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DRAFT SITE INVESTIGATION WORK PLAN SITE 95 OPERABLE UNIT 22 (OU 22) HISTORIC
LIVESTOCK DIPPING VATS MCB CAMP LEJEUNE NC (DRAFT ACTING AS FINAL)
02/01/2006
CH2M HILL

DRAFT

Site Investigation Work Plan

Site 95 – Operable Unit No. 22

Historic Livestock Dipping Vats

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina



Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic Division
Norfolk, Virginia

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February 2, 2006

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Subject: CLEAN III CTO 105 - Draft Site Investigation Work Plan, Operable Unit 22 (Site 95 - Historic Livestock Dipping Vats)

Dear Mr. Hood:

CH2M HILL is pleased to submit the draft version of the Site Investigation Work Plan for Site 95 (Operable Unit 22 - historical livestock dipping vats), MCB Camp Lejeune. The Work Plan has been posted on the Enterprise System. Copies have also been sent to the following: MCB Camp Lejeune EMD, US Environmental Protection Agency, NC Department of Environment and Natural Resources, Shaw Group, and Baker Environmental.

If you have any questions or comments, please contact me at (704) 329-0073 ext. 227.

Sincerely,

CH2M HILL

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QC Review Page

Site Investigation Work Plan

OU No. 22, Site 95

MCB Camp Lejeune

Jacksonville, North Carolina

Contract Task Order Number - 036
Contract Number N62470-02-D-3052
Navy CLEAN III Program

Prepared by

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January 2006

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1.0 Introduction

This Site-Specific Work Plan presents the strategy and technical approach for Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Site Investigation (SI) under the Installation Restoration (IR) program at Operable Unit (OU) 22, Site 95 - Historic Livestock Dipping Vats at Marine Corps Base (MCB) Camp Lejeune, North Carolina (the Base). A site location map is provided as **Figure 1-1**.

This Site-Specific Work Plan was prepared by CH2M HILL under Contract Task Order (CTO) 0105 of the Department of the Navy's (DoN's) Comprehensive Long-Term Environmental Action Navy (CLEAN) Program. CH2M HILL is responsible for implementation of this project. It should be noted that this Site-Specific Work Plan is to be used in conjunction with the Master Project Plans, which include the Master Work Plan, Master Quality Assurance Project Plan (QAPP), and Master Health and Safety Plan (HASP) (CH2M HILL, 2005). The Master Project Plans will be referenced to the greatest extent possible.

Three historic livestock dipping vats were discovered during an archaeological investigation at the Base. These vats were apparently constructed and utilized by local farmers during the early to mid 1900s (see section 2.2). The dipping vats are identified by their locations (Lyman Road, Magnolia Road, and Jaybird Road). Since initial assessment of the Jaybird and Magnolia Road locations indicated exceedances of regulatory thresholds for pesticides and metals which required additional assessment, it was assumed that the third location (Lyman Road) which was used for the same purpose, also requires assessment. The purpose of this Work Plan is to collect additional analytical data from the three areas to better understand the nature and extent of impacts at each location.



Legend

-  Livestock Dipping Vats
-  Installation Area

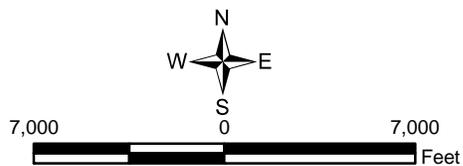


Figure 1-1
Site Location Map
MCB Camp Lejeune
Camp Lejeune, North Carolina

2.0 Background Information

Background information for the Base, including location, topography, geology, and CERCLA-related history, is presented in the Master Work Plan and is not repeated herein. Site-specific background information for Site 95 is presented below.

2.1 Operable Unit 22, Site 95; Historic Livestock Dipping Vats

Operational Unit 22, Site 95 consists of three separate sites, with one known animal dipping vat at each location. The vats were initially identified during an archaeological investigation of the Base. These vats were apparently utilized for dipping livestock into a solution of arsenic or pesticides for tick control. This type of vat was required by the federal government during the period of 1906 through 1961 in the southern United States in an effort to control cattle tick fever. Prior to 1940, an arsenic solution was mandated for use in the vats. After 1940, some states also allowed the use of DDT and chlordane in addition to arsenic. Various petroleum products were used as carriers for the pesticides. The sites are located in undeveloped wooded areas of the Base near Magnolia Road, Jaybird Road and Lyman Road as shown in **Figure 1-1**.

2.1.1 Site History and Past Investigations

Initial assessment of two dipping vat sites (Magnolia Road and Jaybird Road) was performed by Baker Environmental, Inc. (Baker) and is documented in the report *Suspected Dipping Vat Sampling and Suspected Asbestos Shingle/Transite Board Sampling* (Baker, 2004). There has been no initial assessment of the third site, the Lyman Road dipping vat, which was located at a later date.

The samples collected by Baker were submitted to the laboratory and analyzed for pesticides and RCRA metals. Based on evaluation of the results, pesticides and metals were detected in soil within the dipping vats at concentrations exceeding the regulatory driven criteria and established background/secondary criteria (for metals only). Constituents exceeding the regulatory standards for soils inside the vats included 4,4-DDT, 4,4-DDE, 4,4-DDD, arsenic, chromium, and/or mercury. Analytical results of the sampling conducted by Baker are summarized in **Table 2-1** below.

TABLE 2-1
 Summary of Historical Soil Analytical Results – Historical Dipping Vats
 MCB Camp Lejeune, North Carolina

Sample ID	Region IX PRGs Residential	NCDENR Soil to GW	Base Background SS – Fine Sand	CDV01	CDV02	GDV01	GDV02	GDV02D
Sample Date				4/1/2004	4/1/2004	4/6/2004	4/6/2004	4/6/2004
Pesticides (µg/L)								
4,4'-DDD	2.4	0.129	NA	17 J	25 U	4.4 U	4.5 U	4.5 U
4,4'DDE	1.7		NA	18	25 U	4.4 U	4.5 U	4.5 U
4,4-DDT	1.7	1.36	NA	17 J	25 U	4.4 U	4.5 U	4.5 U
Metals (mg/Kg)								
Arsenic	2.2	5.24	0.671	565	457	21.6	5.6	5.6
Barium	5,400	848	16.8	50 B	51.8 B	305	676	803
Cadmium	37	2.72	0.0549	1.3 B	1.7 B	0.49 U	1.3	0.76 B
Chromium*	30	27.2	15.2	3.5 B	3.4 B	35.5	45.8	48.2
Lead	400	270	20.9	<u>142</u>	<u>155</u>	<u>75.6</u>	<u>99.2</u>	<u>119</u>
Mercury	23	0.0154	0.1	<u>0.55</u>	<u>0.79</u>	<u>0.26</u>	0.03 B	0.02 B
Silver	390	0.223	ND	0.65 U	0.89 U	0.23 U	0.28 U	0.28 B
Total Solids				19	13	75	73	73

Notes: Data courtesy of Baker Environmental (June, 2004 report)

*Hexavalent chromium value (conservative) used for comparison to Region IX PRGs

J = Result is estimated

Shaded values exceed Region IX Residential PRGs

U = Not Detected

Bold values exceed NCDENR Soil to GW standard

B = No qualifier noted in Baker report

Underlined values exceed Base Background Metals Levels

CDV represents the Magnolia Road Site

GDV represents the Jaybird Road Site

3.0 Data Quality and Sampling Objectives

The site-specific objectives presented in this section have been developed using the USEPA seven-step data quality objectives (DQOs) process, as presented in the USEPA Guidance for the Data Quality Objectives Process (USEPA, 2000a) and USEPA Data Quality Objectives Process for Hazardous Waste Site Investigations (USEPA, 2000b).

3.1 Data Quality Objectives Process

DQOs are qualitative and quantitative statements, developed using the USEPA DQO process, that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as a basis for establishing the quality and quantity of data needed to support decisions. DQOs define the performance criteria that limit the probabilities of making decision errors by considering the purpose of collecting data, defining the appropriate type of data needed, and specifying tolerable probabilities of making decision errors. The seven-step DQO process is as follows:

- Step 1 – State the Problem
- Step 2 – Identify the Decision
- Step 3 – Identify the Inputs to the Decision
- Step 4 – Define the Boundaries of the Study
- Step 5 – Develop a Decision Rule
- Step 6 – Specify Tolerable Limits on Decision Errors
- Step 7 – Optimize the Design for Obtaining Data

The following sections present the seven-step DQO process developed for the SI at Site 95.

3.1.1 Step 1 – State the Problem

The first activity associated with this step is to establish the planning team. The planning team will include the United States Environmental Protection Agency (US EPA), North Carolina Department of Natural Resources (NC DENR), Naval Facilities Engineering Command (NAVFAC) Atlantic Division, the Activity, and CH2M HILL. These team members are decision-makers for the DQO Process.

The planning team's primary goal is to determine the potential for future corrective action at Site 95. Specifically, the objectives of the SI are as follows:

- Collect information to supplement and/or verify the environmental setting at the Site, including hydrogeology, geology, hydrology, topography, aquifer characteristics, and any other anthropogenic influences that may affect the hydrology or contaminant pathways at the site.
- Characterize the sources via the collection of analytical data, and evaluate the migration and dispersal characteristics of the waste.

-
- Characterize the hazardous constituents (if any) via the collection of groundwater and soil samples in the vicinity of the Site. Characterization includes a definition of the extent, origin, direction and rate of movement of any contamination.
 - Evaluate potential receptors by collecting data describing human populations and environmental systems susceptible to contaminant exposure.
 - Evaluate the risk of any contaminants associated with the Site to human health and the environment.
 - Provide recommendations for site management.

The problem is that the Site 95 has not been adequately characterized and the extent of contamination has not been determined (i.e., a sufficient quantity of data does not exist to support a corrective action decision).

The final activity associated with this step is to identify available resources, constraints, and deadlines. The project team organization and project schedule are presented in Sections 5.0 and 6.0 of this Site-Specific Work Plan, respectively. The schedule presents the anticipated completion and/or submittal dates for specific tasks or documents.

3.1.2 Step 2 – Identify the Decision

The principal study question identified is:

- What is the nature and extent of contamination in the vicinity of the Site 95?

Before a decision statement can be formulated, a definition of “contaminated” must be clarified. For the Installation Restoration (IR) program, soil and groundwater will be considered “contaminated” if concentrations of COPCs exceed the applicable North Carolina 2L Standards, NC DENR soil to groundwater screening criteria and/or USEPA Region IX Preliminary Remediation Goals (PRGs) and the established background/secondary criteria (for metals only) (Baker 2001a, 2001b, 2002).

Considering the principal study question and definition of “contaminated,” the decision statement is as follows:

- Define the nature and extent of contamination in the vicinity of the Site 95 by determining whether or not the concentration of a given COPC at any given sampling point exceeds the regulatory driven criteria and established background/secondary criteria (for metals only).

3.1.3 Step 3 – Identify the Inputs to the Decision

Existing information regarding the nature and extent of contamination in the vicinity of the Site 95 comes from a previous investigation by Baker. The preliminary assessment of two of the dipping vat locations (Magnolia Road and Jaybird Road) is described in the Baker report *Suspected Dipping Vat Sampling and Suspected Asbestos Shingle/Transite Board Sampling* (Baker, 2004). There has been no preliminary assessment of the third location (Lyman Road). In order to determine the potential for future corrective action or additional actions, additional data is required to characterize and define the extent of contamination at the Site. The type of data and sources used to resolve the decision statement include the following:

Kinds of Information	Sources of Information
Nature and extent of contaminated soil	Existing analytical data and new analytical data
Nature and extent of contaminated groundwater	New analytical data from groundwater samples from new monitoring wells
Groundwater flow/hydrogeologic characteristics	New groundwater elevation data
Engineering properties of soil (e.g., permeability, dry bulk density, grain size)	New geotechnical data from Shelby tube samples

The criterion for determining the presence of contamination will be based on analytical results and applicable regulatory driven criteria and background/secondary criteria (for metals only) as described in Section 3.1.2. The samples will be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, natural attenuation indicator parameters (NAIPs), and total Analyte list (TAL) metals using a fixed-based laboratory as described in Sections 4.3.6.

3.1.4 Step 4 – Define the Boundaries of the Study

Soil and groundwater samples will be collected at the locations shown on **Figure 4-1**. The estimated area of each sampling unit will be approximately 20,000 square feet based on a typical dip vat layout. The estimated depth of sampling ranges from approximately 0 to 30 feet.

Temporal changes in the extent of contamination are expected to be limited. Loss of contaminant mass does occur through natural attenuation processes (e.g., dilution, biodegradation, dispersion). As a result, data collection is not time dependent and the decision regarding the nature and extent of contamination will be based on existing conditions at the time of the investigations.

Practical constraints to sample collection are minor to moderate. There are no known significant physical barriers or access issues at the sites, however, it should be noted that the vat areas are located in heavily wooded areas. Clearing of brush and small trees will be required. Larger trees will be left in place whenever possible. Weather conditions (such as heavy rain or lightning) can delay the field activities, but is not a serious constraint.

3.1.5 Step 5 – Develop a Decision Rule

The decision rule developed for the SI at Site 95 is as follows:

- If a given concentration at a given sampling point exceeds the regulatory driven criteria and background/secondary criteria (for metals only) for that contaminant, then that sampling point will be considered to be within the contaminant plume.

3.1.6 Step 6 – Specify Tolerable Limits on Decision Errors

Specification of tolerable limits on the decision errors will not be performed at this time. The sampling scheme is flexible and will include points inside and outside the suspected contaminant source area/plume so that the extent of contamination should be sufficiently defined. Specification of tolerable limits on the decision errors may be developed at a later date as determined by the planning team.

3.1.7 Step 7 – Optimize the Design for Obtaining Data

There are two fundamental goals for Step 7, and both rely on review of existing data and information:

- To evaluate the decision rule
- To design and optimize the sampling and analysis program

The decision rule developed in Step 5 has been shown to be valid following review of existing data. In this case, a simple statistical hypothesis test, broadly classified as a one-sample test was used. The test involved comparison of individual analytical data to a known value (regulatory driven criteria and established background/secondary criteria).

Existing information/data has been reviewed to evaluate and develop the data collection strategy for the field program. The referenced document is the *Suspected Dipping Vat Sampling and Suspected Asbestos Shingle/Transite Board Sampling Report (Baker, 2004)*. The development of alternate sampling plans is not practical given the nature of the SI. In addition, the flexibility of the Site-Specific Work Plan optimizes resources in that the number and location of sampling points is determined by field conditions.

