SUPPLEMENTAL GROUNDWATER CHARACTERIZATION WORKPLAN

SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

Prepared for:

Beazer East, Inc.

Prepared by:

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215302

August 2005

KEY ENVIRONMENTAL INCORPORATED

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SECTION 1.0

1.0 INTRODUCTION

This document was prepared on behalf of Beazer East, Inc. (Beazer) and presents a workplan for supplemental groundwater characterization in the shallow and intermediate groundwater-bearing units at the South Cavalcade Superfund Site located in Houston Texas (Figure 1). The scope of the investigation was developed through a series of meetings and communications among representatives of Beazer, U.S. Environmental Protection Agency (EPA) and the Texas Commission on Environmental Quality (TCEQ). The scope of the investigation was discussed with EPA and TCEQ during a meeting in Houston on April 5, 2005 and concurrence regarding the scope of work was achieved. At the meeting, EPA requested that Beazer prepare a brief workplan describing the scope of the investigation and the methodologies to be utilized for its implementation. This workplan was prepared in response to the EPA request. The specific objectives of the planned investigative activities are outlined in the following subsection.

1.1 PROJECT OBJECTIVES

The purpose of the investigation is to provide additional data to support re-evaluation of the current groundwater remedy for the Site to include a monitored natural attenuation component. The specific project objectives are as follows:

- To further define groundwater migration pathways for the shallow and intermediate aquifers, as they pertain to contaminant distributions;
- To refine the delineation of the dissolved phase plume in the area southwest of the Site; and,
- To provided additional data and information to support the design of a monitored natural attenuation monitoring network.

The investigation of the shallow and intermediate zones will target potential preferential pathways for migration of impacted groundwater from the source areas at the Site, as identified through separate analyses of site-specific geologic information performed by Beazer and EPA and as agreed upon during a September 8, 2004 meeting.

SECTION 2.0

2.0 SCOPE OF WORK

The following sections present the scope of work for the investigative activities and methodologies to be used for its implementation. All work will be conducted in accordance with a site-specific Heath and Safety Plan which is provided as Attachment A of this Work Plan.

2.1 POTENTIAL PREFFERENTIAL PATHWAY INVESTIGATION

This task includes the completion of six shallow zone and ten intermediate zone soil borings within eleven targeted areas on-Site, and off-Site areas to the west and south. At each location, continuous soil recovery and logging will be performed. Lithologies will be described in detail and NAPL presence, along with a qualitative assessment of the degree of saturation (i.e., residual or free-phase) will be noted. All field data will be tabulated on the Field Investigation Spreadsheet (Attachment B) and transferred to a Site base map on a daily basis. The resulting maps and tables will be distributed and reviewed daily to allow for real-time decision making concerning the need to perform additional work as described in Section 2.1.3 relating to step-out boring locations. Groundwater samples will be collected at each location. Figure 2 presents the targeted areas and the proposed soil boring/groundwater sampling locations.

The investigation areas were initially identified and agreed upon by Beazer, TCEQ and EPA during a meeting on September 8, 2004. Following this meeting, EPA, TCEQ and Beazer visited the Site to review these areas. These areas are based on review of geologic information, as locations along potential groundwater migration pathways in both the shallow and intermediate zones. This determination was based upon the noted presence of coarser grained soils in these areas. The number of initial borings in each area was also agreed upon by Beazer, EPA and TCEQ during the April 5, 2005 meeting. As indicated in Section 2.1.3, additional borings may be added to the program if field observations indicate impact at a particular initial boring location. Also, if a particular proposed located is not accessible to the drilling equipment, the boring will be relocated to the nearest accessible location.

2.1.1 Soil Borings and Soil Sample Collection

The soil borings will be advanced into the subsurface using direct push techniques (e.g., Geoprobe®). Before any subsurface work begins, underground utilities in the vicinity of the borings will be located by contacting the Texas One Call System. Boring locations may require adjustment based on the utility locations. The shallow zone borings will be advanced to the top of the clay unit, and are not expected to exceed a depth of 25 feet below ground surface (bgs). The intermediate zone borings will be advanced to the bottom of the intermediate zone and are not expected to exceed a depth of 55 ft bgs.

A continuous soil core will be collected from all of the borings. The soil will be classified by the field geologist according to the Unified Soil Classification System (USCS). Soil descriptions will be recorded on the Soil Boring Log Field Form presented in Attachment B. Soil boring logs will include description of any potential preferential pathway features that are observed (i.e.

thickness of coarser-grained seams), and any evidence of NAPL presence. Documentation of NAPL presence will include descriptions of odor, color, and qualitative degree of saturation (i.e. residual or free phase). The degree of impact, if any, will be recorded on the boring logs on a depth-specific basis. A qualitative numeric scale will be used to document the degree of impact, as follows:

0 – No observed DNAPL, stains, or odors
1 – Odor and/or PID measurements above background
2 – Non-natural staining (color) or sheen
3 – Residual DNAPL (e.g., droplets, globules) observed (color)
4 – Apparent free phase DNAPL present

If sheens or discolorations are observed in the soil core samples, additional down-gradient investigation will be conducted as discussed in Section 2.1.3. Note that determination of the presence of DNAPL in the soil cores is best made via removal of a portion of the soil once the soil core is sliced open. Removal of soil that was directly in contact with the liner (along the entire length of the liner) will expose minimally disturbed soil (i.e., soil that has not been subjected to smearing along the liner wall).

A Photoionization Detector (PID) will be used to screen the soil core for volatile organic compounds (VOCs). Initially, each core will be scanned along its length with the PID to identify any potentially impacted intervals. Sections of the core will then be retained for head space analysis in approximately two-foot intervals including any potentially impacted intervals identified by the initial scan.

One soil sample from each intermediate zone boring will be collected for analysis of Total Organic Carbon (TOC) content via the Walkley-Black Method. The sample for TOC analysis will be taken from the more coarse-grained strata within the intermediate zone boring. Note that suitable TOC samples were obtained for the shallow zone during the data collection efforts completed in support of in the Verification of the Groundwater Fate and Transport Evaluation Report (VGFTR).

Following the completion of each soil boring, all downhole equipment will be thoroughly cleaned by washing all surfaces with an Alconox® (or equivalent) solution and rinsing with potable water.

2.1.2 Groundwater Sample Collection and Analysis

One groundwater sample will be colleted at each soil boring location. Where shallow and intermediate zone borings are co-located, one sample will be collected from within the shallow zone and one sample will be collected from the intermediate zone. At the shallow zone boring locations, a temporary monitoring well (one-inch inside diameter PVC pipe) will be installed in the boring. Information from the Verification of the Groundwater Fate and Transport Evaluation Report (VGFTER) showed that the dissolved constituents of interest preferentially migrate in the lower portion of the aquifer. As such, the screen interval for the shallow temporary wells will be

five feet in length and will be set with its base at least six-inches below the interface between the sand unit and the underlying clay

Once a sufficient volume of water has entered the temporary well, micro-purging of the well using a low flow (peristaltic) pump will be attempted. If the well goes dry in response to purging, the well will be allowed to recover and the sample collected as soon practicable. Otherwise, the sample will be collected after the parameter stabilization criteria specified in the Standard Operating Procedure (Attachment C) have been attained or a minimum of three well volumes have been removed, whichever occurs first. Purge water will be discharged into a bucket or similar container and will be visually inspected for any indication of impact.

Groundwater samples will be collected using a peristaltic pump and dedicated Teflon tubing. To minimize agitation and aeration of the samples, they will be obtained as follows: 1) crimping the tubing upstream of the pump; 2) removing the tubing from the pump body, and 3) draining the groundwater from the tubing directly into the sample vials. Groundwater sample collection from the shallow zone will not occur during or immediately following heavy precipitation events.

The method used to collect intermediate zone groundwater samples must prevent cross-contamination with the shallow zone groundwater. The depth interval of the samples (i.e. screen interval) will be selected in the field to intersect any sandy intervals identified in the soil core. Two potential sampling approaches are: 1) advancing a second boring to the targeted depth and using an in-situ collection method (i.e. Geoprobe® Screen Point Sampler), or 2) installing a temporary well inside the initial boring.

The decision on which approach to be used will be made in the field based on the position of the sandy intervals within the intermediate zone. If the sandy intervals are encountered near the base of the intermediate zone, a temporary well would be installed. If the sandy zones occur in the upper portion of the intermediate zone, then a second boring may be advanced to the target depth and the screen point sampler utilized for sample collection. If multiple thin sandy intervals occur throughout the intermediate, then the former method will be used.

If the point sampler is used, the groundwater sample will be collected as soon as sufficient groundwater enters the sample interval. If intermediate zone temporary wells are installed, then groundwater samples will be collected via lowflow/micro-purge methods, as previously discussed for the shallow zone temporary wells. The intermediate zone temporary wells must have annular bentonite seals above the screened zone. Purge water will be containerized for discharge to the on-Site groundwater treatment facility.

The depth to groundwater in the intermediate zone may preclude the use of a peristaltic pump for purging and/or sample collection. If this is the case, low flow bladder pumps will be used for purging and groundwater sample collection.

Field parameters including temperature, pH, conductivity, turbidity, dissolved oxygen (DO), and oxidation-reduction potential (ORP) will be measured at the time of sample collection using a water quality instrument(s). These results will be recorded on field sample log sheets

(Attachment B). Observations during both purging and sampling regarding evidence of the potential presence of DNAPL (e.g., sheens, phase separation, spots, globules, color, etc.) will also be recorded on the sample log sheets.

