation 200-1 contains specific guidelines for field storage tanks larger than 660 gallons or 1,320 gallons in multiple tanks. No tank will be placed within 50 meters of surface water. Storage tank emplacements are required to have containment structures and cleanup equipment on hand.

6.0 SPILL COUNTERMEASURES

This section describes the procedures used on Fort Wainwright for the following:

- Spill discovery
- Spill notification and reporting
- Spill response
- Spill cleanup
- Disposal of recovered material

6.1 Spill Discovery

Surface fuel spills at tanker truck refueling areas and at aboveground fuel storage tanks will be discovered by onsite personnel monitoring the fuel transfer or by automatic fuel monitoring systems. Leaks from underground storage tanks will be discovered by automatic leak detection systems, which are being installed on underground tanks (regulated and nonregulated) that are not already in compliance.

6.2 Spill Notification and Reporting

State of Alaska regulations 18 AAC 75, Oil and Hazardous Substances Pollution Control and 18 AAC 78, Underground Storage Tanks, require all oil spills, regardless of size, to be reported to the Alaska Department of Environmental Conservation (ADEC). Spills also will be reported as soon as possible to the commander of the military unit or the immediate civilian supervisor. All spills, regardless of size, at Army-operated fuel facilities or caused by Army personnel, will be reported to the Fort Wainwright Fire Department by calling 911.

The Public Works Environmental Office will contact and provide all required reports to State, Federal, and local agencies. The oil spill reporting procedure is shown in figure 6-1. The Fort Wainwright Fire Department serves as the Installation On-Scene Coordinator (IOSC).