4.0 Site investigation Tasks and Responsibilities

4.1 Project Management

Project management activities include such items as daily technical support and oversight; budget and schedule review and tracking; preparation and review of invoices; personnel resource planning and allocation; and coordination with NAVFAC, the Activity, and subcontractors.

4.2 Field Activities

The field activities for the SI at Site 95 will include the following subtasks:

- Mobilization/Demobilization
- Site Clearing
- DPT Soil Sampling
- Soil Borings
- Monitoring Well Installation and Development
- Monitoring Well Sampling
- Laboratory Analytical Program
- Quality Assurance/Quality Control (QA/QC)
- Sample Preservation and Handling
- Investigative Derived Waste (IDW) Management
- Survey

The following subsections present a discussion of the proposed field activities.

4.2.1 Mobilization/Demobilization

Mobilization/demobilization consists of securing equipment and supplies necessary for the field activities and shipping or transporting those items both to and from the field. Travel time to and from the Base, construction of decontamination areas, location of poly-tank and drum storage areas, field establishment of sampling locations, and underground utility clearance are also included under this task. Activity personnel will be consulted during mobilization efforts.

4.2.2 Site Clearing

A subcontractor will be procured to perform site clearing activities. The clearing activities will involve the removal of brush and small trees. Whenever possible, trees larger than approximately 4 inches in diameter will be left undisturbed. The clearing work will involve chainsaw and bush hog clearing of several strips across the site in order to allow access to proposed sampling locations. Procedures for site clearing activities are presented in the Site Specific Health and Safety Plan.

4.2.3 Direct Push Technology Boring (Soil Sampling)

Prior to sampling, the presence of underground utilities will be determined by an independent utility locating service. The investigation will consist of gridded soil sampling using direct push technology. Continuous core soil samples will be collected for visual description and VOC screening using a macro-core soil sampler. Approximately 32 DPT borings will be advanced at each vat location. Borings will be placed on approximate 20 foot centers near the vats, with slightly wider spacing in the surrounding areas. The direct push sampling locations are shown on **Figure 4-1**.

Soil samples for laboratory analysis will be collected at each boring location from a depth interval of 0 to 1 foot bgs. Additional soil samples will be collected from every other boring at a depth of two to six feet bgs, or to water table, whichever is encountered first.

Once the target depth of each borehole has been reached and all samples have been collected, the borehole will be abandoned using a grout mixture with Portland cement conforming to ASTM requirements and NCDENR guidelines.

Soil samples will be analyzed for VOCs, SVOCs, PCBs, TAL metals, and pesticides in accordance with **Table 4-1**.

4.2.4 Soil Borings

Three soil borings will be drilled at each dipping vat location as shown on (**Figure 4-1**). One boring will be advanced adjacent to the deepest part of the trench, one boring will be advanced adjacent to the exit end of the trench and one boring will be placed in the assumed downgradient direction, to form a triangular pattern. One undisturbed soil sample will be collected from the downgradient soil boring at each dipping vat location for geotechnical parameters including permeability, porosity and grain size distribution. Each soil boring will be advanced into the water table (approximately 15 to 30 feet below ground surface) using an ATV-mounted rig and hollow-stem auger methods. Soil samples will be collected at five-foot intervals using a split-spoon sampler and field screened for total volatile organic vapors using a photoionization detector (PID). Specific sampling and field screening procedures are presented in the Master Project Plans.

After completion of each soil boring to the desired depth, the boring will be converted to a permanent monitoring well.

4.2.5 Monitoring Well Installation and Development

Three shallow monitoring wells will be installed to depths of approximately 15 to 30 feet below ground surface (bgs) approximately as shown on **Figure 4-1** at each dipping vat location. Actual monitoring well locations will be determined in the field, based on local topography and site conditions.

The monitoring well borings will be drilled using 4 ¼-inch inside diameter (ID), hollow-stem augers. Soil samples for laboratory analysis will be collected as described in Section 4.3.4. Soil samples from each boring will be collected as needed for geological descriptions and will be at the discretion of the site manager/field geologist.

Well installation procedures are presented in the Master Project Plans and summarized below. The wells will be constructed, as directed by CH2M HILL's on-site geologist, using two-inch ID,

Schedule 40, polyvinyl chloride (PVC) well casing and screen materials. Ten feet of 0.010-inch slot well screen will be used for each well. Well screens will be installed to bisect the water table. The annular space around the well screen will be backfilled with well-graded, fine sand as the hollow-stem augers are being withdrawn from the borehole. The sand will extend to approximately two feet above the top of the screened interval. An approximate two-foot thick bentonite seal will be placed above the sand pack and hydrated with potable water, as necessary. The annular space above the bentonite seal will be backfilled with cement/bentonite grout to prevent surface and near subsurface water from infiltrating into the screened groundwater-monitoring zone. Stick-up well covers, each with four protective bollards, will be installed at each well and surrounded by a concrete pad. All wells will have a water-tight, locking cap installed on the PVC riser. A padlock will be installed on each of the stick-up covers.

Each new well will be developed using pumping and surging methods. Typical limits placed on well development may include any of the following:

- Clarity of water based on visual determination
- A maximum time period (typically two hours for shallow wells)
- A maximum borehole volume (typically three to five borehole volumes plus the amount of any water added during the drilling or installation process)
- Stability of pH, specific conductance, and temperature measurements (typically less than 10 percent change between three successive measurements)
- Clarity based on turbidity measurements [typically less than 20 Nephelometric Turbidity Units (NTU)].

Well development procedures are detailed in the Master Project Plans.

4.2.6 Monitoring Well Sampling

Monitoring well sampling will take place no sooner than two days after completion of well development. This will allow an adequate amount of time for the wells to equilibrate. The wells will be purged and sampled using peristaltic pumps and low-flow purging/sampling methods. New disposable tubing will be used for each well. Specific sampling procedures are presented in the Master Project Plans and summarized below:

- The well cap will be removed and escaping gasses will be measured at the wellhead using a PID. This will determine the need for respiratory protection.
- After proper respiratory protection has been donned, as necessary, the static water level will be measured. The total depth of the monitoring well will not be measured, as not to stir up any sediment. The total well depth will be obtained from Test Boring and Well Construction Records. The water volume in the well will then be calculated.
- The sampling device intake will be slowly lowered until the bottom end is two to three feet below the top of the well screen or the top of the water level, whichever is greater. Next, the water level probe will be placed into the monitoring well just above the water.
- Purging will begin. The pumping rate will be set to create a sustainable flow (approximately 0.3 liter/minute or less) without causing a significant drop in water level in

the well. The static water level will be periodically measured throughout purging to verify that a significant drop in water level has not occurred.

- Water Quality Parameters (WQPs), including pH, specific conductance, temperature, turbidity, and dissolved oxygen will be measured frequently.
- Purging will be complete when three successive readings of pH, specific conductance, temperature, and dissolved oxygen have stabilized within 10 percent (0.1 Standard Units for pH), turbidity is less than 10 NTUs, or there is no further discernable upward or downward trend. A minimum of one well volume will be purged prior to sampling. If a well is purged dry, the well will be allowed to recharge (preferably to 70 percent of the static water level) prior to sampling.
- Upon WQP stabilization, groundwater samples will be collected and placed into the appropriate sample container(s).

Groundwater samples for laboratory analysis will be collected from each monitoring well and analyzed for VOCs, SVOCs, PCBs, NAIPs, TAL metals, and pesticides in accordance with **Table 4-1**.

4.3 Field Quality Assurance/Quality Control

Specific Quality Assurance/Quality Control (QA/QC) requirements are presented in the Master QAPP, which is contained in the Master Project Plans. The Master QAPP describes the different levels of sample analysis and the associated QC procedures required with each. Adherence to established USEPA chain-of-custody (COC) procedures during the collection, transport, and analyses of the samples will be maintained throughout the project. Laboratory analyses of the samples will conform to accepted QA requirements.

The following QA/QC samples will be collected/prepared during the field activities to ensure precision, accuracy, representativeness, completeness, and comparability:

- Equipment rinsate blanks
- Field blanks
- Field duplicates
- Matrix Spike/Matrix Spike Duplicates (MS/MSDs)

Equipment rinsate blanks will be collected by running laboratory-supplied distilled/deionized water over/through the sampling equipment and placing it into the appropriate sample containers for laboratory analyses. Equipment rinsate blanks will be collected from selected disposable sampling equipment (i.e., roll of tubing, stainless steel spoon, etc.); one equipment rinsate blank will be collected each day for reusable sampling equipment. The results will be used to verify that the sampling equipment has not contributed to contamination of the samples.

One field blank will be collected from each source of water used in decontamination. The field blanks will be collected by pouring the water from the original container or spigot directly into the sample bottle set. Field blanks will not be collected in dusty environments. The results will

be used to verify that the water used in decontamination has not contributed to contamination of the samples.

Field duplicate samples will consist of one unique sample, split into two aliquots, and analyzed independently. Duplicate soil samples analyzed for parameters other than VOCs will be homogenized and split. Samples for VOC analyses will not be mixed, but select segments of the soil will be collected. Duplicate water samples will be collected simultaneously. The duplicate samples will be analyzed to verify the reproducibility of the laboratory results and degree of variability of reported concentrations. Duplicate samples will be collected at a frequency of 10 percent.

MS/MSD samples will be prepared in the field to address aliquoting reproducibility and to provide information on matrix reproducibility otherwise unobtainable from samples reported below analytically reproducible and statistically valid levels. MS/MSD samples will be prepared at a frequency of five percent for each group of samples of a similar matrix.

4.4 Sample Handling and Analysis

Samples for chemical analyses will be placed into laboratory -prepared sample containers with the appropriate preservatives and stored on ice in a cooler at approximately 4° Celsius (or less) until shipped to the laboratory.

Sample preservation details are presented in the Master Project Plans. The type of container used for each sampling effort, as well as a summary of preservation requirements is described in the Master QAPP.

Proper COC documentation will be maintained for all samples from the time of collection until they are shipped to the analytical laboratory. The COC forms will contain the following information: project number (CTO), sampler names, sample numbers, number of containers, methods of preservation, date and time of sample collection, analysis requested, date and time of transportation to the laboratory, method of transportation, and any other information pertinent to the samples. Specific COC procedures are presented in the Master Project Plans.

Samples will either be hand delivered to the laboratory via courier or shipped via overnight courier.

4.5 Investigation Derived Waste Management

IDW will be managed in accordance with Section 4.20 of the Master Project Plans. IDW will consist of health and safety disposables, potentially contaminated soil, decontamination fluids, and groundwater. Health and safety disposables, such as sampling gloves, will be placed in plastic bags and disposed in 55 gallon drums. Soil IDW generated as part of the field activities will be containerized in Department of Transportation (DOT) approved 55- gallon drums. Water IDW will be placed in poly tanks or 55-gallon drums. The drums will be transported to and staged at a designated 90- day storage area pending final disposition.

4.6 Survey

The sample locations and monitoring wells will be surveyed by a subcontractor licensed in the State of North Carolina for topographic elevation relative to mean seal level (MSL) and horizontal position within the North Carolina State Plane Coordinate System. The vertical accuracy of the survey will be within 0.01 feet and the horizontal accuracy will be within 0.1 feet. Surveying procedures are presented in the Master Project Plan.

4.7 Data Management and Validation

It is anticipated that data management activities will consist primarily of entering field and laboratory data onto computerized spreadsheets using database software and tabulating field and analytical results for preparation of the report.

An independent data validator will be subcontracted for data validation. The laboratory analytical results will be evaluated to assess the technical adequacy and usability of the data. The data will be technically reviewed based on specifications set forth in the Naval Energy and Environmental Support Activity (NEESA) and USEPA guidance documents.

4.8 Data Evaluation

This task involves efforts related to the data once it is received from the laboratory and is validated. In addition, this task involves the evaluation of field-generated data including laboratory analytical data, water level measurements, Test Boring and Well Construction Records, water quality measurements, and other field notes. Efforts under this task will include the tabulation of validated analytical data and field data; generation of Test Boring and Well Construction Records; and generation of groundwater contour maps and other diagrams/figures/tables associated with field notes or data received from the laboratory (e.g., sampling location maps).

The laboratory analytical results will be compared to the North Carolina 2L standards, NC DENR Soil to Groundwater screening criteria, and/or USEPA Region IX PRGs and the established base background/secondary criteria (for metals only).

4.9 Risk Assessment

A Screening Level Human Health Risk Assessment (HHRA) and a Screening Level Ecological Risk Assessment (ERA) will be conducted with the previous data and the addition of samples collected during this SI at each Site. The laboratory analytical results will be compared to the North Carolina 2L standards, NC DENR Soil to Groundwater screening criteria, and/or USEPA Region IX PRGs and the established base background/secondary criteria (for metals only).

A Conceptual Site Model is presented in **Figure 4-2**.

4.10 Report Preparation

An SI report will be prepared for the three sites following the general format as presented in EPA's Guidance For Performing Site Inspections Under CERCLA, Interim Final (1992) and will include, but not be limited to, the following:

- Information to supplement and/or verify the environmental setting of the site including geology and hydrogeology
- A summary of the investigation/sampling activities
- Characterization of the source(s)
- Evaluation of the nature and extent of contamination
- Screening Level Human health and ecological risk assessments
- Conclusions and recommendations

A draft SI report will be submitted to the partnering team for comments and approval. Response to comments and necessary revisions will be made to the draft report before issuing a final report.