Groundwater samples will be collected directly into pre-preserved, laboratory supplied containers, and placed immediately on ice. The samples will be analyzed for benzene and naphthalene via EPA SW-846 Method 8260B. The Method Detection Limits and Reporting Limits are provided in Section 2.4 of the QAPP (Attachment D).

2.1.3 Step-out locations

In the event that NAPL or other obvious evidence of groundwater impact are observed in the soil core or groundwater sample, one or more additional borings, with groundwater sampling, will be performed. The additional boring(s) will be located hydraulically downgradient in the direction of groundwater flow.

All field data will be tabulated on the Field Investigation Spreadsheet (Attachment B) and transferred to a Site base map on a daily basis. The resulting maps and tables will be distributed and reviewed daily to allow for real-time decision making concerning the need to perform additional work as described in Section 2.1.3 relating to step-out boring locations.

2.1.4 Abandonment

The temporary wells will be removed from the subsurface prior to demobilization. The soil borings will then be abandoned by backing filling with bentonite chips to approximately 2 feet below ground surface. The remainder of the hole will be plugged with concrete or cement grout. Where borings are advanced through paved surfaces, the pavement will be restored in kind.

2.1.5 Survey

Each location will be surveyed by a licensed Texas surveyor to determine horizontal location and elevation in reference to the Texas Coordinate System, South Central Zone, and the 1973 United States Coastal and Geodetic Survey adjustment of the 1929 mean sea level datum, respectively.

2.2 EXISTING MONITORING WELL AND PIEZOMETER SAMPLING

Groundwater samples will be collected from twenty-six monitoring wells and piezometers at the Site. Figure 3 shows the well and piezometer locations to be sampled. The wells/piezometers to be sampled include the following:

Shallow Zone

PZN-20	PZS-30
PZN-30	PZS-40
PZN-50	PZS-60

MW-01	MW-08
MW-05	MW-09
MW-24	MW-26
MW-25	OW-01
OW-08	OW-09

Intermediate Zone

P-01	MW-10
P-02R	MW-11
P-03R	MW-12R
P-04	MW-14R
P-05	MW-16

Groundwater sample collection from the shallow zone monitoring wells and piezometers will not occur during or immediately following heavy precipitation events.

Sample collection activities at each location will be recorded on the Groundwater Sample Collection Record (Attachment B). Prior to sample collection, depth to water, depth to DNAPL (if present), and total depth will be measured relative to an established measuring point with an oil-water interface indicator. Groundwater samples will not be collected from monitor wells or piezometers where DNAPL is detected.

Groundwater purging and sampling will be conducted in accordance with the Standard Operating Procedure included as Attachment C. The groundwater sample will be collected in pre-preserved, laboratory-supplied containers and immediately placed on ice. The samples will be analyzed for benzene and naphthalene by EPA Method 8260B.

All re-used, downhole equipment (i.e. pumps, cable, oil-water interface indicator) will be decontaminated between sample locations by washing all surfaces with an Alconox® (or equivalent) solution, followed by a deionized water rinse. All purge water will be containerized for discharge to the on-site water treatment facility.

2.3 QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance/Quality Control (QA/QC) for the project is discussed in detail in the Quality Assurance Project Plan (QAPP) provided as Attachment D. A brief summary of planned field QA/QC sampling, a general discussion of sample handling and custody, and an overview of the data usability assessment is provided in this section.

The following QA/QC samples will be collected as part of the Potential Preferential Pathway Investigation: one blind duplicate; one equipment blank; and, one Matrix Spike/Matrix Spike Duplicate (MS/MSD). Two blind duplicates, one equipment blank and two MS/MSDs will be collected as part of the Monitoring Well/Piezometer Sampling. In addition, one trip blank will accompany each cooler containing the groundwater samples for VOC analyses.

All samples will be maintained at a temperature of approximately 4 degrees Celsius and will be delivered to laboratory in timely manner such that the applicable method holding times for analysis are not exceeded. Chain of Custody (COC) documentation will be completed by the field sampling team leader and will accompany the sample shipment to the laboratory.

To ensure the utility of the sample results, a data usability assessment of the analytical data will be completed. This review will be completed by the Contractor's QA/QC Officer. The analytical results generated via SW-846 Method 8260B will be reviewed in accordance with specific critical components of relevant U.S. EPA guidance for data validation. Specifically, analytical results will be reviewed considering the following general rubrics:

- Sample holding time compliance
- Acceptable surrogate spike recoveries
- Laboratory method blank artifacts
- MS/MSD RPDs and recoveries

The analytical results will be reviewed to ensure that samples were analyzed within an acceptable time frame (based on the date of sample collection). Surrogate recoveries will be reviewed to determine if the Gas Chromatography/Mass Spectrometry instrumentation was performing adequately. Method blank results will be reviewed to identify the possibility of laboratory contamination of the samples. The MS/MSD results will provide an indication of the precision of the analytical method given the potential for matrix interference effects.

The data usability assessment will be completed in accordance with applicable sections of with the following guidance document: U.S. EPA's Contract Laboratory Program, National Functional Guidelines for Organic Data Review. As required, this guidance document will be used in conjunction with the laboratory SOPs for the respective analytical methods. Professional judgment will be exercised throughout the data assessment effort, particularly for situations that are not addressed or clearly specified in the SOPs or in the guidance documents.

SECTION 3.0

3.0 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) may include soil cuttings, purged groundwater, decontamination fluids, disposable sampling materials, and personal protective equipment (PPE). All liquid IDW will be directed to the on-Site groundwater treatment system. All solid IDW will be contained in labeled, steel 55-gallon drums temporarily staged at the Site. One representative soil sample will be collected and analyzed to characterize the solid material for disposal. Once characterized, the solid IDW will be properly disposed of off-Site in accordance with all applicable state and federal regulations.

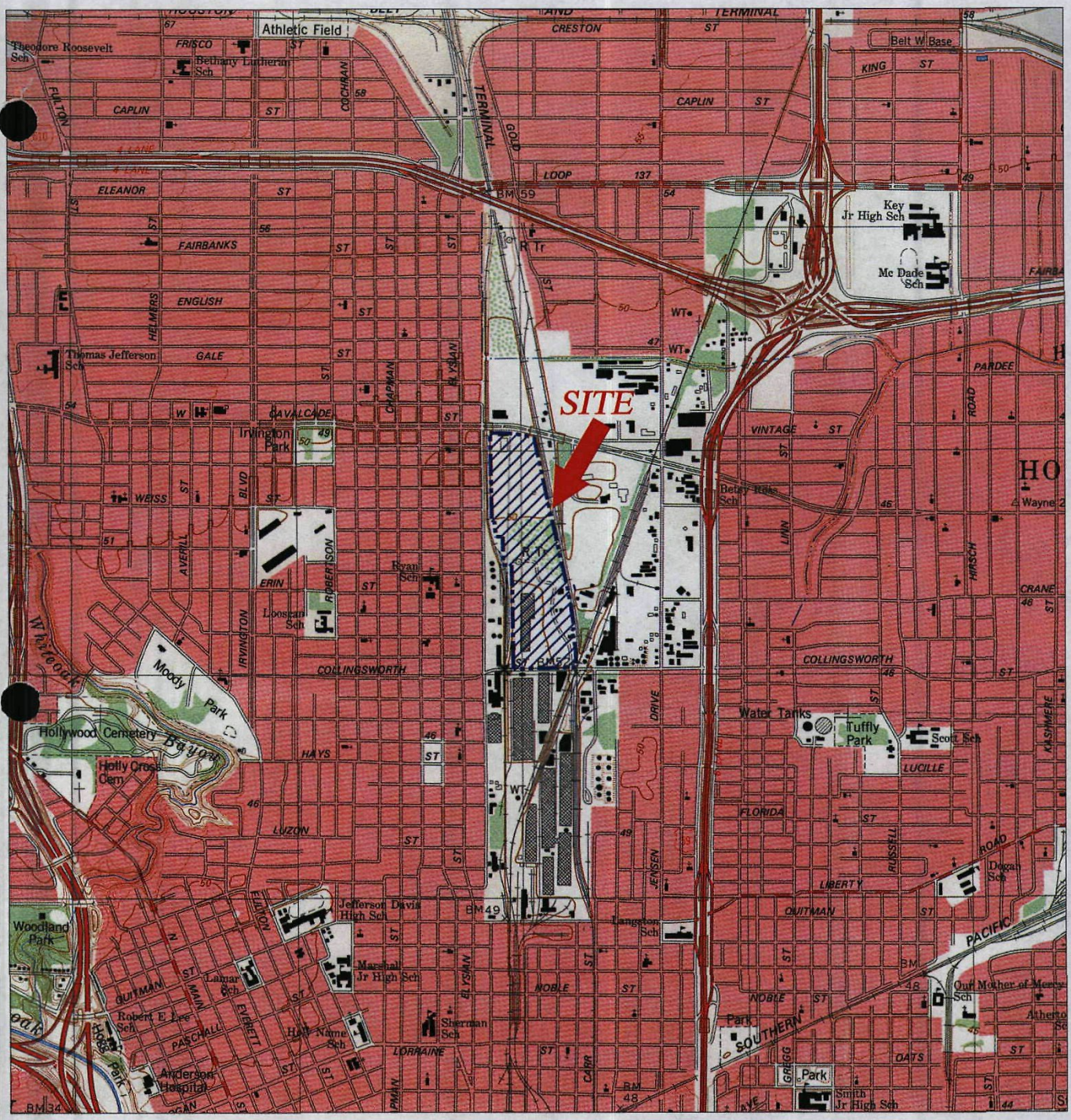
SECTION 4.0

4.0 SCHEDULE AND DELIVERABLES

Pending approval to proceed and access to off-site properties, the field activities can be completed in four weeks (including one week for mobilization/procurement). Analyses of the soil and groundwater samples will be completed in four weeks following completion of field activities. As discussed at the April 5, 2005 meeting, Beazer, EPA and TCEQ will meet upon completion of the field activities, sample analysis, and data compilation to review and evaluate the investigation data. It is planned that preliminary data evaluation and compilation will be completed within three weeks of receipt of the analytical data. Beazer will provide to EPA and TCEQ all geologic and chemical data acquired during the investigation in advance of the meeting. It is planned that this meeting will be held two weeks after submittal of the preliminary geologic and chemical data. It is anticipated that the scope of the report of findings and schedule for submittal will be determined during the meeting and that locations for proposed permanent monitoring wells can also be discussed.