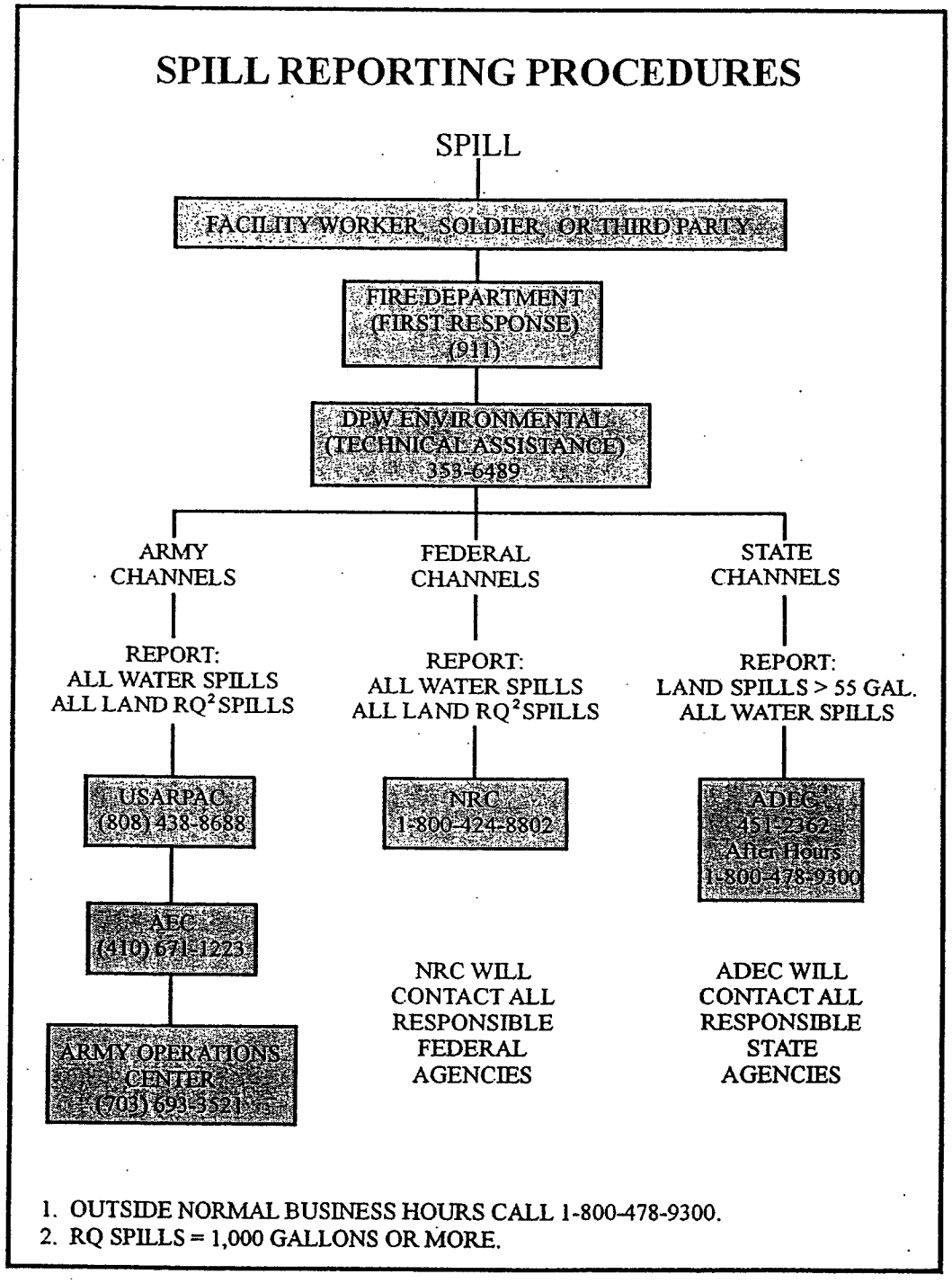

SPILL REPORTING PROCEDURES
SPILL
FACILITY WORKER, SOLDIER, OR THIRD PARTY
FIRE DEPARTMENT (FIRST RESPONSE) (911)
DPW ENVIRONMENTAL (TECHNICAL ASSISTANCE) 353-6489
ARMY CHANNELS
FEDERAL CHANNELS
STATE CHANNELS
REPORT: ALL WATER SPILLS ALL LAND RQ² SPILLS
REPORT: ALL WATER SPILLS ALL LAND RQ² SPILLS
REPORT: LAND SPILLS > 55 GAL. ALL WATER SPILLS
USARPAC (808) 438-8688
NRC 1-800-424-8802
ADEC 451-2362 After Hours 1-800-478-9300
AEC (410) 671-1223
ARMY OPERATIONS CENTER (703) 693-3521
NRC WILL CONTACT ALL RESPONSIBLE FEDERAL AGENCIES
ADEC WILL CONTACT ALL RESPONSIBLE STATE AGENCIES
1. OUTSIDE NORMAL BUSINESS HOURS CALL 1-800-478-9300.
2. RQ SPILLS = 1,000 GALLONS OR MORE.

Figure 6-1

The Air Force or their contractor will report fuel spills at Air Force tanks on Army land according to procedures outlined in the *Oil and Hazardous Substance Discharge Prevention and Contingency Plan, Eielson Air Force Base, Alaska.* The USAF will notify ADEC directly (or through their contractor) of fuel spills. Courtesy notification will be given to the Fort Wainwright Public Works Environmental Office. The USAF will notify the Fort Wainwright Fire Department only when spills present a threat to life, health, property, or the environment and are beyond the USAF's immediate capability to contain.

The BLM or their contractor will report spills at their facility according to their SPCC plan. The BLM will notify ADEC directly (or through their contractor) of fuel spills at their facility. Courtesy notification will be given to the Fort Wainwright Public Works Environmental Office. The BLM will notify the Fort Wainwright Fire Department only when spills present a threat to life, health, property, or the environment and are beyond the BLM's immediate capability to contain.

The spill report will include the following information:

- Date and time of discharge
- Location of discharge
- Name of facility
- Person or persons causing or responsible for discharge
- Type of material spilled
- Estimated quantity of material spilled
- Cause and source of spill
- Potential impacts to environmentally sensitive areas, e.g. ground water, surface water, or wildlife
- Cleanup actions undertaken
- Estimated amount of spilled oil cleaned up
- Estimated amount of hazardous waste generated
- Date, location, and method of ultimate disposal of the hazardous substance and any contaminated materials
- Actions being taken to prevent the recurrence of the discharge

Figure 6-2 is an example of a spill notification report. Releases of more than 55 gallons outside of secondary containment, or any discharge of oil into water, will be reported immediately to ADEC upon discovery, according to 18 AAC 75. Releases of more than 10 gallons or more than 55 gallons within secondary containment will be reported to the

ALASKA DEPT. OF ENVIRONMENTAL CONSERVATION
OIL & HAZARDOUS SUBSTANCES SPILL NOTIFICATION

NOTE: Outlined areas for DEC use only

SPILL #	FILE #	LC	
SPILL NAME, IF ANY	PERSON REPORTING	PHONE NUMBER	
DATE/ TIME OF SPILL	DATE/TIME REPORTED DATE/TIME DISCOVERED	REPORTED HOW? (phone, fax, etc...)	
LOCATION		SUBSTANCE SPILLED	
QUANTITY SPILLED	QUANTITY CONTAINED	QUANTITY RECOVERED	QUANTITY DISPOSED
POTENTIAL RESPONSIBLE PARTY		OTHER POTENTIAL RESPONSIBLE PARTIES, IF ANY	
SOURCE OF SPILL			
CAUSE OF SPILL			
CLEANUP ACTIONS			
DISPOSAL METHODS AND LOCATION			
ENVIRONMENTAL DAMAGE (circle one) YES NO	SURFACE AREA AFFECTED (in square feet)	SURFACE TYPE (describe area affected)	
COMMENTS			
TYPE OF DEC RESPONSE (phone, field visit, lock report)	NAMES OF DEC STAFF RESPONDING	CASE STATUS (open, closed, trans. to cont. sites)	
REPORT PREPARED BY		DATE REPORT PREPARED	

Figure 6-2. Spill Notification Report

ADEC within 48 hours of discovery. Releases of less than 10 gallons do not need to be reported to the ADEC, but a record of the release will be maintained in the SPCC Plan in accordance with 40 CFR 112.2 and 18 AAC 75.