TABLE 4-1
SAMPLE ANALYSIS SUMMARY - OU22, SITE 95
SITE INVESTIGATION, CTO - 0105
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample Type	Boring/Monitoring Well Designation	Soil Samples						Water Samples					
		VOCs (OLM 04.3)	SVOCs (OLM 04.3)	PCBs (OLM 04.3)	Pesticides (OLM 04.3)	TAL Metals (ILM 05.3)	Soil Properties	VOCs (OLC 03.2)	SVOCs (OLC 03.2)	PCBs (OLC 03.2)	Pesticides (OLC 03.2)	TAL Metals (ILM 05.3)	NAIPs
DPT Surficial (<1 foot deep)	IR95JR-IS100 through IRJR-IS132	3	33	3	33	33							
	IR95MR-IS100 through IRMR-IS132	3	33	3	33	33							
	IR95LR-IS100 through IRLR-IS132	3	33	3	33	33							
	SUBTOTAL	9	99	9	99	99							
DPT Deep (>4 feet deep)	IR95JR-IS100 through IRJR-IS132	3	18	3	18	18							
	IR95MR-IS100 through IRMR-IS132	3	18	3	18	18							
	IR95LR-IS100 through IRLR-IS132	3	18	3	18	18							
	SUBTOTAL	9	54	9	54	54							
Monitoring wells	IR95JR-MW01	1	1	1	1	1	1	1	1	1	1	1	1
	IR95JR-MW02	1	1	1	1	1		1	1	1	1	1	1
	IR95JR-MW03							1	1	1	1	1	1
	IR95MR-MW01	1	1	1	1	1	1	1	1	1	1	1	1
	IR95MR-MW02	1	1	1	1	1		1	1	1	1	1	1
	IR95MR-MW03							1	1	1	1	1	1
	IR95LR-MW01	1	1	1	1	1	1	1	1	1	1	1	1
	IR95LR-MW02	1	1	1	1	1		1	1	1	1	1	1
	IR95LR-MW03							1	1	1	1	1	1
SUBTOTAL	6	6	6	6	6	3	9	9	9	9	9	9	
Total Environmental Samples		24	159	24	159	159	3	9	9	9	9	9	9
Trip Blanks ⁽¹⁾		3	0	0	0	0	0	1	0	0	0	0	0
Duplicate Samples ⁽²⁾		3	16	3	16	16	0	1	1	1	1	1	0
Matrix Spike Samples (MS) ⁽³⁾		2	10	2	10	10	0	1	1	1	1	1	0
Matrix Spike Duplicate Samples (MSD) ⁽⁴⁾		2	10	2	10	10	0	1	1	1	1	1	0
Field Blanks ⁽⁵⁾		1	1	1	1	1	0	1	1	1	1	1	0
Equipment Rinsate Blanks ⁽⁶⁾		5	5	5	5	5	0	2	2	2	2	2	0
TOTAL SAMPLES		40	201	37	201	201	3	16	15	15	15	15	9

NOTES

- ⁽¹⁾ One per cooler containing VOCs
- ⁽²⁾ One per every 10 field samples
- ⁽³⁾ One per every group of 20 samples
- ⁽⁴⁾ One per every group of 20 samples
- ⁽⁵⁾ One per week
- ⁽⁶⁾ One per day

IR95MR-IS100

IR95MR-IS101

IR95MR-IS102

IR95MR-IS103

IR95MR-IS104

IR95MR-IS105

IR95MR-IS106

Estimated extent of holding pen

IR95MR-IS107

IR95MR-IS108

IR95MR-IS109

IR95MR-IS110

IR95MR-IS111

IR95MR-IS112

IR95MR-IS113

Livestock dipping vat
Estimated extent of drip pad

IR95MR-IS114

IR95MR-IS115

IR95MR-IS116

IR95MR-IS117

IR95MR-IS118

IR95MR-MW01

IR95MR-MW02

IR95MR-IS119

IR95MR-IS120

IR95MR-IS121

IR95MR-IS122

IR95MR-IS123

IR95MR-IS124

IR95MR-IS125

IR95MR-IS126

IR95MR-MW03

IR95MR-IS127

IR95MR-IS128

IR95MR-IS129

IR95MR-IS130

IR95MR-IS131

IR95MR-IS132

APPROXIMATE SCALE
1" = 20'

LEGEND

- Proposed DPT boring location
- ⊙ Proposed Monitoring Well location
(Actual locations to be determined in the field.)

FIGURE 4-1
 PROPOSED SAMPLE LOCATION MAP-TYPICAL
 OU 22, SITE 95
 MARINE CORPS BASE, CAMP LEJEUNE
 NORTH CAROLINA

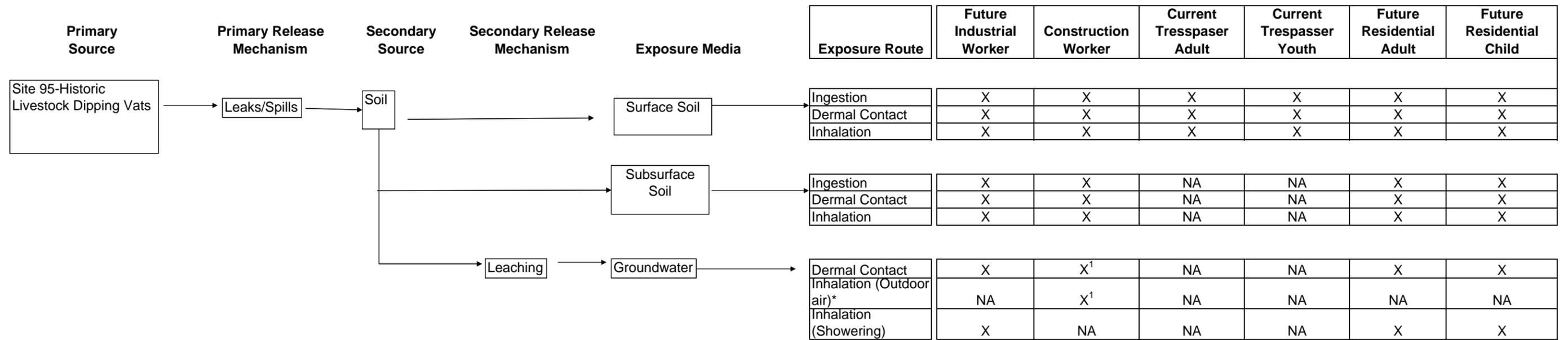


FIGURE 4-2
Preliminary Conceptual Site Model for HHRA at Site 95
Camp Lejeune, North Carolina

* EPA Region III's Version of a Two-Film Volatilization Model used for groundwater inhalation exposure to ambient air.
NA - Not Applicable or pathway is incomplete
X - Potentially complete exposure pathways
¹ - The construction worker could potentially contact only shallow groundwater at the site

5.0 Project Management and Staffing

The proposed management and staffing of the subject RI is shown on **Figure 5-1**. CH2M HILL's primary participants for this project (CTO 0105) are as follows:

- Mr. Matt Louth - Activity Coordinator
- Mr. Tegwyn Williams - Project Manager
- Task Managers

Mr. Williams and the Task Managers will have the overall responsibility for conducting the field activities and completing the reports associated with this CTO. They will be supported by geologists, engineers, scientists, biologists, and clerical personnel, as needed. The Task Managers will report to Mr. Williams and Mr. Louth who will then relay pertinent issues and maintain close contact with NAVFAC Atlantic and the Base.

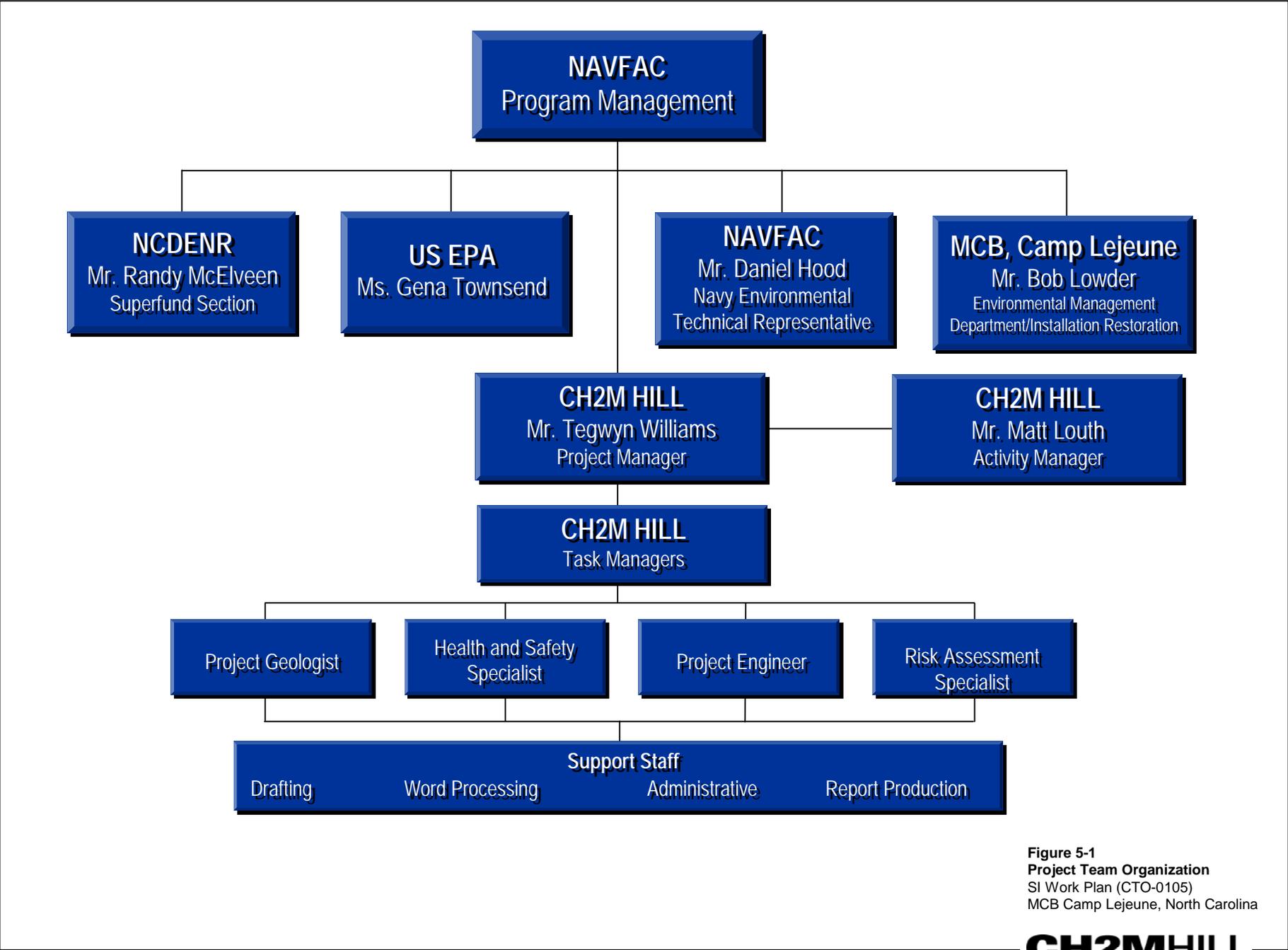


Figure 5-1
Project Team Organization
 SI Work Plan (CTO-0105)
 MCB Camp Lejeune, North Carolina



6.0 Project Schedule

The project schedule is presented in **Figure 6-1**. The schedule presents the anticipated completion and/or submittal dates for specific tasks or documents.

FIGURE 6-1 PROPOSED PROJECT SCHEDULE - OU22, SITE 95 SITE INVESTIGATION WORK PLAN, CTO - 0105 MCB, CAMP LEJEUNE, NORTH CAROLINA	
TASK NAME	DURATION (days)
SI Field Work	30
Laboratory Analysis/Data Validation	45
Draft SI Report	90
Agency Review	40
Final SI	30

7.0 References

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QAPP Addendum

DRAFT

QAPP Addendum

Site 95 – Operable Unit No. 22 Historic Livestock Dipping Vats

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina



Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic Division
Norfolk, Virginia

Contract No.
N62470-02-D-3052
CTO-0105
Navy Clean III

February 2006

Prepared by

CH2MHILL

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(NOTE: Italicized print indicates that information in that section is presented in the Master Site QAPP and not in this QAPP Addendum.)

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List of Acronyms and Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DQOs	Data Quality Objectives
MCB	Marine Corps Base
OU	Operable Unit
QAPP	Quality Assurance Project Plan
SI	Site Investigation
USEPA	United States Environmental Protection Agency

1.0 Introduction

This Quality Assurance Project Plan (QAPP) Addendum provides site-specific quality assurance information for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigations (RIs) at Marine Corps Base (MCB) Camp Lejeune, North Carolina. General information that is required for the QAPP is presented in the Master Site QAPP, which is contained in the Master Project Plans for Camp Lejeune (CH2MHill, 2005). This QAPP Addendum is designed to be used in conjunction with the Master Site QAPP. Site personnel are required to review the information presented in both the Master Site QAPP and this QAPP Addendum prior to conducting the field activities.

2.0 Project Description and Organization

An SI will be conducted at Operable Unit 22, Site 95. The primary objectives of the SI are to determine the nature and extent of contamination and evaluate potential impacts to human health and the environment.

The field activities will include the collection and analyses of soil and groundwater samples from surface soils, soil borings, and monitoring wells at Site 95. Detailed sampling procedures and sample handling and analyses requirements are presented in the Site Specific Work Plan. Tables 4-1 contained in the Site Specific Work Plan presents a summary of the sampling and analytical program proposed for the site. The sample locations are shown on **Figure 4-1** of the Site Specific Work Plan.

Data quality and sampling objectives and the United States Environmental Protection Agency (USEPA) seven-step data quality objectives (DQOs) process, as presented in the USEPA Guidance for the Data Quality Objectives Process (USEPA, 2000a), and USEPA Data Quality Objectives Process for Hazardous Waste Site Investigations (USEPA, 2000b) are presented in Section 3.0 of the Site Specific Work Plan.

Key personnel responsible for quality assurance of the project are presented in Section 5.0 of the Site Specific Work Plan. CH2MHill's primary participants are as follows:

- Mr. Matt Louth - Activity Coordinator
- Mr. Tegwyn Williams - Project Manager
- Mr. Jeremy Vaughan - Site Manager

Mr. Louth and Mr. Williams will have the overall responsibility for conducting the field activities and completing the report associated with this project. They will be supported by geologists, engineers, scientists, biologists, and clerical personnel, as needed. The primary subcontractors required for this project include a drilling contractor, utility locator, surveyor, analytical laboratory, and independent data validator. Miscellaneous subcontractors may also be procured for various support services. Specific subcontractors have not yet been selected. Figure 5-1 contained in the Site Specific Work Plan presents the project organization, responsibilities, and support staff.

Health and Safety Plan

Site Specific Health and Safety Plan Addendum For OU 22, Site 95

**Marine Corps Base
Camp Lejeune, North Carolina**

Contract Task Order 0105

February, 2006

Prepared for
**Department of the Navy
Atlantic Division
Naval Facilities Engineering Command**

Under the
**NAVFAC CLEAN III Program
Contract N62470-02-D-3052**

Prepared by



Charlotte, North Carolina

Introduction

The health and safety of site personnel and the public are a primary concern during investigative and remedial activities at potentially hazardous sites. This Site Specific Health and Safety Plan (HASP) template is to be used in the formation of site specific HASP's.

CH2M HILL SITE SPECIFIC HEALTH AND SAFETY PLAN
(Reference CH2M HILL SOP 19, *Health and Safety Plans*)

This health and safety plan will be kept on the site during field activities and will be reviewed and updated as necessary. The plan adopts, by reference, the standards of practice (SOP) in the CH2M HILL *Corporate Health and Safety Program* as appropriate. The site safety coordinator (SC-HW) is to be familiar with these SOPs and the content of this plan. Site personnel must sign Attachment 1. In addition, this plan adopts procedures in the work plan for the project.