A proposed project schedule is provided in graphical form as Figure 4. The duration of major activities is displayed and relevant milestones (e.g., mobilization and meeting dates) are depicted on Figure 4. Note that the schedule, as proposed, is based on various assumptions regarding agency review periods. Furthermore, the schedule is also based on the assumption that adverse weather conditions will not be encountered during the field effort.

FIGURES



REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE OF SETTEGAST, TEXAS – 1982

KEY ENVIRONMENTAL, INC.

ISSUE DATE:

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BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA

DRAWN: BKC	DATE: 5-19-05	KEY ENVIRONMENTAL INCORPORATED
CHKD: JRH	DATE: 5-19-05	
APPD: JSZ	DATE: 5-19-05	
SCALE: 1" = 2000'		

SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

SITE LOCATION MAP

DRAWING NUMBER
05-070
FIGURE 1

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LEGEND

- PROPERTY BOUNDARY
- RAILROAD
- FENCE
- A06-SB05 — SOIL BORING LOCATION
- OW-02 — MONITORING WELL LOCATION
- RWN-3 — GROUNDWATER EXTRACTION WELL
- RWS-1 — DNAPL AND GROUNDWATER EXTRACTION WELL
- RWN-4 — DNAPL RECOVERY WELL LOCATION
- DPN-TN3 — DIRECT PUSH BORING TEMPORARRY PIEZOMETER LOCATION
- STRUCTURE
- PAVED AREA
- PROPOSED INTERMEDIATE ZONE INVESTIGATION AREA
- PROPOSED SHALLOW ZONE INVESTIGATION AREA
- PROPOSED SHALLOW AND INTERMEDIATE ZONE INVESTIGATION AREA
- PROPOSED SHALLOW ZONE SOIL BORING LOCATION
- PROPOSED INTERMEDIATE ZONE SOIL BORING LOCATION

0 100 200 400 FEET

NOTE: SEE SECTION 2.1 FOR DESCRIPTION OF HOW INVESTIGATION AREAS WERE DETERMINED.

BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA

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SCALE:	AS SHOWN		

KEY ENVIRONMENTAL INCORPORATED

SOUTH CAVALCADE SUPERFUND SITE
BEAZER EAST, INC.
HOUSTON, TEXAS

PROPOSED SOIL BORING LOCATIONS

DRAWING NUMBER 05-070
FIGURE 2

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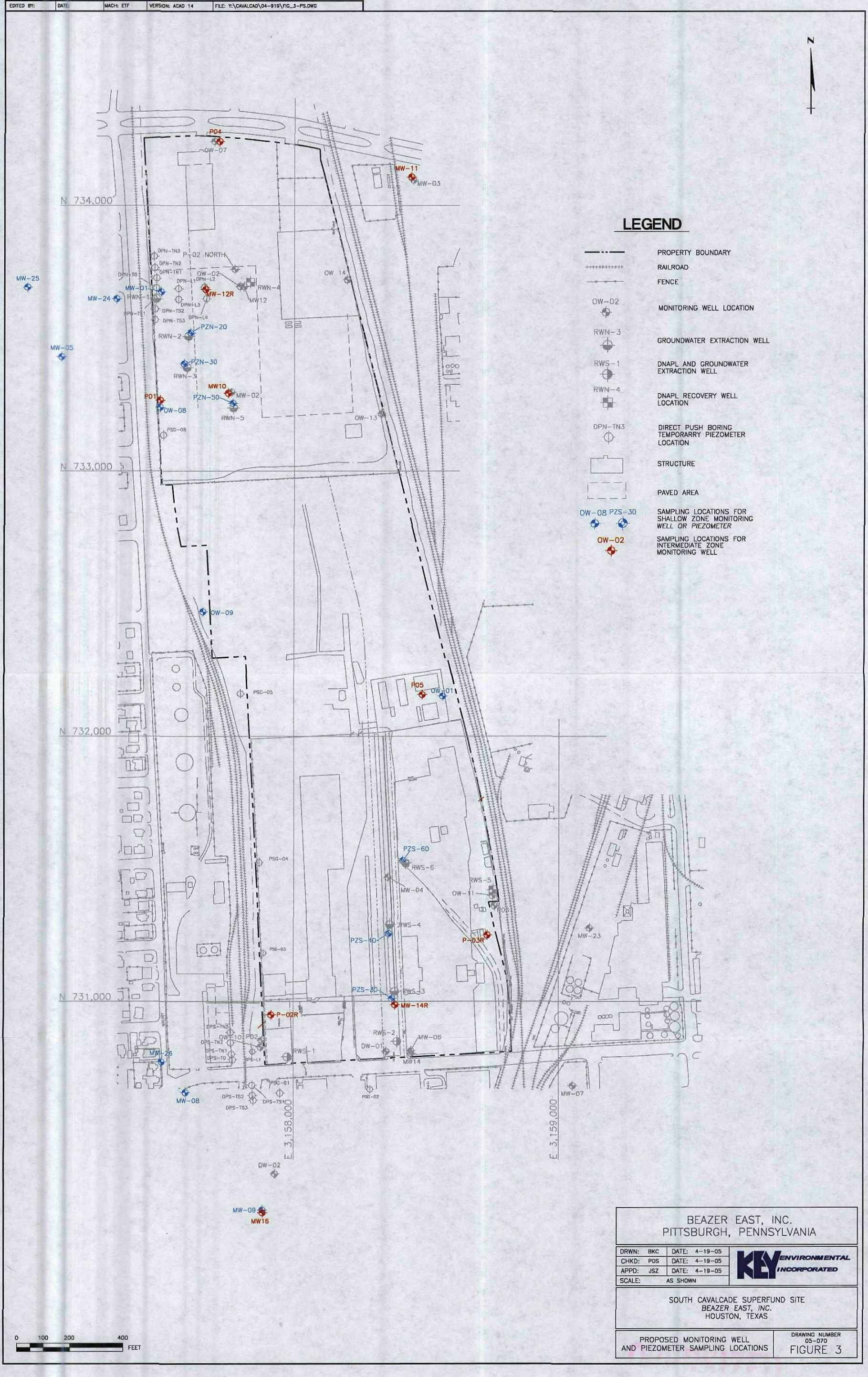

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PITTSBURGH, PENNSYLVANIA

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CHKD: PDS	DATE: 4-19-05		
APPD: JSZ	DATE: 4-19-05		
SCALE: AS SHOWN			