6.3 Spill Response

The Fire Department will respond to all spills at Army-operated facilities or caused by Army personnel and will contact additional response personnel if the unit or office responsible for the spill does not have sufficient equipment or technical expertise to contain and control the spill. The Fort Wainwright Fire Department will be the on-scene commander for oil discharge spill response. The unit responsible for the spill will do only the following items that can be performed without endangering lives:

Emergency Spill Response Actions

1. Identify the source of the spill.

2. Person in charge reports the spill to the Fire Department by calling 911. The Fire Department implements the site safety plan.

3. Evacuate personnel and restrict access to the spill area to authorized personnel.

4. Provide first aid to any injured; call 911 if medical assistance is required.

5. Identify safety hazards, such as ignition sources and toxic fumes. Shut off electricity at a location where disconnect spark is not a hazard.

6. Put on personal protection devices if needed.

7. Eliminate ignition sources.

8. Close valves or take other action to stop the flow.

9. Contain the spill with booms, sorbents, snow, dirt, or other material.

10. Start cleanup operations. If spill endangers life, exceeds technical capabilities, or involves unknowns, withdraw and wait for the Fire Department to arrive. If the spill exceeds the unit's cleanup capability, the unit will control the spill as best as possible with the primary goal of preventing the spill from entering a waterbailage, sewer, or drain, and wait for Fire Department assistance.

Figure 6-3 is the emergency notification list, which contains the offices and phone numbers of Fort Wainwright's emergency response organizations. The Fire Department also maintains a list of key spill response personnel and their off-duty phone numbers. Public Works operates and maintains all equipment used to pump, transfer, and drain product from tanks or bermed areas. All equipment is stored and dispatched from the heavy equipment yard at building 3015. Pump and hose fittings are compatible with transfer equipment. Table 6-1 is an inventory of Fort Wainwright's spill response equipment.

Table 6-1.-- Fort Wainwright spill response equipment inventory

Item	Year	Make	Model	Capacity	Rate	Amount
Pumper trailer	1990	Klein		1,000 gal	100 gpm	1
Loader	1985	John Deere	W21C			2
Loader	1991	Michigan	L160			1
Grader	1985	Caterpillar	1306			4
Grader	1986	Caterpillar	1306			3
Dozer	1983	John Deere	550			1
Dozer	1981	John Deere	450			1
Dozer	1981	Caterpillar	D-7			1
Truck, dump	1983	Ford				2
Truck, dump	1989	International				1
Truck, dump	1991	International				1
Tractor w/ Lowboy trailer	1988	Ford				1
Hazmat Response Vehicle	1998	Chevy Step Van				1

Emergency Response Notification List

ORGANIZATION	FUNCTION	TELEPHONE
Fire Department is the On-Scene Coordinator	Contact for all spills	911 Off post, 353-6485
Public Works Environmental Office	Response Assistance and Agency Notification	353-1797 353-6490
Public Works Roads and Grounds	Heavy Equipment and Manpower	353-7192
Directorate of Logistics (Contracting)	Technical Support	353-7302
Military Police	Traffic Control and Evacuation Assistance	353-7535
Bassett Hospital	Ambulance and Emergency Room	353-5143
Detachment 5, 11th Weather Squadron	Weather/Toxic Corridors	353-7111

The Fort Wainwright Fire Department maintains a list of off-duty numbers for personnel representing each of the listed offices.

Figure 6-3

6.4 Spill Cleanup

Fort Wainwright Public Works stores and maintains all cleanup supplies used to assist in the emergency cleanup of a spilled product. The supplies are stored at building 3584, the chip barn. Cleanup supplies include the following:

- 17 bags of 34 by 38-inch absorbent pads
- 6 bags of 6-inch by 10-foot booms
- 58 rolls of 38-inch by 144-foot absorbent rolls
- bags of 17 by 19-inch absorbent pads
- rolls of impermeable liner
- 50 55-gallon drums (closed top)
- 100 55-gallon drums (open top)
- 50 5-gallon drums (open top)

The following supplies are available from Alyeska's pre-positioned oil spill contingency equipment stored on Fort Wainwright:

- 2 rolls of sorbent blankets
- 2 cartons of boom
- 2 cartons of pads
- 600 feet of containment boom
- 1 weir-type skimmer
- 1 oleophilic-type skimmer

The Fire Department emergency response inventory is stored in building 3032 and includes:

- 4 Scott air packs per truck company
- 2 explosimeters
- 2 O_2 LELs

The BLM has spill kits stationed at various locations around their facility. The kits contain sorbent pads, sorbent boom, heavy duty trash bags suitable for oil waste, and protective gloves.

6.5 Disposal of Recovered Material

Contaminated oil recovered from a spill will be stored in drums and/or tanker trucks awaiting disposal through the Defense Reutilization and Marketing Office (DRMO) on Fort Wainwright. Contaminated sorbents and debris generated from a spill cleanup will be placed in overpack drums and turned into the DRMO has hazardous waste. Contaminated soil will be removed and disposed of in accordance with the State of Alaska guidance. Large amounts of soil will be stockpiled in a bermed and lined area until they can be remediated.