1 PROJECT INFORMATION AND DESCRIPTION

CLIENT OR OWNER: Department of the Navy **PROJECT NO:** 328432
Atlantic Division
Naval Facilities Engineering Command

CH2M HILL PROJECT MANAGER: Tegwyn Williams **OFFICE:** CLT

SITE NAME: Marine Corps Base, Camp Lejeune; OU 22, Site 95

SITE ADDRESS: Jacksonville, North Carolina

DATE HEALTH AND SAFETY PLAN PREPARED: 8/16/05

DATE(S) OF INITIAL VISIT: January 20, 2006

DATE(S) OF SITE WORK: January 20, 2006 through December 30, 2006

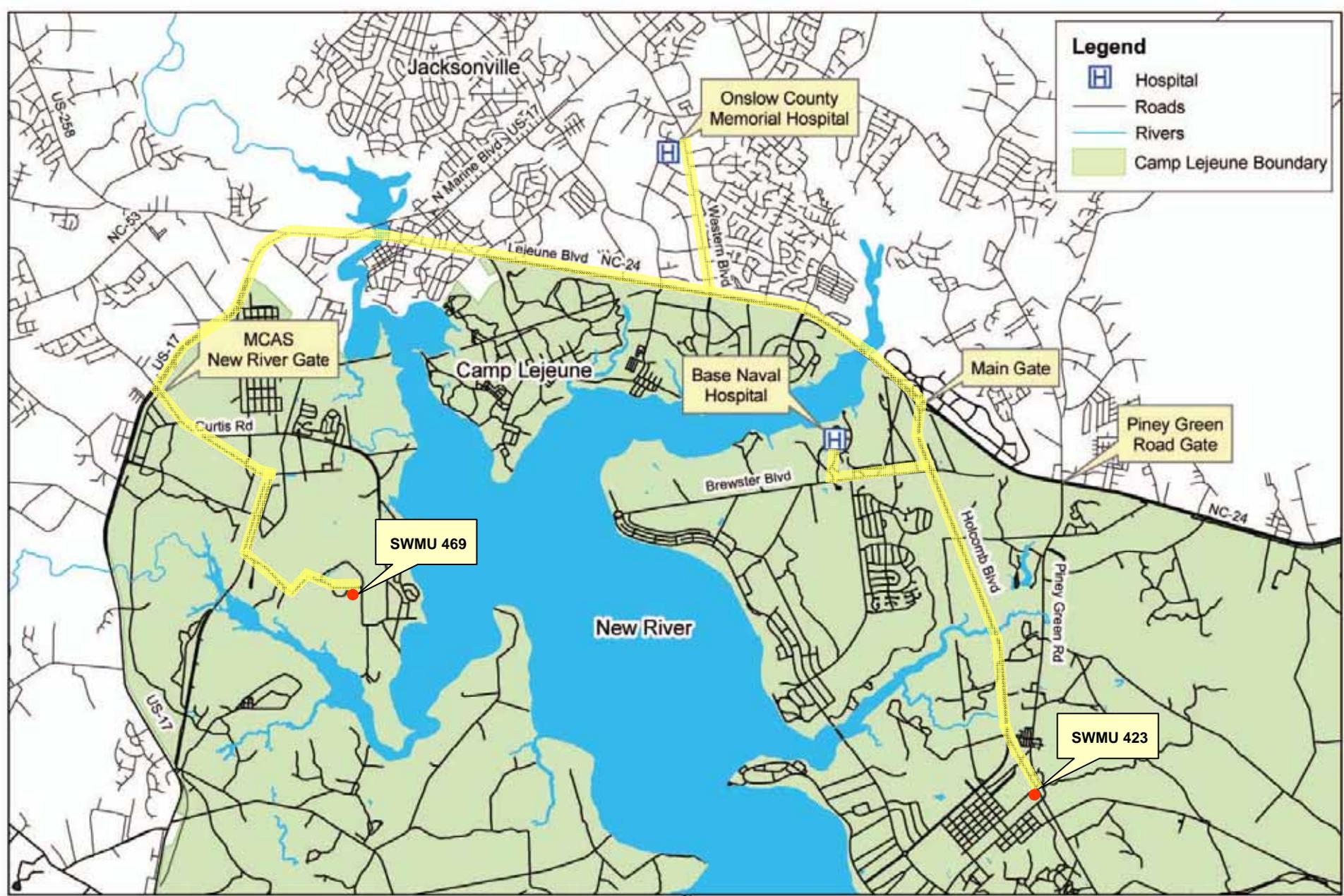
SITE ACCESS: Three separate small sites, accessibility unknown, exact locations also unknown.

SITE SIZE: Three separate small sites. Approximately 1/4 acre each.

SITE TOPOGRAPHY: Generally flat to gently sloping. Wooded

SITE DESCRIPTION AND HISTORY: Site 95 consists of three separate small sites. At each site, there is a concrete or brick lined trench that was filled with a solution of arsenic or pesticides that the livestock walked through for control of ticks. The dates of operation of these facilities are not known, but this type of facility was used to treat cattle and other livestock for ticks during the period of approximately 1906 through 1961. All three sites are located within the boundaries of MCB Camp Lejeune. At least two of the sites are located in overgrown wooded areas near existing roads, and will require some site clearing to gain access. No initial assessment has been performed on the third site.

An initial assessment (by hand auger) of these two sites was performed by Baker Environmental in 2004. Arsenic, chromium, mercury, DDT, DDD and DDE were detected in that assessment. A small ATV mounted hollow stem auger drill rig will be used for installation of three shallow 15 to 30 ft deep monitoring wells at each site. Groundwater samples will be collected from each well. Sediment samples, and if available, surface water samples will be collected from each trench area.



2 PROJECT ORGANIZATION AND TASKS TO BE PERFORMED UNDER THIS PLAN

2.1 PROJECT ORGANIZATION

CLIENT: Daniel Hood
Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

CH2M HILL: Activity Manager: Matt Louth / VBO
Project Manager: Tegwyn Williams/ CLT
Health and Safety Manager: Mike Goldman / ATL
Field Team Leader: Dan Tomczak / RDU
James Frank/RDU
Jeremy Vaughan/CLT
Donna Laudermilch/CLT
Mike Skeean/CLT
Field Team Members: Frank Gerraughty/CLT
Matt Westendorf / CLT
Jonathan Burton/CLT
Mark Strong/CLT
David Dry/CLT

CONTRACTORS and SUBCONTRACTORS: Professional Locating Service. Others to be determined.

2.2 DESCRIPTION OF TASKS (Reference CH2M HILL SOP HS-19, *Written Plans*)

Refer to site-specific addenda (i.e., work plan, field sampling plan) for detailed task information. A health and safety risk analysis has been performed for each task and is incorporated into this HASP through task-specific hazard controls and requirements for monitoring and protection. Tasks in addition to those listed below and in the Master HASP require an approved amendment before additional work begins.

2.2.1 HAZWOPER-REGULATED TASKS

- Utility location
- Monitoring well installation
- IDW Management
- Groundwater level measurement
- Surveying
- Sampling of soil and groundwater

2.2.2 NON-HAZWOPER-REGULATED TASKS

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-Hazwoper-trained personnel. **Prior approval from the HSM is required before these tasks are conducted on regulated hazardous waste sites.**

- Subsurface utility location
-

2.2.3 Chainsaw Safety

- Maintain your chainsaw regularly.
- Keep the chain sharp and correctly tensioned.
- Always carry the saw with the cutter bar facing backwards and the guard in position when not in use.
- Fit the bar cover when the chainsaw is not in use.
- Wear protective equipment - cut resistant pants or chaps, ear muffs, safety glasses or face shield, helmet, boots and close fitting clothing.
- Never use a chainsaw if you are tired, under the influence of alcohol or drugs, or if the weather conditions are not suitable. Chainsaw operators need to be alert to avoid accidents.
- When operating a chainsaw it is important to maintain a firm grip - get a good foothold and keep the saw close to your body.
- Always cut at peak motor revs, to have a better chance of cutting through any obstruction.
- Never allow an inexperienced person to use a chainsaw. All chainsaw operators should be properly trained. - Less experienced operators should always be closely supervised.
- Some operations such as removing branches from standing trees, the removal of trees on wires and cutting trees thicker than the bar guide length, should only be undertaken by a professional.

2.2.4 Tree Felling Safety

- Before trimming a tree, inspect the area to identify possible hazards (e.g., presence of power lines, broken or cracked limbs after a severe storm) and take appropriate actions to prevent injuries or accidents. Assume any power lines are energized or "live".
- Mark off area around tree and prevent bystander access. Always work with another person who stays on the ground.
- Learn to recognize trees weakened by disease and types of trees prone to cracking. Inspect tree limbs for strength before climbing.
- Check for cavities in the tree, rotten or dead branches, splits and cracks in the trunk or where branches are attached, broken branches hanging in the tree, etc.
- Inspect the fall protection equipment and lines before each time they are used.
- Tag and remove any damaged or defective equipment from service until it can be repaired or replaced and disposed of properly, according the manufacturer's recommendations..
- If a ladder is used, tie it off on a secure branch.

- Use approved and appropriate fall protection gear when working above ground including when working from a ladder or platform.
- Break small dead branches off by hand as you climb.
- Remove larger branches with proper tools.
- Place hands and feet on separate limbs and move only one hand or foot at a time.
- Raise or lower tools by attaching hand lines to the end of tools. Tools attached at the center might catch on branches. Smaller tools may be raised and lowered in a bucket attached to a hand line.
- Use non-conductive tools and personal protective equipment if working near electrical power lines.
- Do not use dead branches for support.
- Do not climb trees during wet or icy weather or under high wind conditions.
- Do not leave partially sawn limbs on trees.
- Do not carry saws, pruners and other tools while climbing.
- Do not use axes or hatchets. Contact the power utility company before working on trees near power lines to arrange for ways to protect the employees (e.g., cutting off the power to the lines and grounding them or using insulating blankets on the power lines).
- Maintain a minimum working distance of 20 feet from "live" power lines for the voltage they are conducting.
- Use proper ropes with appropriate carriers and hooks for raising and lowering equipment.
- Use a pull rope to prevent branches from falling toward power lines.
- Use non-conducting tools and equipment.
- Wear rubber gloves when using a pole pruner.
- Ensure that the pole pruner's cutting head is connected to the lever at the lower end of the pole with a polypropylene rope. Do not use a wire or chain.
- Apply and maintain a coating of non-conductive, wood preservative to help keep wooden pruner handles dry.
- Use approved safety belts, lifelines, and leather gauntlet gloves.
- Wear head and eye protection and footwear protection with slip-resistant soles.
- Choose close-fitting, long-sleeved clothing

2.2.5 Clearing and Grubbing Operations

- Ensure that environmental-protection considerations are addressed before conducting clearing operations.
- Plan clearing operations to allow disposal of debris in one handling. It is best to travel in one direction when clearing. Changing direction tends to skin and scrape the trees instead of uprooting them or allowing a clean cut. Clearing techniques vary with the type of vegetation being cleared, the ground's soil type, and the soil's moisture condition.
- Moving the dozer, with the blade slightly below ground level, will usually remove small trees and brush. The blade cuts, breaks off, or uproots most of the tree and bends the rest for removal on the return trip. A medium tractor with a dozer blade can clear and pile about 0.25 acres of brush or small trees per hour.
- To remove a medium-size tree (7 to 12 inches in diameter), raise the blade as high as possible to gain added leverage and then push the tree over slowly. As the tree starts to fall, back the dozer quickly to avoid the rising roots. Then lower the blade and drive the dozer forward, lifting out the roots. The average time for a medium tractor with a dozer blade to clear and pile medium trees is 2 to 9 minutes per tree.
- Removing large trees (12 to 30 inches in diameter) is much slower and more difficult than clearing brush and smaller trees. First, gently and cautiously probe the tree for dead limbs that could fall. Determine the tree's natural direction of lean, if any; this is the best direction for pushing the tree

over. Then, position the blade high and center it on the tree for maximum leverage. If possible, push the tree over the same as a medium tree.

- Never operate clearing tractors too close together.
- Do not follow a tree too closely when pushing it, because when it begins to fall, its stump and roots may catch under the front of the dozer.
- Clean out accumulated debris in the dozer's belly pan often to prevent fires in the engine compartment.
- Unauthorized personnel are required to remain clear of the clearing and grubbing operations.

2.3 TASK HAZARD ANALYSIS

Engineering and administrative controls are to be implemented by the party in control of the site or the hazard (i.e., CH2M HILL, subcontractor, or contractor). CH2M HILL employees and subcontractors must, at a minimum, remain aware of hazards affecting them regardless of who is responsible for controlling the hazards. Specialty subcontractors are responsible for the safe operation of their equipment (e.g., drill rig, heavy equipment). CH2M HILL employees are not to operate, or assist in the operation of, any subcontractor or contractor equipment.

		Tasks								
Potential Hazard (Refer to SOP, or HSP Section)	Engineering Controls, Administrative Controls, and Work Practices	Drilling, Geoprobe Installation, Well Installation and Abandonment	Groundwater Monitoring , Aquifer Testing, and Video Surveying of Wells	Clearing, Grubbing and Tree Removal	Surface Water and Sediment Sampling from the Shore or Water	Hand Augering	Surveying	IDW Drum Sampling and Disposal ^a	Observation of Loading of Material for Offsite Disposal	Remediation and Construction Oversight
Flying debris/objects	Wear safety eyewear and hardhat	X		X						
Noise > 85dBA	Wear ear plugs/muffs	X		X						
Electrical	Locate underground and overhead utilities prior to task	X		X						
Suspended Loads	Wear hardhat, Be aware of location of overhead hazards	X		X						
Buried Utilities, drums, tanks	Locate underground utilities prior to task. Stop if object is encountered	X								
Slip, trip, fall	Be sure of footing, especially in wet or muddy conditions	X	X	X	X	X	X	X		
Back injury	Be careful when lifting and use proper lifting techniques	X	X	X				X		
Visible lightning	Discontinue task if lightening is observed	X	X	X		X	X			
Drilling (Geoprobe)	Be careful of equipment and pinch points	X								

3.1 HAZARDS POSED BY CHEMICALS BROUGHT ON THE SITE

This section discusses hazards posed by chemicals commonly used during environmental investigation activities. Additional chemicals may be needed for future tasks.