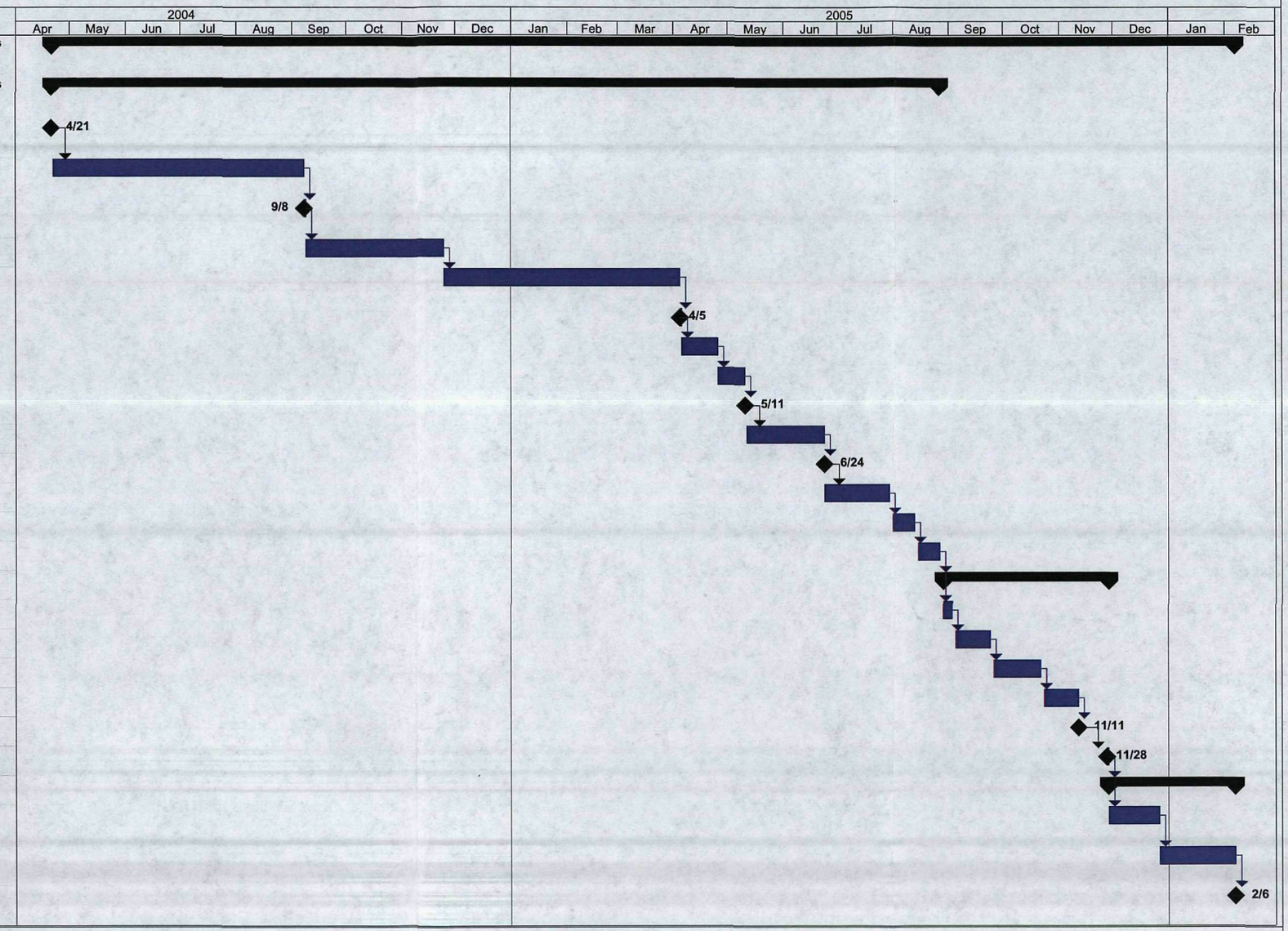
SOUTH CAVALCADE SUPERFUND SITE
BEAZER EAST, INC.
HOUSTON, TEXAS

PROPOSED MONITORING WELL AND PIEZOMETER SAMPLING LOCATIONS

DRAWING NUMBER 05-070
FIGURE 3

FIGURE 4
PROJECT SCHEDULE
SUPPLEMENTAL GROUNDWATER CHARACTERIZATION
SOUTH CAVALCADE SUPERFUND SITE

ID	Task Name	Duration
1	**SUPPLEMENTAL GROUNDWATER CHARACTERIZATION**	**469 days**
2	**Scope of Work Development**	**353 days**
3	Project Meeting	1 day
4	Geologic Data Review/Evaluation	99 days
5	Project Meeting	1 day
6	Boring/Temporary Well Plan Preparation	55 days
7	Boring/Temporary Well Plan Review/Approval	93 days
8	Project Meeting	1 day
9	Boring/Temporary Well Work Plan	14 days
10	Work Plan Preliminary Review	11 days
11	Work Plan Review Teleconference	0 days
12	Work Plan Revision/QAPP Preparation	31 days
13	Submission of Revised Work Plan and QAPP	0 days
14	Work Plan and QAPP Review/Comment	26 days
15	Work Plan and QAPP Revision	10 days
16	Revised Work Plan Review/Approval	10 days
17	**Workplan Implementation**	**66 days**
18	Subcontract Procurement/Mobilization	5 days
19	Temporary Wells/Groundwater Sampling	15 days
20	GroundwaterAnalyses	20 days
21	Data Evaluation	15 days
22	Submit Data to EPA/TCEQ	0 days
23	Project Meeting	1 day
24	**Monitoring Plan**	**50 days**
25	Prepare Monitoring Plan	20 days
26	Agency Review/Approval	30 days
27	Initiate Monitoring Program	0 days



Task Progress Milestone Summary

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8/11/05

ATTACHMENT A

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

SUPPLEMENTAL GROUNDWATER CHARACTERIZATION

SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

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July 2005

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) describes Site specific procedures to be implemented by KEY Environmental, Inc. (KEY) employees and sub-contractors when performing work activities at the South Cavalcade Superfund Site in Houston, Texas. All work must be performed in accordance with applicable federal, state, and local regulations, including, but not limited to:

U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) - 29 Code of Federal Regulations (CFR) 1910.120, "Hazardous Waste Operations and Emergency Response"; and,

OSHA - 29 CFR 1926, "Safety and Health Regulations for Construction."

The health and safety practices, procedures, and personal protective equipment (PPE) requirements established within this HASP are based on hazards known to be present at this Site. All protective measures employed must be commensurate with known hazards associated with specific work activities and job tasks and must be modified if other hazards are identified during the course of the work.

This HASP should not be used for activities other than those outlined in the scope of work unless a task-specific hazard and exposure assessment is performed and any additional protective measures incorporated into the HASP. This HASP is intended for use by KEY and may not include all subcontractor activities. Contractors or subcontractors performing activities not included in this HASP must prepare their own HASP in accordance with OSHA 29 CFR 1910.120.

2.0 PROGRAM ORGANIZATION AND RESPONSIBILITIES

Some activities covered by this HASP will be performed by one or two persons from KEY. Some activities may also involve the use of subcontractors.

2.1 WORK PERFORMED BY KEY PERSONNEL

KEY On-Site Personnel are responsible for:

- Their own safety;
- Ensuring that they have the proper PPE and other necessary safety equipment;
- Ensuring that their training and medical surveillance is up-to-date;
- Becoming familiar with and complying with the HASP;
- Attending training sessions to review the HASP and other safety/health information;
- Being alert to previously identified and new hazards;
- Reporting unidentified hazards to the KEY Health and Safety Manager; and
- Conducting themselves in a manner that is orderly and appropriate for the Site.

KEY Project Manager

The Project Manager is responsible for ensuring that all activities are conducted in accordance with the HASP. The Project Manager has the authority to suspend field activities if employees are in danger of injury or exposure to harmful agents. The Project Manager's responsibilities include:

- Coordinating the development of a Site-specific HASP for all phases of the project;
- Ensuring that the appropriate health and safety equipment and PPE are available for project personnel;
- Ensuring that all personnel have received the appropriate training before they engage in activities that are potentially hazardous;
- Ensuring that all required personnel have received the required medical examination, testing, and screening before engaging in work activities; and,

- Designating a Site Health and Safety Officer (SHSO) and other Site personnel who will ensure compliance with the HASP.

2.2 SUBCONTRACTOR ACTIVITIES

Environmental investigative, or other, activities may include the use of subcontractors. In addition to being responsible for their own safety as outlined above –

The on-site KEY personnel are also responsible for:

- Ensuring that KEY personnel, subcontractor personnel, and visitors comply with the requirements of this HASP; and,
- Notifying the KEY Project Manager or KEY Health and Safety Manager of any changes in work conditions or tasks which may require changes to the HASP.
- Acting as the Site Health and Safety Officer for field activities, whose duties include:
  - Coordinating safety meetings and daily safety briefings, as necessary;
  - Acting as the Emergency Coordinator at the Site and arrange for emergency response in cooperation with local emergency and health officials;
  - Monitoring conditions during field activities to assure compliance with HASP;
  - Monitoring conditions during field activities to determine if more stringent procedures or a higher level of PPE should be implemented;
  - Maintaining a log to record conditions, personnel involved in field activities, and other pertinent health and safety data;
  - Overseeing the arrangement and execution of personnel and equipment decontamination;
  - Suspending field activities if necessary, and resume activities when appropriate, and;
  - Controlling visitor, subcontractor, and employee access to hazardous areas.

Subcontractors are responsible for:

- Becoming familiar with the HASP;
- Complying with the contents of the HASP;
- Implementing their own HASP, or work procedures not covered in this HASP, as necessary and applicable;
- Attending training sessions to review the HASP and other safety/health information;
- Being alert to previously identified and new hazards;
- Reporting unidentified hazards to the KEY SHSO; and,
- Conducting themselves in a manner that is orderly and appropriate for the Site.

3.0 SITE CHARACTERIZATION AND HAZARD ASSESSMENT

3.1 SITE DESCRIPTION AND BACKGROUND

The South Cavalcade Superfund Site occupies approximately sixty-six acres of urban land approximately three miles north of downtown Houston, Texas. The site is rectangular in shape with a length of approximately 3,400 feet in the north-south direction, and a width of approximately 900 feet in the east-west direction. A site location map is provided as Figure 1 and a site plan is provided as Figure 2.

The Site was operated as a wood treating plant from 1910 until 1962 using creosote and various metal salts in the wood treating process. The wood treating process area was located in the southern portion of the Site, along Collingsworth Street. Koppers Company, Inc. (Koppers), now known as Beazer East, Inc, (Beazer), operated the wood treating facility from 1944 until closure in 1962. A coal tar distillation plant was operated by Koppers on the southeastern portion of the Site from about 1944 until 1962. Since the discontinuation of these operations several trucking companies have occupied the property. The Site is currently occupied by three trucking firms and much of the ground surface, especially in the southern and northern areas of the Site, is covered by concrete or asphalt pavement, or buildings. The central part of the Site is undeveloped. Land use in the vicinity of the Site is a mixture of commercial, industrial, and residential. The nearest residences are located several hundred feet to the west of the Site.

Groundwater monitoring wells and extraction wells have been installed at the Site as a result of previous investigations and the remedial action designated for the Site. A groundwater treatment facility is located along the eastern Site boundary in the central portion of the Site. Dense Non-Aqueous Phase Liquid (DNAPL) is recovered through the extraction wells.

3.2 SCOPE OF WORK

The scope of work includes:

- Completion of soil borings;
- Installation of temporary monitoring wells;
- Groundwater sample collection;

- Abandoning wells;
- Surveying well and boring locations; and,
- Sampling existing monitoring wells and piezometers.

Tasks involved in the scope of work may include, but may not be limited to:

Soil borings:

- Completing approximately sixteen soil borings by continuous push technology (Geoprobe);
- Continuous soil recovery and logging data;
- Screening soil for volatile organic compounds (VOCs); and,
- Collecting soil samples for analysis.

Groundwater Sample Collection:

- Installation of temporary monitoring wells (approx. 1" dia.);
- Seal wells with bentonite above screened zone;
- Purge wells;
- Containerize purge water for discharge to existing treatment plant;
- Collect groundwater samples with peristaltic pump or hand bailers;
- Measure field parameters such as pH, conductivity, turbidity, dissolved oxygen and oxidation-reduction potential; and
- Package and send samples to laboratory.

Abandon Wells:

- Remove PVC pipe;
- Backfill holes with bentonite chips;
- Grout with concrete or cement;
- Restore pavement.

Survey boring holes and well locations.

Sampling Existing Wells:

- 26 existing monitoring wells and piezometers;
- Measure depth to water, depth to dense non-liquid phase liquid (DNAPL), and total depth;
- Collect water samples from wells with no DNAPL;
- Purge and sample wells;
- Decon equipment with Alconox and deionized water; and,
- Containerize purge water and decontamination liquids for on-site treatment.

Stage investigative-derived waste (IDW) temporarily on-site and collect a soil sample for analysis prior to disposal.

The work will be performed outside the source area where there is less potential for exposure to potential Site constituents.

3.3 CHEMICAL HEALTH HAZARDS

Potential chemical health hazards at the Site include the potential exposure to creosote/coal tar constituents including polynuclear aromatic hydrocarbons (PAHs), including naphthalene; and to the volatile organic compounds (VOCs) benzene, toluene, ethylbenzene, and xylene (BTEX). The Groundwater Fate and Transport Evaluation Report found the following upper range concentrations of potential constituents[1].

Constituent	Soil (mg/kg)	Groundwater (ug/l)
Benzene	---	780
Toluene	---	340
Ethylbenzene	---	940
Xylenes	---	1,000
PAHs Total	8,597	87,290
Naphthalene	---	43,000

The most likely routes of exposure to Site chemicals are through direct contact with soils and groundwater, and more likely, through direct contact with DNAPL when measuring DNAPL in wells. Concentrations of VOCs are low so there is only a very low potential for exposure to these compounds during work activities.

3.3.1 PAHs

The main route of exposure for creosote compounds, including PAHs, is skin/eye contact and absorption; a secondary route of exposure is inhalation of dust and vapors. The PAHs found on the Site pose only a slight inhalation hazard because they are not very volatile, that is, they are unlikely to vaporize. However, PAHs can cause skin and eye irritation upon contact and can cause systemic

1 Key Environmental, Inc. Groundwater Fate and Transport Evaluation Report for the South Cavalcade Superfund Site, 1998.

poisoning upon prolonged contact, inhalation, or ingestion. Some PAHs can cause cancer after prolonged exposure. However, prolonged overexposure to PAHs is not expected due to the short duration of anticipated project work. OSHA has not established exposure limits for most individual PAHs. Coal tar pitch volatiles is a category that contains several compounds, most of which are PAHs, so coal tar pitch volatiles is used as a surrogate measure for PAHs.

Immediate or acute effects from short-term exposure to coal tar compounds include irritation; burning, itching, redness, skin color changes, and rashes from skin contact with coal tar compounds. Photosensitization, a tendency to sunburn more easily or a worsening of rash with exposure to sunlight, may occur with skin contact to coal tar compounds. Inhalation of coal tar compounds, or dust which contains coal tar compounds, may irritate the respiratory tract. Eye contact may cause eye irritation, burning and inflammation. Ingestion may result in nausea, vomiting, abdominal pain, rapid pulse, respiratory distress and shock. Absorption into the body systems by any route may cause trouble breathing, dizziness, headache, continuous or drawn out pulse, nausea, vomiting, salivation, and convulsions. Chronic or long-term effects of overexposure to coal tar compounds may cause dermatitis, and cancer of the skin, kidneys, and respiratory tract.

Refer to Section 9.1 for first aid information on treating creosote exposures.

Exposure to potential Site constituents can be avoided or limited by the use of gloves and skin protection. For these reasons, potential exposure risks to PAHs are considered to be reasonably low.

3.3.2 VOCs

Benzene, ethylbenzene, toluene, xylene, methylene chloride and styrene may pose an inhalation hazard as well as a skin and eye hazard. However, the low concentrations of VOCs in ground water and soil represent a low risk of overexposure to these compounds. Acute or immediate effects of overexposure to VOCs include eye, nose, and respiratory tract irritation, headache, dizziness, drowsiness, shortness of breath, intoxication, nausea, vomiting, abdominal pain, and dermatitis. Severe overexposure may lead to unconsciousness and convulsions, coma, and death. Other signs of overexposure may include heartbeat irregularities, bronchitis, pulmonary edema, muscle spasms,

incoordination, and confusion. Effects of frequent or long-term overexposure include headache, nervousness, lack of hunger, pale skin, rash, and sleeplessness. Chronic inhalation may result in lung, liver, and kidney damage. Long-term overexposure to benzene can cause blood disorders, such as leukemia and aplastic anemia. Benzene is a suspected human carcinogen.

Table 1 presents exposure limits and other properties of chemicals that may be present at this Site. More information concerning the health effects of Site chemicals can be found in the Material Safety Data Sheets (MSDS) in Appendix A. The MSDS for coal tar creosote is representative of information concerning PAHs.

3.3.4 Work Task Chemical Hazard Assessment

The overall chemical health hazard assessment for this Site is low. Potential exposure to Site constituents will be reduced or eliminated by following the work practices and using the personal protective equipment (PPE) designated in this HASP. Table 2 indicates the chemical hazards associated with Site work tasks, relative hazard assessment, proposed initial levels of personal protection, and air monitoring requirements.

3.4 PHYSICAL HAZARDS

The primary physical hazards on the Site are those associated with drilling activities. Physical hazards during groundwater sampling and DNAPL measurements and sampling may include muscle strain, lacerations, struck by and against, and slip, trip and fall. Safe work practices for these potential hazards are outlined in Section 5.0.

3.5 CONFINED SPACES

No confined space entry (CSE) is anticipated for work covered by this HASP. However, if a situation arises that requires entering a confined space then KEY Environmental and OSHA CSE procedures must be followed, including atmospheric testing of the space and completion of a CSE permit before entry. A minimum of two trained employees must be present for any entry.

3.6 HEAT STRESS

A general physical hazard associated with outdoor work during warm weather is heat stress. There are three heat disorders that are of particular concern - heat cramps, heat exhaustion, and heat stroke. *Heat cramps* occur due to the depletion of body salts from sweating. *Heat exhaustion* results from significant loss of body salts and fluid. Its symptoms may include weakness or fatigue, nausea, headaches, and in more serious cases, clammy, moist skin with pale or flushed complexion. *Heat stroke* is the most serious and occurs when the body's system to regulate internal temperature fails. Symptoms of heat stroke are hot, dry skin; mental confusion or delirium; convulsions or unconsciousness; and body temperature of 105°F or higher. In this situation, medical attention is needed immediately; heat stroke may be fatal.

To prevent heat disorders, attention must be paid to such variables as temperature, humidity, air movement, and the physical condition of employees. In addition, breaks must be taken as needed to let the body cool. Liquids designed to replace lost body salts must be provided regularly.

3.6.1 Heat Stress Prevention

Heat stress can occur even when temperatures are considered moderate, such as in spring or fall. The following recommendations should be followed to help reduce heat stress:

- Personnel must drink plenty of liquids to replace body fluids lost to sweating. To prevent dehydration personnel should be encouraged to drink generous amounts of water even if not thirsty. Heat-related problems can happen before the sensation of thirst occurs.
- Cool drinking water, 50°F to 60°F, should be made available to all personnel.
- Only water, or occasionally, electrolyte-balanced drinks, such as Gatorade®, should be used to replace lost fluids due to sweating.
- Beverages containing caffeine, such as colas, coffee, or tea, should be limited or not used because of their diuretic (water depleting) effects.

- Salt tablets should not be used unless prescribed by a physician.
- Self-monitoring of physical condition and buddy monitoring will be essential in order to prevent any heat stress illness. All personnel should be aware of heat stress symptoms and the proper precautions to take if heat stress is observed.
- Rest periods must be provided for all personnel. This means at least 15 minutes in the morning and in the afternoon and at least 30 minutes for lunch. A more frequent rest schedule may be implemented by the SHSO depending on weather conditions and the type of work performed.

3.7 OUTDOOR HAZARDS

Biological hazards present at the Site may include poisonous plants, insects, and animals. Poison ivy and/or poison oak may be present. Contact with the leaves, vine, roots, or sap of poison ivy or poison oak causes a skin rash on many people. All workers must be familiar with the appearance of poison ivy (three leaves) and wear impervious protective clothing as necessary to prevent contact with poison ivy. Poison ivy/oak can still cause a reaction even in cold weather because the sap is still in the plant.