3.1.1 HAZARD COMMUNICATION

(Reference CH2M HILL SOP HS-05, *Hazard Communication*)

The project manager is to request Material Safety Data Sheets (MSDSs) from the client or from the contractors and the subcontractors for chemicals to which CH2M HILL employees potentially are exposed. The SC-HW is to do the following:

- Give employees required site-specific HAZCOM training.
- Confirm that the inventory of chemicals brought on the site by subcontractors is available.
- Before or as the chemicals arrive on the site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, if any.

The chemical products listed below will be used on the site. Refer to Master HASP for MSDSs.

Chemical	Quantity	Location
Methane	1 liter, compressed	Support Zone
Isobutylene	1 liter, compressed	Support Zone
Pentane	1 liter, compressed	Support Zone
Hydrochloric Acid	<500 mL	Support Zone / sample bottles
Nitric Acid	<500 mL	Support Zone / sample bottles
Sulfuric Acid	<500 mL	Support Zone / sample bottles
Sodium Hydroxide	<500 mL	Support Zone / sample bottles
Methanol	< 1 Gallon	Support / Decon Zones
Isopropanol	< 1 Gallon	Support / Decon Zones
pH buffers	<500 mL	Support Zone
MSA sanitizer	< 1 Liter	Support / Decon Zones
Alconox/Liquinox	< 1 Liter	Support / Decon Zones

3.1.2 SHIPPING AND TRANSPORTATION OF CHEMICAL PRODUCTS

(Reference CH2M HILL's *Procedures for Shipping and Transporting Dangerous Goods*)

Nearly all chemicals brought to the site are considered hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive the CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

3.2 CONTAMINANTS OF CONCERN					
Contaminant	Location and Highest Concentration (ppm)	Exposure Limit ^a	IDLH ^b	Symptoms and Effects of Exposure	PIP ^c (eV)
Arsenic	565 mg/Kg SD	0.002 mg/m ³ (15 min)	5 mg/m ³ Ca (as arsenic)	Ulceration of nasal septum,, derm, GI disturbances, peri neur, resp irrit, hyperpigmentation of skin	NA
Chromium	45.8 mg/Kg SD	0.5 mg/m ³	250 mg/m ³	Irrit. eyes, skin; lung fibrosis	Not listed
Mercury	0.79 mg/Kg SD	0.05 mg/m ³ (Hg vapor) (skin)	10 mg/m ³	Irrit. eyes, skin; cough, chest pain, dysp., bron, pneu; tremor; insom, irrity, indecision, head, lass; stomatitis, salv; GI dist, anor, low wgt; proteinurea	Not listed
4,4'-DDT	17 J µg/Kg SD	0.5 mg/m ³	500 mg/m ³ Ca	Irrit. eyes, skin; paresthesia of tongue, lips, face; tremors; convulsions; weakness, exhaustion; convulsions; paresis hands; vomit	Not listed
4,4'-DDE (not listed)	18 µg/Kg SD	NA	NA	Suspected Human Carcinogen - AVOID SKIN CONTACT and decon immediately after intrusive work	UK
4,4'-DDD (not listed)	17 J µg/Kg SD	NA	NA	Confirmed Human Carcinogen - AVOID SKIN CONTACT and decon immediately after intrusive work	UK

3.2 CONTAMINANTS OF CONCERN					
Contaminant	Location and Highest Concentration (ppm)	Exposure Limit ^a	IDLH ^b	Symptoms and Effects of Exposure	PIP ^c (eV)
<p>Footnotes:</p> <p>a: Appropriate value of PEL, REL, or TLV listed</p> <p>b: IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant)</p> <p>c: PIP = photoionization potential</p> <p>GW - Groundwater</p> <p>SD - Sediment</p> <p>SW - Surface Water</p> <p>J - Estimated concentration</p> <p>D - Compound identified in analysis at a secondary dilution factor</p> <p>B - Analyte found in associated blank as well as in sample</p>					

3.3 POTENTIAL ROUTES OF EXPOSURE		
<p>DERMAL: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 5.</p>	<p>INHALATION: Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in sections 5 and 6, respectively.</p>	<p>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 eating, drinking, or smoking).</p>

4 PERSONNEL

4.1 FIELD TEAM CHAIN OF COMMAND AND COMMUNICATION PROCEDURES

4.1.1 CLIENT

Client Contact

...NAVFAC Engineering Command
Code OPCEV
6506 Hampton Blvd
Norfolk, Virginia 23508-1273
757-322-4589
daniel.r.hood@navy.mil

Base Contact

Camp Lejeune - EMD
Building 12
Marine Corps Base
Camp Lejeune, NC 28542-0004
(910) 451-9607
LowderRA@lejeune.usmc.mil

4.1.2 CH2M HILL

Activity Manager/Phone: Matt Louth / VBO (757) 671-8311 ext 417
Project Manager/Phone: Tegwyn Williams (704) 329-0073 ext. 227
Health and Safety Manager (HSM)/Phone: Mike Goldman (770) 604-9182 ext 396
Field Team Leader/Phone: Dan Tomczak. RDU (919) 875-4311 ext 19
Site Safety Coordinator/Phone: Dan Tomczak. RDU (919) 875-4311 ext 19

The SC-HW is responsible for contacting the field team leader and the project manager. In general, the project manager either will contact or will identify the client contact. The Health and Safety Manager (HSM) should be contacted as appropriate. The SC-HW or the project manager must notify the client and the HSM when a serious injury or a death occurs or when health and safety inspections by OSHA or other agencies are conducted. Refer to Master HASP sections 11 and 12 for emergency procedures and phone numbers.

4.1.3 SUBCONTRACTORS

(Reference CH2M HILL SOP HS-55, *Subcontractor, Contractor, and Owner*)

When specified in the project documents (e.g., contract), this plan may cover CH2M HILL subcontractors. However, this plan does not address hazards associated with tasks and equipment that the subcontractor has expertise in (e.g., operation of drill rig). Specialty subcontractors are responsible for health and safety procedures and plans specific to their work. Specialty subcontractors are to submit plans to CH2M HILL for review and approval before the start of fieldwork. Subcontractors must comply with the established health and safety plan(s). CH2M HILL must monitor and enforce compliance with the established plan(s).

Subcontractor: Professional Locating Service
Subcontractor Contact: Phil Minix
Telephone: (910) 347-7519, (910) 389-6145 mobile

Subcontractor: **Others to be determined**
Subcontractor Contact:
Telephone:

4.1.4 CONTRACTORS

(Reference CH2M HILL SOP HS-55, *Subcontractor, Contractor, and Owner*)

This plan does not cover contractors that are contracted directly to the client or the owner. CH2M HILL is

not responsible for directing contractor personnel and is not to assume responsibility through their actions. When the contractor is in control of the site, ask the contractor to conduct a briefing of their health and safety practices and to describe how they apply to CH2M HILL's activities. Request a copy of the contractor's health and safety plan.

Contractor: Shaw Group
 Contact Name:
 Telephone:

5 PERSONAL PROTECTIVE EQUIPMENT (PPE)

(Reference CH2M HILL SOPs HS-07, *Personal Protective Equipment*, and HS-08, *Respiratory Protection*)

5.1 PPE SPECIFICATIONS^a

Task	Level	Body	Head	Respirator ^b
Drilling Oversight/Soil Sample Collection	D	Work Clothes, Steel toe boots, Impermeable gloves and inner gloves	Hard hat, hearing protection, safety glasses	No
Groundwater Sample Collection	D	Work Clothes, steel toe boots, Impermeable gloves and inner gloves.	Hard hat, Safety glasses, face shield	No
Sediment and/or Surface Water Sample Collection	D	Work Clothes, steel toe boots, Impermeable gloves (optional steel toe rubber boots if needed)	Hard hat, safety glasses, face shield	No

^a CH2M HILL will provide PPE to only CH2M HILL employees.

^b No facial hair that would interfere with respirator fit is permitted.

5.2 REASONS FOR UPGRADING OR DOWNGRADING LEVEL OF PROTECTION

Upgrade*	Downgrade
<ul style="list-style-type: none"> Request from individual performing task. Change in work task that will increase contact or potential contact with hazardous materials. Occurrence or likely occurrence of gas or vapor emission. Known or suspected presence of dermal hazards. Instrument action levels (Section 6) exceeded. 	<ul style="list-style-type: none"> New information indicating that situation is less hazardous than originally thought. Change in site conditions that decrease the hazard. Change in work task that will reduce contact with hazardous materials.

*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 specified in Section 5 and an SC-HW who meets the requirements specified in the Master HASP 4.1 is present.

6 AIR MONITORING SPECIFICATIONS

Instrument	Tasks	Action Levels ^a		Frequency ^b	Calibration
FID: OVA model 128 or equivalent	Drilling and all intrusive work	Drilling and all intrusive work	Level D Level C Evacuate work area and contact HSM	Initially and periodically during task	Daily
PID: OVM with 10.6eV lamp or equivalent	Drilling and all intrusive work	Drilling and all intrusive work	Level D Level C Evacuate work area and contact HSM	Initially and periodically during task	Daily
CGI: MSA model 260 or 261 or equivalent	Drilling and all intrusive work	Drilling and all intrusive work	No explosion hazard Potential explosion hazard Explosion hazard; evacuate or vent	Continuous during advancement of boring or trench	Daily

^a Action levels apply to sustained breathing-zone measurements above background.

^b The exact frequency of monitoring depends on field conditions and is to be determined by the SSC; generally, every 5 to 15 minutes if acceptable; 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 the measured percent of O₂ is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O₂ action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O₂ action levels are required for confined-space entry (refer to Section 2).

^d Refer to SOP HS-10 for instructions and documentation on radiation monitoring and screening.

^e Noise monitoring and audiometric testing also required.

Instrument	Gas	Span	Reading	Method
PID: OVM, 10.6 or 11.8 eV bulb	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing
PID: MiniRAE, 10.6 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	1.5 lpm reg T-tubing
PID: TVA 1000	100 ppm isobutylene	CF = 1.0	100 ppm	1.5 lpm reg

FID: OVA	100 ppm methane	3.0 ± 1.5	100 ppm	T-tubing 1.5 lpm reg T-tubing
FID: TVA 1000	100 ppm methane	NA	100 ppm	2.5 lpm reg T-tubing
CGI: MSA 260, 261, 360, or 361	0.75% pentane	N/A	50% LEL ± 5% LEL	1.5 lpm reg direct tubing

Method Description:

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel. Results reported to:

HSM: Michael Goldman CIH

Other:

7 APPROVAL

This site-specific health and safety plan has been written for use by CH2M HILL only. CH2M HILL 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.

7.1 ORIGINAL PLAN

WRITTEN BY: David Dry

DATE: 8/16/2005

APPROVED BY: Michael Goldman

DATE: 8/30/2005

7.2 REVISIONS

REVISIONS MADE BY:

DATE:

REVISIONS TO PLAN:

REVISIONS APPROVED BY: DATE:

8 ATTACHMENTS

Attachment 1: Employee Signoff

Material Data Safety Sheets

Material Safety Data Sheet

Di-Tert-Butyl Malonate

ACC# 52853

Section 1 - Chemical Product and Company Identification

MSDS Name: Di-Tert-Butyl Malonate

Catalog Numbers: AC406620000, AC406620025, AC406620100, AC406620250

Synonyms: Propanedioic Acid; Bis(1,1-Dimethylethyl) Ester

Company Identification:

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01

For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
541-16-2	Propanedioic Acid, Bis(1,1-Dimethylethyl) Ester	ca 100	208-769-6

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: clear, colorless liquid. Flash Point: 88 deg C.

Caution! Combustible liquid and vapor. May cause eye and skin irritation. May cause respiratory and digestive tract irritation. The toxicological properties of this material have not been fully investigated.

Target Organs: None known.

Potential Health Effects

Eye: May cause eye irritation. The toxicological properties of this material have not been fully investigated.

Skin: May cause skin irritation. The toxicological properties of this material have not been fully investigated.

Ingestion: May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated.

Inhalation: May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated.

Chronic: No information found.

Section 4 - First Aid Measures

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and

lower eyelids. Get medical aid.

Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion: Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Combustible liquid. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Containers may explode when heated.

Extinguishing Media: Use water spray to cool fire-exposed containers. Use agent most appropriate to extinguish fire. Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Flash Point: 88 deg C (190.40 deg F)

Autoignition Temperature: Not available.

Explosion Limits, Lower:Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 1; Flammability: 2; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Keep away from heat, sparks and flame. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Propanedioic Acid, Bis(1,1-Dimethylethyl) Ester	none listed	none listed	none listed

OSHA Vacated PELs: Propanedioic Acid, Bis(1,1-Dimethylethyl) Ester: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: clear, colorless

Odor: Not available.

pH: Not available.

Vapor Pressure: Not available.

Vapor Density: 7.5

Evaporation Rate: Not available.

Viscosity: Not available.

Boiling Point: Not available.

Freezing/Melting Point: -7 deg C

Decomposition Temperature: Not available.

Solubility: Not available.

Specific Gravity/Density: .9660g/cm³

Molecular Formula: C₁₁H₂₀O₄

Molecular Weight: 216.28

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Incompatible materials, ignition sources, excess heat, strong oxidants.

Incompatibilities with Other Materials: Oxidizing agents.

Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.

Hazardous Polymerization: Has not been reported

Section 11 - Toxicological Information

RTECS#:

CAS# 541-16-2 unlisted.

LD50/LC50:

Not available.

Carcinogenicity:

CAS# 541-16-2: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information available.**Teratogenicity:** No information available.**Reproductive Effects:** No information available.**Mutagenicity:** No information available.**Neurotoxicity:** No information available.**Other Studies:**

Section 12 - Ecological Information
--

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.**RCRA U-Series:** None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Please contact Fisher Scientific for shipping information	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information
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US FEDERAL**TSCA**

CAS# 541-16-2 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

Page 3 of 6

CERCLA Hazardous Substances and corresponding RQs

None of the chemicals in this material have an RQ.

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

Section 313 No chemicals are reportable under Section 313.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 541-16-2 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

Not available.

Risk Phrases:

Safety Phrases:

S 24/25 Avoid contact with skin and eyes.

S 37 Wear suitable gloves.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 28A After contact with skin, wash immediately with plenty of water

WGK (Water Danger/Protection)

CAS# 541-16-2: No information available.

Canada - DSL/NDSL

CAS# 541-16-2 is listed on Canada's NDSL List.