Ticks may be present throughout the Site on brush, grass, and weeds. Some ticks carry disease, such as Lyme disease or Rocky Mountain spotted fever. Wear protective clothing or secure pant legs to lower leg or boot and apply bug repellent to this area as noted below for mosquitoes. Frequently assist each other in inspecting for ticks. If a tick is found attached to the skin, do not attempt to pick the tick off the skin with fingernails or scrape with a credit card, etc. Carefully remove the tick with tweezers taking care that all parts are removed. Thoroughly scrub the area with soap and water. Save the tick in a small jar or plastic bag and take it to a doctor or health department for identification. If a red circle or rash forms in the area of the tick bite or if flu-like symptoms appear in a few days or weeks consult a doctor for treatment.

A particular hazard at this Site during warmer weather is mosquitoes. Besides the annoyance of the buzzing insects and ordinary mosquito bites, some mosquitoes can transmit West Nile Virus and other diseases. West Nile Virus can be a serious disease, especially for people over 50 years old. Most people have no symptoms after infection but some people have mild symptoms that can

include fever, headache, body aches, nausea, vomiting, and swollen lymph glands or a skin rash on the chest, stomach and back. Symptoms last a few days to several weeks. A few people develop severe illness. Symptoms may include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis. Symptoms may last several weeks and neurological effects may be permanent. People older than 50 are at a higher risk to get sick. A very few people may die from a West Nile virus infection.

The best way to prevent West Nile Virus is to avoid being bitten by mosquitoes. When working outdoors wear light-colored long sleeve shirts, long pants and socks sprayed with insect repellent. Use repellent carefully! Follow the manufacturer's directions for the repellent you are using. Repellents with DEET (N, N-diethyl-meta-toluamide) or permethrin are effective against mosquitoes and other biting insects. You can use DEET directly on your skin and clothing but do not use on skin under clothing. Use permethrin only on clothing, not directly on skin, and let sprayed clothing dry before use. Repellents with a higher concentration do not mean they work better but that they work longer.

According to the Centers for Disease Control (CDC), a recent study indicated the following:

- A product containing 23.8% DEET provided an average of 5 hours of protection from mosquito bites.
- A product containing 20% DEET provided almost 4 hours of protection.
- A product containing 6.65% DEET provided almost 2 hours of protection.
- Products containing 4.75% DEET and 2% soybean oil were both able to provide roughly 90 minutes or protection.

Sweating or getting wet may mean you need to re-apply repellent more frequently. If possible wash exposed skin before re-applying repellent. Be sure to wash skin that was sprayed with repellent at the end of the day. Wash hands before eating or using the restroom.

Wasps, bees and other stinging insects may also be found at the Site. Use of DEET of repellent containing permethrin will help keep wasps and bees away. However, if a nest is disturbed the repellent will not help. Be alert for bees flying into and out of a particular area, hanging nests, and nests in logs, pipes and other structures. Wear light-colored clothes as darker clothes tend to annoy

some stinging insects.

First aid for insect bites and stings includes: applying a baking soda paste of ice wrapped in a wet cloth. Commercial bee sting kits may be helpful. Honeybees leave their stingers in the body; these can be removed by gently scraping the skin, working side to side of the stinger. A bee sting or snake suction device can also be used. If an insect bite becomes red or inflamed or the person becomes dizzy, nauseous, or short of breath then get to medical care immediately.

Poisonous red ants or fire ants also may be found at the Site. These ants usually build mounds in open sunny areas and near rotting logs, around tree stumps, and sometimes near buildings. They are attracted to electrical fields and may sometimes be found around electrical housings and installations and also around well pipes. Fire ant stings are painful and the venom leaves a white pustule. Symptoms of a fire ant sting include burning and itching as well as the white pustule which may take a day or two to form. Fire ants can sting repeatedly and will attack anything that disturbs their nest. Although stings are not usually life threatening, multiple stings may lead to secondary infections.

The best protection in areas of heavy fire ant infestation is to wear boots with pant legs tucked in or taped to boots so ants cannot crawl up under pant legs. In areas of where ants are less concentrated continual vigilance is needed to ensure that ants do not crawl onto personnel. If stung treat the area with an insect bite remedy that deadens pain and protects against infection. Get medical help in case of multiple stings; or if a person reacts severely to stings.

Avoid unnecessary contact with animals. Some animals may carry disease or poison or may cause injury by biting. If an animal is acting strangely, or if a wild animal approaches humans, leave the area. If necessary, call animal control personnel. Do not try to feed wild animals.

Snakes may also be present on the Site. Leave snakes alone, do not attempt to catch or kill. Stay out of tall grass, brush, and wood or rock piles. Keep hands and feet out of areas you cannot see. If bitten, get the person to medical help immediately. If practical, try to quickly identify the type of snake or at least the color and markings and size. First aid for snake bites includes: Wash the bite with soap and water or antiseptic cleanser, immobilize the bitten area and keep it lower than the

heart, cover the area with a clean, cool compress or a moist dressing to minimize pain and swelling. Keep the victim calm and comfortable. If the victim cannot reach medical care within 30 minutes apply a bandage, wrapped 2 to 4 inches above the bite, to help slow the venom. This should not cut off the flow of blood from a vein or artery – the band should be loose enough to slip a finger under it. Without cutting, place a suction device over the bite to help draw venom out of the wound. Continue alternating suction and application of a compress while transporting to a doctor or hospital. Do not give the victim food or alcohol and only limited other liquids as necessary.

4.0 MEDICAL SURVEILLANCE

4.1 PRE-ASSIGNMENT SCREENING

KEY employees who work at this Site must have a current medical screening and approval for Site work in accordance with 29 CFR 1910.120 (f) and KEY medical screening policies and procedures. This screening includes:

- Medical history;
- Occupational history;
- Physical examination;
- Determination of fitness to work wearing protective equipment and respirators;
- Baseline laboratory studies; and,
- Medical evaluation to determine employee's ability to wear a respirator (for employee's who may wear a respirator).

Employees engaged in work with potential exposure to hazardous materials must undergo a periodic update of medical and occupational history and a periodic physical examination equivalent to the pre-assignment exam. Medical examinations must also be made available to any employee that has developed, or believed he has developed, signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or if the employee has been injured or exposed above the permissible exposure limit (PEL) or published exposure levels in an emergency situation.

4.2 SUBCONTRACTORS

Subcontractors performing work under this HASP are required to have medical training as above. In general, subcontractors who will perform work at this Site where there is a potential for contact with Site constituents are required to follow the medical surveillance requirements of 29 CFR 1910.120 and a medical surveillance program. Subcontractors who perform work where there is no potential for exposure to Site constituents, are not required to follow the medical surveillance requirements of 29 CFR 1910.120.

5.0 WORK PRACTICES AND SITE CONTROL

5.1 SAFE WORK PRACTICES

5.1.1 Routine Safe Work Practices

Proper personal hygiene and the buddy system are integral parts of safe work practices and must be followed by all KEY employees while working at the Site:

- Site activities that involve serious hazards should be performed by a work team of at least two people. Site personnel may use judgment and be flexible in defining when two persons must be present.
- Hygienic practices consistent with work hazards are necessary. Eating and food preparation will be prohibited in any area other than those designated and properly protected. No food or tobacco products will be permitted in work areas. Beverages are only permitted as noted in Section 5.1.9. Employees who handle potentially contaminated materials or articles will wash with soap or mild detergent and water before eating or using the rest room.

5.1.2 Work Restrictions

All outdoor work at the Site must be conducted during daylight hours unless adequate lighting is provided. Outdoor work must cease immediately upon the signs of impending thunderstorms and lightning or other severe weather, as determined by the SHSO.

5.1.3 Underground and Overhead Utilities

Underground utilities and pipelines can present special hazards such as electrocution, sudden release of pressure (gas or liquid), and explosion and fire. Check with Facility personnel and contact local utilities before drilling or other subsurface work and/or call the Houston One-Call Center at 1-800-669-8344. Check for any overhead wires before work. Keep equipment at least 20 feet away from overhead lines.

5.1.4 Geoprobe®

Personnel working on or near the Geoprobe® must be aware of the hazards of the equipment and follow the manufacturer's use recommendations. Particular hazards include pinch points when raising/lowering and other movement of the probe, pinch points when "hammering", and hot hydraulic fluid in the hoses. Unauthorized personnel must not attempt to operate the Geoprobe®. Hearing protection should be worn when operating or working near the Geoprobe®.

5.1.5 Drill Rigs

Personnel working on or near drill rigs must be aware of the hazards of drilling activities and rotating/moving parts used in the drilling process.

- Clear away all debris from the immediate area
- Be sure that the area to be drilled is free of underground power lines, gas lines, water mains, sewers, or other utilities.
- Before erecting the derrick, be sure that there are no overhead power lines, tree branches, or other obstructions in the path.
- Stay a safe distance from the lines being used for hoisting and pulling. Never straddle or reach across them.
- Always stand clear of the cable, hoisting plug, and rods while the operator releases the tension on the cable. The bail or hoisting plug may spin rapidly when the tension is released.
- Never place a hand on the guide or drive head when the drive hammer is suspended or in use. Many hand injuries around drill rigs occur in this fashion.
- Do not leave the rod suspended when not in use. Release tension so the rod touches the ground and can be secured to the side of the rig, or lay the rod on the ground.
- Wear ear protection when operating or standing near (5 feet) of the drill rig.

5.1.6 Opening Wells

Opening wells may release vapors of potentially hazardous site constituents, which have concentrated in the headspace of wells. Precautions to prevent exposure include:

- Open wells carefully and allow to vent before taking measurements or sampling;
- Stand to the side and avert face when opening wells.

5.1.7 Sampling Wells, Performing DNAPL Thickness Measurements and DNAPL Removal from Wells

These activities increase the potential for exposure to Site constituents that can cause eye, skin and respiratory tract irritation, burns and photosensitization. Care must be taken to wear long sleeves, nitrile gloves, and safety glasses, especially when manually bailing, to limit exposure from NAPL on the rope and bailer. Attempt to bail in a manner that limits the whipping of rope during the process. A Tyvek suit or apron may be needed if there is a potential for getting DNAPL on oneself during sampling, measuring, or when deconning the measuring tape.

5.1.8 Noise

Employees working on or near noisy equipment must wear hearing protection if the 8-hour time-weighted average noise level exceeds 85 decibels. A general field rule is that hearing protection must be used if normal speech cannot be understood within an arms length of the person talking.

5.1.9 Use of Drinking Water or Liquids

All carrying containers and cup dispensers must be closed and covered to protect against dust and vapors.

- Only disposable cups may be used to dispense and drink liquids.
- Use a cup dispenser so that one cup may be easily removed at a time and no other cups are touched.
- Cups may not be reused. (One use may be several consecutive refills. Do not set a cup down and reuse that same cup during the next break.)

- Remove or clean soiled gloves before using a cup.
- Thoroughly clean and decontaminate the drink container and cup dispenser before refilling and before taking them off-Site.

5.1.10 Slip, Trip, Fall

Hazards found at the Site and areas where groundwater sampling occurs may include uneven terrain, holes, ditches, unstable slopes, slippery surfaces, unmarked projections, and ground debris that can cause employees to trip and fall. Take care to notice and avoid unsafe site conditions.

- Visually examine the walking area;
- Test your footing;
- Make sure the walking/work area is adequately lit;
- Be aware of ground debris; remove broken glass, nails, wire, and other debris if possible, or mark off and avoid areas of heavy debris.

5.2 SITE ACCESS/SITE CONTROL

Reduce or eliminate the possibility of exposure or transfer of contaminated substances through the following methods, as appropriate for the work task(s):

- Set up barriers to exclude personnel from contaminated areas;
- Minimize the number of personnel and equipment at the Site;
- Establish work zones within the Site;
- Establish control points with regular access to and egress from work zones;
- Conduct operations in a manner to reduce exposure of personnel and equipment; and,
- Implement appropriate decontamination procedures.

5.2.1 Site Access

The Site is enclosed by fencing. Access for authorized personnel is through a locked gate on Cavalcade Street. The SHSO will be responsible for security around the exclusion/work zones.

5.2.2 Work Zones

Exclusion zones for well installation should be established approximately 20-25 feet around the drill rig. Once the well is installed and the rig moves to a different area that particular EZ ceases to exist. Unauthorized personnel may be kept out of these areas with signs or verbal warnings.

Specific work zones are not necessary for tasks where there is little chance of overexposure to Site constituents to others. These tasks include ground water and soil sampling.

At least partial decontamination of personnel and equipment should occur at work areas when appropriate. A separate, common decontamination area(s) should be set up to allow for personnel decontamination as well as equipment decontamination after work is complete for each day. The SHSO must determine the appropriate Site zones upon arrival at the Site and before intrusive activities begin. The location of the Site work zones may change with the work and the type of activity performed.

5.3 SITE HOUSEKEEPING

The Site must be kept in a neat, organized, and orderly fashion. Items, such as tools, equipment, hoses, *etc.*, must be kept picked up to minimize tripping and falling hazards. Used disposable clothing and equipment must be placed in drums or plastic bags immediately upon removal and the drum lids replaced or bags closed.

5.4 SANITATION/CHANGING FACILITIES

Appropriate sanitation must be used on-Site, including, but not limited to, the following:

- Maintaining an adequate supply of potable water.
- All individuals who enter any designated EZ must follow decontamination procedures as outlined in Section 8.0 of this HASP.
- Access to nearby sanitary facilities, including adequate toilets and wash facilities.

5.5 CONSTITUENT(S) AND EXPOSURE PREVENTION

Exposure to hazardous or contaminated materials must be kept to a minimum by adherence to the recommended PPE and decontamination procedures. All Site personnel must avoid potential exposure to Site constituents when possible, e.g., do not handle potentially contaminated materials without proper PPE, do not stand downwind during excavation or other subsurface activities, etc.

5.6 BUDDY SYSTEM

Personnel must adhere to the buddy system when conducting field activities, meaning that they must work in groups of at least two when wearing PPE or when working in an exclusion zone.

5.7 SITE COMMUNICATIONS

- Verbal and Hand Signals - will be the main types of Site communication.
- Telephones - Cell phones may be used for off-Site communication, if necessary.

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 SITE-SPECIFIC LEVELS OF PROTECTION

The level of protection for most Site activities will be Level D or a modified Level D. Level D will consist of:

- Long or short sleeve shirts (as appropriate for the season) and long pants.
- Appropriate gloves for material handling activities
- Steel-toe and shank safety boots
- Hard hat.
- Safety glasses with side shields.
- Hearing protection as required.

Level D plus nitrile gloves may be used for most, if not all, Site activities where the only contact with potential site constituents is handling soil/sediment samples or ground water during sampling.

A Modified Level D may be needed for bailing or other activities that increase the chance for skin exposure to NAPL. Modified Level D may consist of Level D as above plus the following as appropriate for the activity:

Modified Level D will consist of Level D as above plus:

- A regular Tyvek or polycoated Tyvek suit or apron to avoid body/clothes contact;
- Nitrile inner gloves;
- Nitrile outer gloves as necessary; and,
- Nitrile Rubber or chemically resistant overboots.

Personnel who may have more than incidental contact with Site constituents, such as drillers, must wear *Modified Level D.* Modified Level D will consist of Level D as above plus:

- Regular Tyvek (or similar material). Use polycoated Tyvek if material is wet.
- Nitrile inner gloves
- Nitrile outer gloves.
- Nitrile Rubber or chemically resistant overboots.

6.2 UPGRADE CONDITIONS

If conditions should change where there is a possibility of overexposure to vapors or dust then vapor/dust suppression techniques used, or employees should work upwind to reduce potential exposures. If these measures do not reduce vapor and/or dust concentrations below the acceptable limits set forth in Section 7.0, then the level of protection will be upgraded to Level C as necessary. Respirator cartridges must be changed at least every 8 hours (every shift), or more often if the workrate is heavy, if the temperature is above 85°F, or if humidity rises above 65%. See Appendix B for respirator change schedule rationale.

Level C protection will consist of:

- NIOSH-approved full-face, air-purifying respirator equipped with appropriate combination organic vapor and P100 dust cartridges.
- Chemical-resistant clothing over work clothes, regular Tyvek, or polycoated Tyvek, as necessary.
- Nitrile outer gloves and nitrile inner gloves.
- Steel-toe, steel shank safety boots with chemical-resistant outer boots.
- Hard hat.
- Hearing protection as required.

Level B protection is not expected to be necessary during Site activities. The SHSO has the responsibility for monitoring Site and work task conditions and deciding the appropriate level of protection based on the air monitoring guidelines presented in Section 7.0 and any other indications of potential exposure.

7.0 MONITORING

7.1 REAL-TIME MONITORING

Monitoring for organic vapors must be conducted prior to and during all intrusive Site activities (soil boring and well installation). A Photoionization Detector (PID) with a 10.2 /10.6 electron volt (eV) bulb must be used to conduct air monitoring for organic vapors. Periodic air monitoring should be conducted in the work zone and in the breathing zone of workers. Readings should be recorded prior to and during initial subsurface activities, whenever there is a reading above background, and at least once per hour during work activities. Readings may be recorded on the Real-Time Monitoring Log (Appendix C) or in the field logbook.

Air monitoring is not required as part of the routine groundwater sampling or depth measurements, or for DNAPL thickness measurements.

For any work activity, a sustained (greater than 5 minutes) organic vapor level in the breathing zone above the concentrations in the following table will require vapor suppression techniques or working upwind of the source. If these methods are not feasible or do not reduce the potential exposure below acceptable levels, then employees must upgrade to Level C protection.

AIR MONITORIING ACTION LEVELS			
Constituent	Concentration	Location	Response
Total Organic Vapors	1 to 10 ppm	Breathing Zone in Work Area	Continue HNu™ for 5 to 15 minutes. If reading still exceeds 1 ppm, use vapor suppression or work upwind.
Total Organic Vapors	10 to 50 ppm	Breathing Zone in Work Area	Upgrade to Level C
Total Organic Vapors	>50 ppm	Breathing Zone in Work Area	Evacuate area until vapors dissipate. Monitor from a distance. Contact the Project Manager for instructions before proceeding.

7.2 INSTRUMENT CALIBRATION

Monitoring equipment must be calibrated and checked for proper operation daily before the start-up of any field activities requiring monitoring. Before initiating field activities, background measurements should be obtained with each instrument upwind and away from potential Site

influences. Instrument calibrations and background levels must be documented on daily air monitoring logs or in a field log. A HNu PID with a 10.2 eV lamp, or equivalent monitor, must be used to monitor for organic vapors.