Canada - WHMIS

WHMIS: Not available.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

Section 16 - Additional Information

MSDS Creation Date: 1/13/1999

Revision #3 Date: 10/03/2005

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any

special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

PRODUCT NAME: PENTANE

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Liquid	
Vapor pressure at 100 °F	: 15	Psia
Vapor density (Air = 1)	: Not Available	
Evaporation point	: Not Available	
Boiling point	: 97	°F
	: 36	°C
Freezing point	: Not Available	
	: Not Available	
Ph	: Not Available	
Specific gravity @ 70 °F	: 2.48	1 atm
Oil/water partition coefficient	: Not Available	
Solubility (H2O)	: Negligible	
Odor threshold	: Not Available	
Odor and appearance	: Colorless liquid and vapor with mild paraffinic odor.	

10. Stability and Reactivity

STABILITY:

Stable

INCOMPATIBLE MATERIALS:

Oxygen, other oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS:

None.

HAZARDOUS POLYMERIZATION:

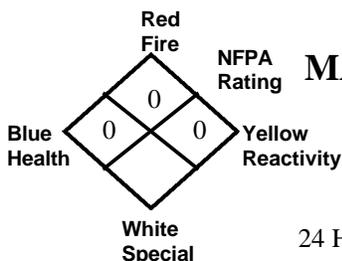
Will not occur.

11. Toxicological Information

No chronic effects data given in the Registry of Toxic Effects of Chemical Substances (RTECS) or Sax, Dangerous Properties of Industrial Materials, 7th ed.

12. Ecological Information

No data given.

Alconox®**MATERIAL SAFETY DATA SHEET**

Alconox, Inc.
30 Glenn Street
White Plains, NY 10603

24 Hour Emergency Number – Chem-Tel (800) 255-3924

I. IDENTIFICATION

Product Name (as appears on label)	ALCONOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 2001
Chemical Family:	Anionic Powdered Detergent
Manufacturer Catalog Numbers for sizes	1104, 1125, 1150, 1101, 1103 and 1112

II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point (F):	Not Applicable
Vapor Pressure (mm Hg):	Not Applicable
Vapor Density (AIR=1):	Not Applicable
Specific Gravity (Water=1):	Not Applicable
Melting Point:	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Not Applicable
Solubility in Water:	Appreciable-Soluble to 10% at ambient conditions
Appearance:	White powder interspersed with cream colored flakes.
pH:	9.5 (1%)

IV. FIRE AND EXPLOSION DATA

Flash Point (Method Used):	None
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO ₂ , foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. REACTIVITY DATA

Stability:	Stable
Hazardous Polymerization:	Will not occur
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition or Byproducts:	May release CO ₂ on burning

VI. HEALTH HAZARD DATA

Route(s) of Entry:	Inhalation? Yes Skin? No Ingestion? Yes
Health Hazards (Acute and Chronic):	Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Exposure may irritate mucous membranes. May cause sneezing.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	Material should be stored in a dry area to prevent caking.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VIII. CONTROL MEASURES

Respiratory Protection (Specify Type):	Dust mask - Recommended
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are useful but not required.
Eye Protection:	Goggles are recommended when handling solutions.
Other Protective Clothing or Equipment:	None
Work/Hygienic Practices:	No special practices required

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.

MSDS Number: **S4034** * * * * * *Effective Date: 08/02/01* * * * * * *Supersedes: 08/20/98*

MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

SODIUM HYDROXIDE

1. Product Identification

Synonyms: Caustic soda; lye; sodium hydroxide solid; sodium hydrate

CAS No.: 1310-73-2

Molecular Weight: 40.00

Chemical Formula: NaOH

Product Codes:

J.T. Baker: 3717, 3718, 3721, 3722, 3723, 3728, 3734, 3736, 5045, 5565

Mallinckrodt: 7001, 7680, 7708, 7712, 7772, 7798

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sodium Hydroxide	1310-73-2	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

**POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED.
HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT.
REACTS WITH WATER, ACIDS AND OTHER MATERIALS.**

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 2 - Moderate

Contact Rating: 4 - Extreme (Corrosive)

Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES

Storage Color Code: White Stripe (Store Separately)

Potential Health Effects

Inhalation:

Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Severe pneumonitis may occur.

Ingestion:

Corrosive! Swallowing may cause severe burns of mouth, throat, and stomach. Severe scarring of tissue and death may result. Symptoms may include bleeding, vomiting, diarrhea, fall in blood pressure. Damage may appear days after exposure.

Skin Contact:

Corrosive! Contact with skin can cause irritation or severe burns and scarring with greater exposures.

Eye Contact:

Corrosive! Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.

Chronic Exposure:

Prolonged contact with dilute solutions or dust has a destructive effect upon tissue.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician, immediately. Wash clothing before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:

Perform endoscopy in all cases of suspected sodium hydroxide ingestion. In cases of severe esophageal corrosion, the use of therapeutic doses of steroids should be considered. General supportive measures with continual monitoring of gas exchange, acid-base balance, electrolytes, and fluid intake are also required.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard. Hot or molten material can react violently with water.

Can react with certain metals, such as aluminum, to generate flammable hydrogen gas.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Adding water to caustic solution generates large amounts of heat.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. Do not flush caustic residues to the sewer. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric or sulfuric. Absorb neutralized caustic residue on clay, vermiculite or other inert substance and package in a suitable container for disposal.

US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Always add the caustic to water while stirring; never the reverse. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product. Do not store with aluminum or magnesium. Do not mix with acids or organic materials.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

- OSHA Permissible Exposure Limit (PEL):

2 mg/m³ Ceiling

- ACGIH Threshold Limit Value (TLV):

2 mg/m³ Ceiling

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a half facepiece particulate respirator (NIOSH type N95 or better filters) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest.. A full-face piece particulate respirator (NIOSH type N100 filters) may be worn up to

50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

White, deliquescent pellets or flakes.

Odor:

Odorless.

Solubility:

111 g/100 g of water.

Specific Gravity:

2.13

pH:

13 - 14 (0.5% soln.)

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

1390C (2534F)

Melting Point:

318C (604F)

Vapor Density (Air=1):

> 1.0

Vapor Pressure (mm Hg):

Negligible.

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Very hygroscopic. Can slowly

pick up moisture from air and react with carbon dioxide from air to form sodium carbonate.

Hazardous Decomposition Products:

Sodium oxide. Decomposition by reaction with certain metals releases flammable and explosive hydrogen gas.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Sodium hydroxide in contact with acids and organic halogen compounds, especially trichloroethylene, may causes violent reactions. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts. Contact with metals such as aluminum, magnesium, tin, and zinc cause formation of flammable hydrogen gas. Sodium hydroxide, even in fairly dilute solution, reacts readily with various sugars to produce carbon monoxide. Precautions should be taken including monitoring the tank atmosphere for carbon monoxide to ensure safety of personnel before vessel entry.

Conditions to Avoid:

Moisture, dusting and incompatibles.

11. Toxicological Information

Irritation data: skin, rabbit: 500 mg/24H severe; eye rabbit: 50 ug/24H severe; investigated as a mutagen.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Sodium Hydroxide (1310-73-2)	No	No	None

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as

hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLID
Hazard Class: 8
UN/NA: UN1823
Packing Group: II
Information reported for product/size: 300LB

International (Water, I.M.O.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLID
Hazard Class: 8
UN/NA: UN1823
Packing Group: II
Information reported for product/size: 300LB

15. Regulatory Information

```
-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA   EC    Japan  Australia
-----
Sodium Hydroxide (1310-73-2)                 Yes   Yes   Yes    Yes
```

```
-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  DSL   NDSL   Phil.
-----
Sodium Hydroxide (1310-73-2)                 Yes   Yes   No     Yes
```

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-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-  -SARA 313-
RQ    TPQ    List  Chemical Catg.
-----
Sodium Hydroxide (1310-73-2)                 No     No    No     No
```

```
-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     -RCRA-    -TSCA-
CERCLA  261.33   8(d)
-----
```

Sodium Hydroxide (1310-73-2) 1000 No No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: No Fire: No Pressure: No
 Reactivity: Yes (Pure / Solid)

Australian Hazchem Code: 2R

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **1**

Label Hazard Warning:

POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe dust.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Label First Aid:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate

precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

*****:

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)


MATERIAL SAFETY DATA SHEET

PRODUCT NAME: PENTANE

1. Chemical Product and Company Identification

BOC Gases,
Division of,
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE
NUMBER: CHEMTREC (800) 424-9300

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE
NUMBER: (905) 501-0802
EMERGENCY RESPONSE PLAN NO: 2-0101

PRODUCT NAME: PENTANE
CHEMICAL NAME: Pentane
COMMON NAMES/SYNONYMS: Amyl hydride
TDG (Canada) CLASSIFICATION: 3
WHMIS CLASSIFICATION: A, B1, D2B

PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 4/5/01

2. Composition, Information on Ingredients

EXPOSURE LIMITS¹:

INGREDIENT	% VOLUME	PEL-OSHA ²	TLV-ACGIH ³	LD ₅₀ or LC ₅₀ Route/Species
Pentane FORMULA: C ₅ H ₁₂ CAS: 109-66-0 RTECS #: RZ9450000	100	1000 ppm TWA	600 ppm TWA	LC ₅₀ : 123,000 ppm inhalation/rat (4 H)

¹ Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.

² As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)

³ As stated in the ACGIH 2001 Threshold Limit Values for Chemical Substances and Physical Agents.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

3. Hazards Identification

EMERGENCY OVERVIEW

Odorless, colorless flammable gas. Dangerous fire and explosion hazard. Avoid heat, sparks and flames. Vapors irritating to the eyes and respiratory system. Skin contact may cause irritation and dermatitis. Inhalation of vapors may cause dizziness, headache and nausea. High concentrations paralyze the central nervous system, causing loss of consciousness and respiratory paralysis. Contents under pressure. Use and store below 125 °F.

PRODUCT NAME: PENTANE

ROUTE OF ENTRY:

Skin Contact Yes	Skin Absorption No	Eye Contact Yes	Inhalation Yes	Ingestion No
---------------------	-----------------------	--------------------	-------------------	-----------------

HEALTH EFFECTS:

Exposure Limits Yes	Irritant Yes	Sensitization No
Teratogen No	Reproductive Hazard No	Mutagen No
Synergistic Effects None Reported		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:

Vapors may cause mild irritation of the eyes.

SKIN EFFECTS:

Vapors may cause mild irritation and dermatitis to the skin.

INGESTION EFFECTS:

None expected.

INHALATION EFFECTS:

Inhalation of vapors may cause dizziness, headache and nausea. High concentrations paralyze the central nervous system, causing loss of consciousness and respiratory paralysis.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None known.

NFPA HAZARD CODES

Health: 1
Flammability: 4
Instability: 0

HMIS HAZARD CODES

Health: 1
Flammability: 4
Reactivity: 0

RATINGS SYSTEM

0 = No Hazard
1 = Slight Hazard
2 = Moderate Hazard
3 = Serious Hazard
4 = Severe Hazard

4. First Aid Measures

EYES:

Flush eyes with water for 15 minutes. If irritation persists, seek medical attention.

SKIN: Flush skin with water for 15 minutes. If irritation persists, seek medical attention.

INGESTION:

Not normally required.

INHALATION:

Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area and given artificial resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive.

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO PENTANE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

MSDS: G-65

Revised: 4/5/01

PRODUCT NAME: PENTANE

5. Fire Fighting Measures

Conditions of Flammability: Flammable liquid and vapor		
Flash point: - 40 °F (-40 °C)	Method: Not Available	Autoignition Temperature: Not Available
LEL(%): 1.4	UEL(%): 7.8	
Hazardous combustion products: Carbon monoxide, carbon dioxide		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: None		

FIRE AND EXPLOSION HAZARDS:

Flammable liquid and vapor. Rapid flame propagation and flashback possible. Cylinder may rupture violently from pressure when involved in a fire situation.

EXTINGUISHING MEDIA:

Water (foam), dry chemical, carbon dioxide.

FIRE FIGHTING INSTRUCTIONS:

If possible, stop the flow of gas. Inerting the atmosphere to reduce oxygen levels may extinguish flame, allowing capping of leaking container. Do not attempt this unless specifically trained. Reduce the rate of flow and inject an inert gas, if possible, before completely stopping the flow to prevent flashback. Do not extinguish the fire until the supply is shut off as otherwise an explosive re-ignition may occur. If the fire is extinguished and the flow of gas continues, use increased ventilation to prevent build-up of explosive atmosphere. Use non-sparking tools to close container valves.

Use water spray to cool surrounding containers. Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. Direct 500 GPM water stream onto containers above liquid level with remote monitors. Limit the number of personnel in proximity of fire and evacuate surrounding areas in all directions.

Firefighters should wear respiratory protection (SCBA) and full turnout or Bunker gear. Continue to cool fire-exposed cylinders until well after flames are extinguished.

6. Accidental Release Measures

Immediately extinguish all ignition sources. No smoking, flares, flames or sparks in hazard area. Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Electrical Classifications:

Class 1, Group not specified.

Earth-ground and bond all lines and equipment associated with the system. All equipment should be non-sparking or explosion proof.

MSDS: G-65

Revised: 4/5/01

PRODUCT NAME: PENTANE

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement.

Use a pressure reducing regulator when connecting cylinder to lower pressure piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125°F (52°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "NO SMOKING" signs in use and storage area. There should be no sources of ignition in areas where this product is being used or stored. Outside or detached storage is preferred.

Never carry a compressed gas cylinder of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

For additional recommendations, consult Compressed Gas Association's Pamphlet P-1.

8. Exposure Controls, Personal Protection

ENGINEERING CONTROLS:

Use a laboratory hood with forced ventilation. Use local exhaust to prevent accumulation above the TWA.

EYE/FACE PROTECTION:

Safety goggles or glasses.

SKIN PROTECTION:

Use butyl rubber, PVC or polyethylene gloves.

RESPIRATORY PROTECTION:

Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION:

Safety shoes.

PRODUCT NAME: PENTANE

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Pentanes	N-pentane or Isopentane
HAZARD CLASS:	3	3
IDENTIFICATION NUMBER:	UN 1265	UN 1265
SHIPPING LABEL:	FLAMMABLE LIQUID	FLAMMABLE LIQUID

Packing Group: I

15. Regulatory Information

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III – HAZARD CLASSES:

Acute Health Hazard

Fire Hazard

Sudden Release of Pressure Hazard

16. Other Information

ACGIH	American Conference of Governmental Industrial Hygienists
DOT	Department of Transportation
IARC	International Agency for Research on Cancer
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
SARA	Superfund Amendments and Reauthorization Act
STEL	Short Term Exposure Limit
TDG	Transportation of Dangerous Goods
TLV	Threshold Limit Value
WHMIS	Workplace Hazardous Materials Information System

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:

Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

MSDS: G-65

Revised: 4/5/01

MSDS Number: **N3666** * * * * * *Effective Date: 05/25/01* * * * * * *Supersedes: 11/17/99*

MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

M Mallinckrodt
CHEMICALS

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

NITRIC ACID 10% R. S.

1. Product Identification

Synonyms: Aqua Fortis; Azotic Acid

CAS No.: 7697-37-2

Molecular Weight: 63.01

Chemical Formula: HNO₃ (10% solution)

Product Codes: Product Codes: H262

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	10%	Yes
Water	7732-18-5	90%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG AND TOOTH

DAMAGE.**Potential Health Effects**

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

Inhalation:

Corrosive! May cause irritation of the nose, throat, and respiratory tract including coughing and choking. Higher concentrations or prolonged exposure to vapors of nitric acid may lead to pneumonia or pulmonary edema.

Ingestion:

Corrosive. May cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.

Skin Contact:

Corrosive! May cause redness, pain, and severe skin burns.

Eye Contact:

Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.

Explosion:

May react explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc.

Fire Extinguishing Media:

Water or water spray.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

Increases the flammability of combustible, organic and readily oxidizable materials.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Separate from combustible, organic, or any other readily oxidizable materials. Protect from freezing.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For Nitric Acid:

OSHA Permissible Exposure Limit (PEL):

2 ppm (TWA)

ACGIH Threshold Limit Value (TLV):

2 ppm (TWA); 4 ppm (STEL)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airtight hood, or full-facepiece self-contained breathing apparatus. Canister-type respirators using sorbents are ineffective.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear to pale yellow solution.

Odor:

Suffocating, acrid.

Solubility:

Infinitely soluble.

Density:

1.054

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100 (as water and acid)

Boiling Point:

ca. 101C (ca. 214F)

Melting Point:

ca. -3C (ca. 27F)

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

No information found.

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

Conditions to Avoid:

Heat and incompatibles.

11. Toxicological Information

For Nitric Acid: Investigated as a mutagen and reproductive effector.

-----\Cancer Lists\-----

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Nitric Acid (7697-37-2)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: NITRIC ACID (WITH 10% NITRIC ACID)

Hazard Class: 8

UN/NA: UN2031

Packing Group: II

Information reported for product/size: 20L

International (Water, I.M.O.)

Proper Shipping Name: NITRIC ACID (WITH 10% NITRIC ACID)

Hazard Class: 8

UN/NA: UN2031

Packing Group: II

Information reported for product/size: 20L

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----
 Ingredient TSCA EC Japan Australia

Nitric Acid (7697-37-2)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----

Ingredient	--Canada--			
	Korea	DSL	NDSL	Phil.
Nitric Acid (7697-37-2)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----

Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
Nitric Acid (7697-37-2)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----

Ingredient	CERCLA	-RCRA-		-TSCA-
		261.33	8(d)	
Nitric Acid (7697-37-2)	1000	No	No	No
Water (7732-18-5)	No	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
 Reactivity: Yes (Mixture / Liquid)

Australian Hazchem Code: 2PE

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0** Other: **Oxidizer**

Label Hazard Warning:

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

Label Precautions:

Do not get in eyes, on skin, or on clothing.
 Do not breathe vapor or mist.
 Use only with adequate ventilation.
 Wash thoroughly after handling.
 Store in a tightly closed container.
 Remove and wash contaminated clothing promptly.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If

breathing is difficult, give oxygen. In all cases call a physician.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 9, 16.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)



MATERIAL SAFETY DATA SHEET

PRODUCT NAME: METHANE

1. Chemical Product and Company Identification

**BOC Gases,
Division of,
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974**

**BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6**

**TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE
NUMBER: CHEMTREC (800) 424-9300**

**TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE
NUMBER: (905) 501-0802
EMERGENCY RESPONSE PLAN NO: 2-0101**

**PRODUCT NAME: METHANE
CHEMICAL NAME: CH4
COMMON NAMES/SYNONYMS: Methyl Hydride
TDG (Canada) CLASSIFICATION: 2.1
WHMIS CLASSIFICATION: A, B1**

**PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 6/1/99**

2. Composition, Information on Ingredients

EXPOSURE LIMITS¹:

INGREDIENT	% VOLUME	PEL-OSHA ²	TLV-ACGIH ³	LD ₅₀ or LC ₅₀ Route/Species
Methane FORMULA: CH ₄ CAS: 74-82-8 RTECS #: PA1490000	100	None Established	Simple Asphyxiant	Not Available

¹ Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.

² As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)

³ As stated in the ACGIH 1998-1999 Threshold Limit Values for Chemical Substances and Physical Agents.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

3. Hazards Identification

EMERGENCY OVERVIEW
Odorless, colorless flammable gas. Dangerous fire and explosion hazard. Avoid heat, sparks and flames. Simple Asphyxiant – This product does not contain oxygen and may cause asphyxia if released in a confined area. Maintain oxygen levels above 19.5%. Contents under pressure. Use and store below 125 °F.

PRODUCT NAME: METHANE

ROUTE OF ENTRY:

Skin Contact No	Skin Absorption No	Eye Contact No	Inhalation Yes	Ingestion No
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HEALTH EFFECTS:

Exposure Limits No	Irritant No	Sensitization No
Teratogen No	Reproductive Hazard No	Mutagen No
Synergistic Effects None reported		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:

None anticipated.

SKIN EFFECTS:

None anticipated.

INGESTION EFFECTS:

None known. Ingestion is unlikely.

INHALATION EFFECTS:

Methane and nitrogen are simple asphyxiants. Exposure to high concentrations of this gas mixture may exclude an adequate supply of oxygen. Oxygen levels should be maintained at greater than 19.5% at normal atmospheric pressure.

Effects of oxygen deficiency resulting from simple asphyxiants may include: rapid breathing, diminished mental alertness, impaired muscular coordination, faulty judgement, depression of all sensations, emotional instability, and fatigue. As asphyxiation progresses, nausea, vomiting, prostration, and loss of consciousness may result, eventually leading to convulsions, coma, and death.

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None known.

NFPA HAZARD CODES

Health: 2
Flammability: 4
Instability: 0

HMIS HAZARD CODES

Health: 0
Flammability: 4
Reactivity: 0

RATINGS SYSTEM

0 = No Hazard
1 = Slight Hazard
2 = Moderate Hazard
3 = Serious Hazard
4 = Severe Hazard

4. First Aid Measures

EYES:

None required.

MSDS: G-56

Revised: 6/1/99

PRODUCT NAME: METHANE

SKIN:

None required.

INGESTION:

Not normally required.

INHALATION:

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO THIS PRODUCT. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Victims should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. If breathing has stopped administer artificial resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive. Keep victim warm and quiet.

5. Fire Fighting Measures

Conditions of Flammability: Flammable gas		
Flash point: -306°F (-188°C)	Method: Closed cup	Autoignition Temperature: 1076°F (580°C)
LEL(%): 5	UEL(%): 15	
Hazardous combustion products: Carbon dioxide, Carbon monoxide		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: Not Available		

FIRE AND EXPLOSION HAZARDS:

Flammable gas. Cylinder may rupture violently from pressure when involved in a fire situation.

EXTINGUISHING MEDIA:

Carbon dioxide, dry chemical or water spray.

FIRE FIGHTING INSTRUCTIONS:

If possible, stop the flow of gas. Inerting the atmosphere to reduce oxygen levels may extinguish flame, allowing capping of leaking container. Do not attempt this unless specifically trained. Reduce the rate of flow and inject an inert gas, if possible, before completely stopping the flow to prevent flashback. Do not extinguish the fire until the supply is shut off as otherwise an explosive re-ignition may occur. If the fire is extinguished and the flow of gas continues, use increased ventilation to prevent build-up of explosive atmosphere. Use non-sparking tools to close container valves.

Use water spray to cool surrounding containers. Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. Direct 500 GPM water stream onto containers above liquid level with remote monitors. Limit the number of personnel in proximity of fire and evacuate surrounding areas in all directions.

Firefighters should wear respiratory protection (SCBA) and full turnout or Bunker gear. Continue to cool fire-exposed cylinders until well after flames are extinguished.

6. Accidental Release Measures

Immediately extinguish all ignition sources. No smoking, flames, sparks or flares in hazard area. Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Electrical Classification:

Not Available

Earth ground and bond all lines and equipment associated with the system. All equipment should be non sparking or explosion-proof.

Methane is non-corrosive and may be used with any common structural material.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure regulator when connecting cylinder to lower pressure piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125°F (52°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Post "NO SMOKING" signs in use or storage areas. There should be no sources of ignition in areas where this product is being used or stored. Outside or detached storage is preferred.

For additional storage recommendations, consult Compressed Gas Association's Pamphlets P-1, P-14, and Safety Bulletin SB-2.

8. Exposure Controls, Personal Protection

ENGINEERING CONTROLS:

Hood with forced ventilation. Local exhaust to prevent dilution of oxygen levels below 19.5%. Mechanical in accordance with electrical codes.

EYE/FACE PROTECTION:

Safety goggles or glasses.

SKIN PROTECTION:

Plastic or rubber gloves. Protective gloves made of any suitable material.

RESPIRATORY PROTECTION:

Positive pressure air line with mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

PRODUCT NAME: METHANE

OTHER/GENERAL PROTECTION:

Safety shoes.

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: Not Available	
Vapor density (Air = 1)	: Not Available	
Evaporation point	: Not Available	
Boiling point	: -285.7	°F
	: -161.5	°C
Freezing point	: -296.5	°F
	: -182.5	°C
pH	: Not Applicable	
Specific gravity	: 0.55	
Oil/water partition coefficient	: Not Available	
Solubility (H ₂ O)	: Negligible	
Odor threshold	: Not Applicable	
Odor and appearance	: Odorless, colorless gas	

10. Stability and Reactivity

STABILITY:

Stable

INCOMPATIBLE MATERIALS:

Oxidizers

HAZARDOUS POLYMERIZATION:

Will not occur.

11. Toxicological Information

No data given in the Registry of Toxic Effects of Chemical Substances (RTECS) or Sax, Dangerous Properties of Industrial Materials, 7th ed.

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

12. Ecological Information

No data given.

MSDS: G-56

Revised: 6/1/99

PRODUCT NAME: METHANE

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Methane, compressed	Methane, compressed
HAZARD CLASS:	2.1	2.1
IDENTIFICATION NUMBER:	UN 1971	UN 1971
SHIPPING LABEL:	FLAMMABLE GAS	FLAMMABLE GAS

15. Regulatory Information

Methane is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III - HAZARD CLASSES:

Fire Hazard
Sudden Release of Pressure Hazard

16. Other Information

ACGIH	American Conference of Governmental Industrial Hygienists
DOT	Department of Transportation
IARC	International Agency for Research on Cancer
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
SARA	Superfund Amendments and Reauthorization Act
STEL	Short Term Exposure Limit
TDG	Transportation of Dangerous Goods
TLV	Threshold Limit Value
WHMIS	Workplace Hazardous Materials Information System

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:

Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

PRODUCT NAME: ISOBUTYLENE

1. Chemical Product and Company Identification

BOC Gases,
Division of,
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE
NUMBER: CHEMTREC (800) 424-9300

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE
NUMBER: (905) 501-0802
EMERGENCY RESPONSE PLAN NO: 2-0101

PRODUCT NAME: ISOBUTYLENE
CHEMICAL NAME: Isobutylene
COMMON NAMES/SYNONYMS: 2-Methylpropene, Isobutene
TDG (Canada) CLASSIFICATION: 2.1
WHMIS CLASSIFICATION: A, B1, D2B

PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 6/1/99

2. Composition, Information on Ingredients

EXPOSURE LIMITS¹:

INGREDIENT	% VOLUME	PEL-OSHA ²	TLV-ACGIH ³	LD ₅₀ or LC ₅₀ Route/Species
Isobutylene FORMULA: C ₄ H ₈ CAS: 115-11-7 RTECS #: UD0890000	99.0 to 99.8	None Established	Simple Asphyxiant	No Data

¹ Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.

² As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)

³ As stated in the ACGIH 1998-1999 Threshold Limit Values for Chemical Substances and Physical Agents.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

3. Hazards Identification

EMERGENCY OVERVIEW

Flammable colorless gas with unpleasant odor. Dangerous fire and explosion hazard. Avoid heat, sparks, and flames. This product does not contain oxygen and may cause asphyxia if released in a confined area. Simple hydrocarbons can cause irritation and central nervous system depression at high concentrations. Contents under pressure. Use and store below 125 °F.

PRODUCT NAME: ISOBUTYLENE

ROUTE OF ENTRY:

Skin Contact No	Skin Absorption No	Eye Contact No	Inhalation Yes	Ingestion No
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HEALTH EFFECTS:

Exposure Limits No	Irritant Yes	Sensitization No
Teratogen No	Reproductive Hazard No	Mutagen No
Synergistic Effects None Reported		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:

High concentrations may cause minor irritation.

SKIN EFFECTS:

None anticipated.

INGESTION EFFECTS:

Ingestion is unlikely.

INHALATION EFFECTS:

Product is relatively nontoxic. May cause minor eye, mucous membrane and respiratory irritation at high concentrations.

Inhalation of high concentrations may cause dizziness, disorientation, incoordination, narcosis, nausea or narcotic effects.

This product may displace oxygen if released in a confined space. Maintain oxygen levels above 19.5% at sea level to prevent asphyxiation.

Effects of oxygen deficiency resulting from simple asphyxiants may include: rapid breathing, diminished mental alertness, impaired muscular coordination, faulty judgement, depression of all sensations, emotional instability, and fatigue. As asphyxiation progresses, nausea, vomiting, prostration, and loss of consciousness may result, eventually leading to convulsions, coma, and death.

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None known.

NFPA HAZARD CODES

Health: 2
Flammability: 4
Instability: 1

HMIS HAZARD CODES

Health: 1
Flammability: 4
Reactivity: 1

RATINGS SYSTEM

0 = No Hazard
1 = Slight Hazard
2 = Moderate Hazard
3 = Serious Hazard
4 = Severe Hazard

4. First Aid Measures

EYES:

None normally required. If irritation occurs, flush eyes with water for 15 minutes. If irritation persists, seek medical attention.

SKIN:

None normally required. If irritation occurs, remove contaminated clothing and wash affected area with soap and water. If irritation persists, seek medical attention.

INGESTION:

Not normally required. Seek immediate medical attention.

INHALATION:

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO PRODUCT. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given assisted (artificial) respiration and supplemental oxygen. Further treatment should be symptomatic and supportive.

5. Fire Fighting Measures

Conditions of Flammability: Flammable liquid and vapor		
Flash point: -105 °F (-76 °C)	Method: Closed Cup	Autoignition Temperature: 869 °F (465 °C)
LEL(%): 1.8	UEL(%): 9.6	
Hazardous combustion products: Carbon monoxide, Carbon dioxide		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: Not Available		

FIRE AND EXPLOSION HAZARDS:

Isobutylene is heavier than air and may travel a considerable distance along the ground to an ignition source and flash back. Isobutylene is a flammable gas! Keep away from open flame and other sources of ignition. Do not allow smoking in storage areas or when handling. Cylinder may rupture violently from pressure when involved in a fire situation.

EXTINGUISHING MEDIA:

Water, carbon dioxide, dry chemical.

FIRE FIGHTING INSTRUCTIONS:

If possible, stop the flow of gas. Inerting the atmosphere to reduce oxygen levels may extinguish flame, allowing capping of leaking container. Do not attempt this unless specifically trained. Reduce the rate of flow and inject an inert gas, if possible, before completely stopping the flow to prevent flashback. Do not extinguish the fire until the supply is shut off as otherwise an explosive re-ignition may occur. If the fire is extinguished and the flow of gas continues, use increased ventilation to prevent build-up of explosive atmosphere. Use non-sparking tools to close container valves.

Use water spray to cool surrounding containers. Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. Direct 500 GPM water stream onto containers above liquid level with remote monitors. Limit the number of personnel in proximity of fire and evacuate surrounding areas in all directions.

Firefighters should wear respiratory protection (SCBA) and full turnout or Bunker gear. Continue to cool fire-exposed cylinders until well after flames are extinguished.

6. Accidental Release Measures

Extinguish all ignition sources. No smoking, flames, flares or sparks in hazard area. Evacuate all personnel from affected area. Use appropriate protective equipment. Increase ventilation to prevent build up of a flammable/explosive atmosphere. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Electrical classification:

Not available.

Earth bond and ground all lines and equipment associated with the product system. **All** equipment should be non-sparking and explosion proof.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure regulator when connecting cylinder to lower pressure (<250 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas, emergency exits, flammables and combustibles. Do not allow the temperature where cylinders are stored to exceed 125°F (52°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time.

Post "No Smoking" signs in storage or use areas. There should be no sources of ignition in storage and use areas. Outside or detached storage preferred.

For additional recommendations consult Compressed Gas Association Pamphlet P-1 and Safety Bulletin SB-2.

Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

8. Exposure Controls, Personal Protection

ENGINEERING CONTROLS:

Use local exhaust to prevent accumulation. Use general ventilation to prevent build up of flammable concentrations. May use hood with forced ventilation when handling small quantities. If product is handled routinely where the potential for leaks exists, all electrical equipment must be rated for use in potentially flammable atmospheres. Consult the National Electrical Code for details.

EYE/FACE PROTECTION:

Safety goggles or glasses.

SKIN PROTECTION:

Protective gloves made of plastic or rubber.

RESPIRATORY PROTECTION:

Positive pressure air line with full-face mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION:

Safety shoes

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure at 70°F	: 39	psia
Vapor density at STP (Air = 1)	: 1.98	
Evaporation point	: Not Available	
Boiling point	: 19.5	°F
	: -6.9	°C
Freezing point	: -220.6	°F
	: -140.3	°C
pH	: Not Available	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H ₂ O)	: Insoluble	
Odor threshold	: Not Available	
Odor and appearance	: A colorless gas with an unpleasant odor similar to that of burning coal.	

10. Stability and Reactivity

STABILITY:

Stable

INCOMPATIBLE MATERIALS:

Oxidizers

PRODUCT NAME: ISOBUTYLENE

HAZARDOUS DECOMPOSITION PRODUCTS:

Carbon monoxide

11. Toxicological Information

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

No chronic effects data given in the Registry of Toxic Effects of Chemical Substances (RTECS) or Sax, Dangerous Properties of Industrial Materials, 7th ed.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Isobutylene	Isobutylene
HAZARD CLASS:	2.1	2.1
IDENTIFICATION NUMBER:	UN 1055	UN 1055
SHIPPING LABEL:	FLAMMABLE GAS	FLAMMABLE GAS

15. Regulatory Information

Isbutylene is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III - HAZARD CLASSES:

Fire Hazard

Sudden Release of Pressure Hazard

16. Other Information

ACGIH	American Conference of Governmental Industrial Hygienists
DOT	Department of Transportation
IARC	International Agency for Research on Cancer
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
SARA	Superfund Amendments and Reauthorization Act
STEL	Short Term Exposure Limit
TDG	Transportation of Dangerous Goods
TLV	Threshold Limit Value
WHMIS	Workplace Hazardous Materials Information System

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:

Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

MSDS Number: **H3880** * * * * * *Effective Date: 05/07/03* * * * * * *Supersedes: 05/10/01*

MSDS**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



Mallinckrodt
CHEMICALS



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

HYDROCHLORIC ACID, 33 - 40%

1. Product Identification

Synonyms: Muriatic acid; hydrogen chloride, aqueous

CAS No.: 7647-01-0

Molecular Weight: 36.46

Chemical Formula: HCl

Product Codes:

J.T. Baker: 5367, 5537, 5575, 5800, 5814, 5821, 5839, 5894, 5962, 5972, 5994, 6900, 7831, 9529, 9530, 9534, 9535, 9536, 9537, 9538, 9539, 9540, 9544, 9548

Mallinckrodt: 2062, 2515, 2612, 2624, 2626, 3861, 5587, H611, H613, H987, H992, H999, V078, V628

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hydrogen Chloride	7647-01-0	33 - 40%	Yes
Water	7732-18-5	60 - 67%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 2 - Moderate

Contact Rating: 3 - Severe (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD;
PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:

Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.

Ingestion:

Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea. Swallowing may be fatal.

Skin Contact:

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.

Eye Contact:

Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Extreme heat or contact with metals can release flammable hydrogen gas.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

If involved in a fire, use water spray. Neutralize with soda ash or slaked lime.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving hydrochloric acid. Stay away from ends of tanks. Cool tanks with water spray until well after fire is out.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National

Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For Hydrochloric acid:

- OSHA Permissible Exposure Limit (PEL):

5 ppm (Ceiling)

- ACGIH Threshold Limit Value (TLV):

2 ppm (Ceiling), A4 Not classifiable as a human carcinogen

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a full facepiece respirator with an acid gas cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator.

WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Colorless, fuming liquid.

Odor:

Pungent odor of hydrogen chloride.

Solubility:

Infinite in water with slight evolution of heat.

Density:

1.18

pH:

For HCL solutions: 0.1 (1.0 N), 1.1 (0.1 N), 2.02 (0.01 N)

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

53C (127F) Azeotrope (20.2%) boils at 109C (228F)

Melting Point:

-74C (-101F)

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

190 @ 25C (77F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:

When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes. Thermal oxidative decomposition produces toxic chlorine fumes and explosive hydrogen gas.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

A strong mineral acid, concentrated hydrochloric acid is incompatible with many substances and highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde.

Conditions to Avoid:

Heat, direct sunlight.

11. Toxicological Information

Inhalation rat LC50: 3124 ppm/1H; oral rabbit LD50: 900 mg/kg (Hydrochloric acid concentrated); investigated as a tumorigen, mutagen, reproductive effector.

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Hydrogen Chloride (7647-01-0)	No	No	3
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.

Environmental Toxicity:

This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 475LB

International (Water, I.M.O.)

Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 475LB

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----

Ingredient	TSCA	EC	Japan	Australia
Hydrogen Chloride (7647-01-0)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----

Ingredient	Korea	--Canada--		
		DSL	NDSL	Phil.
Hydrogen Chloride (7647-01-0)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----

Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
Hydrogen Chloride (7647-01-0)	5000	500*	Yes	No
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----

Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8(d)
Hydrogen Chloride (7647-01-0)	5000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2R

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**

Label Hazard Warning:

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor or mist.

Use only with adequate ventilation.

Wash thoroughly after handling.

Store in a tightly closed container.

Remove and wash contaminated clothing promptly.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water.

Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using

this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

*****:

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **S8237** * * * * * *Effective Date: 05/08/03* * * * * * *Supersedes: 09/14/00*

MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

SULFURIC ACID, 10 - 51%

1. Product Identification

Synonyms: Oil of vitriol; Babcock acid; sulphuric acid

CAS No.: 7664-93-9

Molecular Weight: 98.07

Chemical Formula: H₂SO₄ in H₂O

Product Codes:

J.T. Baker: 0331, 4700, 4701, 5253, 5691, 5951, 9696, S8237

Mallinckrodt: H378, H379, H390, V011, V029, V487, V581

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sulfuric Acid	7664-93-9	10 - 51%	Yes
Water	7732-18-5	49 - 90%	No

3. Hazards Identification

specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, always add the acid to water; never add water to the acid. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For Sulfuric Acid:

- OSHA Permissible Exposure Limit (PEL) -
1 mg/m³ (TWA)

- ACGIH Threshold Limit Value (TLV) -
1 mg/m³(TWA), 3 mg/m³ (STEL), A2 - suspected human carcinogen for sulfuric acid contained in strong inorganic acid mists.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a full

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 3 - Severe (Water Reactive)

Contact Rating: 4 - Extreme (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD;
PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:

Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. May cause lung edema, a medical emergency.

Ingestion:

Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow ingestion or skin contact. Circulatory shock is often the immediate cause of death.

Skin Contact:

Corrosive. Symptoms of redness, pain, and severe burn can occur. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow skin contact or ingestion. Circulatory shock is often the immediate cause of death.

Eye Contact:

Corrosive. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.

Chronic Exposure:

Long-term exposure to mist or vapors may cause damage to teeth. Chronic exposure to mists containing sulfuric acid is a cancer hazard.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician immediately.

Ingestion:

DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Excess acid on skin can be neutralized with a 2% solution of bicarbonate of soda. Call a physician immediately.

Eye Contact:

Immediately flush eyes with gentle but large stream of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Call a physician immediately.

5. Fire Fighting Measures

Fire:

Concentrated material is a strong dehydrating agent. Reacts with organic materials and may cause ignition of finely divided materials on contact.

Explosion:

Contact with most metals causes formation of flammable and explosive hydrogen gas.

Fire Extinguishing Media:

Dry chemical, foam or carbon dioxide. Do not use water on material. However, water spray may be used to keep fire exposed containers cool.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving this material. Stay away from sealed containers.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as

facepiece respirator with an acid gas cartridge and particulate filter (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P particulate filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear oily liquid.

Odor:

Odorless.

Solubility:

Miscible with water, liberates much heat.

Specific Gravity:

1.40 (50%), 1.07 (10%)

pH:

1 N solution (ca. 5% w/w) = 0.3; 0.1 N solution (ca. 0.5% w/w) = 1.2; 0.01 N solution (ca. 0.05% w/w) = 2.1.

% Volatiles by volume @ 21C (70F):

No information found.

Boiling Point:

ca. 290C (ca. 554F) (decomposes at 340C)

Melting Point:

3C (100%), -32C (93%), -38C (78%), -64C (65%).

Vapor Density (Air=1):

3.4

Vapor Pressure (mm Hg):

1 @ 145.8C (295F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Concentrated solutions react violently with water, spattering and liberating heat.

Hazardous Decomposition Products:

Toxic fumes of oxides of sulfur when heated to decomposition. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas, and with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Water, potassium chlorate, potassium perchlorate, potassium permanganate, sodium, lithium, bases, organic material, halogens, metal acetylides, oxides and hydrides, metals (yields hydrogen gas), strong oxidizing and reducing agents and many other reactive substances.

Conditions to Avoid:

Heat, moisture, incompatibles.

11. Toxicological Information

Toxicological Data:

Oral rat LD50: 2140 mg/kg; inhalation rat LC50: 510 mg/m³/2H; standard Draize, eye rabbit, 250 ug (severe); investigated as a tumorigen, mutagen, reproductive effector.

Carcinogenicity:

Cancer Status: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mists containing sulfuric acid" as a known human carcinogen, (IARC category 1). This classification applies only to mists containing sulfuric acid and not to sulfuric acid or sulfuric acid solutions.

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Sulfuric Acid (7664-93-9)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

When released into the soil, this material may leach into groundwater. When released into the air, this material may be removed from the atmosphere to a

moderate extent by wet deposition. When released into the air, this material may be removed from the atmosphere to a moderate extent by dry deposition.

Environmental Toxicity:

LC50 Flounder 100 to 330 mg/l/48 hr aerated water/Conditions of bioassay not specified; LC50 Shrimp 80 to 90 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC50 Prawn 42.5 ppm/48 hr salt water /Conditions of bioassay not specified.

This material may be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SULFURIC ACID (WITH NOT MORE THAN 51% ACID)

Hazard Class: 8

UN/NA: UN2796

Packing Group: II

Information reported for product/size: 20L

International (Water, I.M.O.)

Proper Shipping Name: SULPHURIC ACID (WITH NOT MORE THAN 51% ACID)

Hazard Class: 8

UN/NA: UN2796

Packing Group: II

Information reported for product/size: 20L

International (Air, I.C.A.O.)

Proper Shipping Name: SULPHURIC ACID (WITH NOT MORE THAN 51% ACID)

Hazard Class: 8

UN/NA: UN2796

Packing Group: II

Information reported for product/size: 20L

15. Regulatory Information

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-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA  EC   Japan  Australia
-----
Sulfuric Acid (7664-93-9)                     Yes  Yes  Yes    Yes
Water (7732-18-5)                             Yes  Yes  Yes    Yes

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-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  --Canada--
                                     DSL    NDSL   Phil.
-----
Sulfuric Acid (7664-93-9)                     Yes   Yes   No     Yes
Water (7732-18-5)                             Yes   Yes   No     Yes

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-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-  -SARA 313-
                                     RQ    TPQ    List  Chemical Catg.
-----
Sulfuric Acid (7664-93-9)                     1000  1000   Yes    No
Water (7732-18-5)                             No    No     No     No

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-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     CERCLA  -RCRA-  -TSCA-
                                     261.33  8(d)
-----
Sulfuric Acid (7664-93-9)                     1000   No     No
Water (7732-18-5)                             No     No     No

```

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
 Reactivity: Yes (Pure / Liquid)

Australian Hazchem Code: 2P

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **2** Other: **Water reactive**

Label Hazard Warning:

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.
Do not breathe mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Do not contact with water.

Label First Aid:

In all cases call a physician immediately. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use. Excess acid on skin can be neutralized with a 2% bicarbonate of soda solution. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 14.

Disclaimer:

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