8.0 MATERIAL HANDLING AND DECONTAMINATION

All waste material, decontamination liquids, and decontamination equipment must be handled in a safe and healthful manner. Decontamination and material handling activities must be carried out within the appropriate work zone.

8.1 DECONTAMINATION

A personnel decontamination area must be provided where surface constituent(s) and outer protective equipment are removed. This area must be determined upon arrival at the Site and before any intrusive activities begin.

8.1.1 Personnel Decontamination

The general decontamination procedure is as follows.

Level D Decontamination:

- Equipment drop onto plastic drop cloth.
- Wash and rinse boot covers and gloves if to be reused.
- Remove and dispose of Tyvek suit in a plastic-lined container or plastic bag.
- Remove boot covers and gloves, dispose in plastic bag or lined containers if not to be reused. Place in "decontaminated PPE" container if to be used again.
- Field-wash hands and face.

Level C Decontamination:

- Equipment drop onto plastic drop cloth.
- Wash and rinse boot covers and outer gloves if to be reused.
- Remove boot covers and other gloves, dispose in plastic bag or lined container if not to be reused. Place in "decontaminated PPE" container if to be used again.

- Remove and dispose of Tyvek suit in a plastic bag or plastic-lined container.
- Wash and rinse inner gloves.
- Remove respirator and place in bin for later cleaning.
- Remove and dispose inner gloves.
- Field-wash face and hands.

There may be partial field decontamination before traveling from one work location to another. This may consist of removing or cleaning boots or boot covers and outer gloves after completing an activity and before moving to the next workstation. The SHSO must advise the field crew of any necessary field decontamination procedures. The SHSO is responsible for monitoring the effectiveness of decontamination procedures and modifying the procedures as necessary to ensure proper decontamination.

8.1.2 Equipment Decontamination

All equipment used in an exclusion zone must be decontaminated before it leaves the Site or is taken into a clean area. Small tools and equipment used in the EZ that become contaminated may be taken to the decontamination area taking care to isolate the tools/equipment from clean materials and equipment. Equipment may be decontaminated by washing with detergent and water then rinsing, or other appropriate decontamination methods. Vehicles that contact potentially contaminated soil or water must be decontaminated before leaving the Site by brushing clean and washing as necessary. Verification that equipment/vehicles leaving the Site have been adequately decontaminated is the responsibility of the SHSO.

9.0 EMERGENCY PROCEDURES

The HASP for this project has been established to allow project activities to be conducted without adverse impacts on worker health and safety. In addition, supplementary emergency response procedures have been developed to cover extraordinary conditions that might possibly occur at the Site. Emergency telephone numbers, directions to the nearest hospital, and a route map to the hospital are presented in Appendix D.

Pre-emergency planning consists of the preparation of this emergency response plan, posting of the emergency contact list and hospital route map, assigning emergency functions to on-Site personnel, training of personnel as necessary, and ensuring that emergency procedures and equipment are in place.

The KEY Supervisor/SHSO is designated as the Site Emergency Coordinator for KEY's activities and is responsible for field implementation of this emergency response plan and has full authority for KEY personnel and subcontractors in the event of an emergency. If outside agencies respond to an emergency, the Site Emergency Coordinator will pass the responsibility and authority for emergency response to the Incident Commander for the outside agency as appropriate. The Site Emergency Coordinator will assist outside emergency response agencies as much as possible to control and resolve the emergency. In general, on-site personnel would immediately evacuate the area to the designated safe place of refuge. Communications consist of verbal and hand signals on-site and use of a portable telephone for off-site communication.

The Site Emergency Coordinator, or if the Site Emergency Coordinator is unavailable, the designated alternate on Site, will contact emergency personnel. In the event of severe injury to KEY personnel or subcontractors, KEY personnel may start first aid then contact outside personnel for assistance.

PPE and emergency equipment will be available on-Site for response to minor emergencies. PPE includes gloves, protective clothing, protective booties, and safety glasses. An emergency first aid kit will also be available on-site.

Evacuation routes, safe distances, and places of refuge will be determined before the start of work at the Site and the locations made known to all personnel who enter the Site. These may be modified at the start of each work day based on site specific or work task factors. The SHSO will maintain security around the immediate Site work zones. Because of the limited number of personnel expected to be working on the Site, the SHSO will know who is on Site and can control entry of personnel into hazardous areas in an emergency.

9.1 EMERGENCY MEDICAL TREATMENT AND FIRST AID

In the event of a safety or health emergency at the Site, appropriate emergency measures will immediately be taken to assist those who have been injured or exposed and to protect others from hazards. The project field personnel will take the injured party and transport (if possible) to the nearest hospital for treatment, after determining whether personnel decontamination can be performed on the injured party.

If the injury to a worker is chemical in nature (e.g., overexposure), the following first-aid procedures will be instituted:

- Eye Exposure - If a solid or liquid gets into the eyes, wash the eyes immediately at the emergency eyewash station using large amounts of water and lifting the lower and upper lids occasionally to help flush the eye. Do not let the victim rub eyes or keep eyes tightly closed. Flush for at least 15 minutes. Obtain medical attention immediately.

- Skin Exposure - Promptly wash the area using mild soap and flooding amounts of water for at least 15 minutes while removing contaminated clothing and shoes. Consult a physician for reddened or blistered skin.

- Swallowing - Do not induce vomiting! Never give anything by mouth to an unconscious person. Call poison control center: Akron Regional Poison Center, (800) 362-9922.

- Breathing - If a person has difficulty breathing, move the exposed person to fresh air at once. Do not use mouth-to-mouth respiration. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and

mask. Keep the affected person warm and at rest. Obtain medical attention as soon as possible.

First aid supplies must be immediately available at the site. Personnel performing work must have a first aid kit as part of their field supplies. First aid kits will consist of appropriate items for the work being performed and anticipated emergencies. Type III first aid kits (ANSI Z308.1-2003) should be available at sites and stored in weatherproof containers with individual sealed packages of required items. First aid items in the kits must contain at a minimum:

- 1 - Absorbent Compress, 4 x 8 in. minimum;
- 16 - Adhesive Bandages 1 x 3 in.;
- 1 roll - Adhesive Tape, 3/8" x 5 yards;
- 10 - Antiseptic applications, 0.5g each;
- 6 - Burn Treatment applications, 0.9g each;
- 2 pair - Medical Exam Gloves;
- 4 - Sterile Pads, 3 x 3 in. minimum; and,
- 1 - Triangular Bandage, 40 x 40 x 56 in. min.

In addition, a portable eyewash bottle and solution should be part of the first aid supplies taken to the Site.

Employees that will work at the Site are responsible for checking the contents of the first aid kit before the kit is sent to the job site to ensure that all required items are present and that expended items are replaced. This employee is also responsible for ensuring that the kit is readily accessible at the site. When more than one person is on site the most senior person has the responsibility for the contents of the kit.

9.2 EMERGENCY EVALUATION, INVESTIGATION AND DOCUMENTATION

The Site Emergency Coordinator will evaluate the available information about the incident and KEY's emergency response capabilities including what happened, any injuries or casualties, further accident potential, and what can be done to remedy the emergency. The type of response action will be based on the available information about the emergency incident.

The emergency incident will be investigated by KEY and all findings put in writing as soon as conditions return to normal. The KEY Supervisor/SHSO will ensure that documentation is as complete as possible by including a chronological history of the incident, facts about the incident and when they became available, titles and names of personnel and composition of teams, actions made, orders given, actions taken, samples and results, possible exposures, and a history of all injuries or illness during or as a result of the emergency. After the situation has returned to normal, all aspects of the emergency incident and the response will be reviewed to assess procedures used, how to improve response, and how to prevent further emergencies.

10.0 TRAINING

10.1 GENERAL

All employees or other personnel entering the Site (other than the support zone) that are also involved in operations that could involve exposure to hazardous waste must receive training in compliance with OSHA 29 CFR 1910.120(e). The training requirements are intended to provide employees with the knowledge and skills necessary to perform hazardous waste site operations while minimizing the potential for injury. Initial training consists of a minimum of 40 hours of off-Site classroom and practical exercise training and 3 days of actual field experience. Training must be updated annually with 8 hours of off-Site training. Supervising personnel will complete an 8-hour training session for supervisors. Training must be certified by record and/or certificate.

10.2 SITE-SPECIFIC TRAINING

Site-specific training must consist of an initial health and safety briefing on the following information:

- Names of individuals responsible for Site health and safety and methods of communicating safety and health concerns;
- Site-specific health and safety hazards;
- Use of PPE;
- Work practices by which employees can minimize risk;
- Safe use of equipment on-Site;
- Recognition of symptoms and signs of exposure to hazardous materials;
- Site control measures;
- Decontamination procedures; and,
- Emergency response procedures.

The SHSO or Site supervisor should give the health and safety briefing prior to initiation of field activities. This briefing must be of sufficient duration to address all of the material covered in this HASP. All personnel that will be participating in field activities must have the opportunity to read this HASP prior to this initial meeting so that any questions they have can be addressed at the initial meeting.

10.3 SAFETY MEETINGS

Prior to commencing field activities each day, a short briefing may be conducted by the Site Supervisor to address the day's activities. The daily briefing also provides the opportunity for the SHSO to address any special health and safety issues and to notify individuals of any deficient areas that need to be corrected or operational changes made that affect field work. The briefing should emphasize the specific concerns associated with the day's planned field activities. Daily weather reports should be reviewed to determine work/rest regimens.

TABLES

TABLE 1

Exposure Limits and Other Properties of Potential Site Constituents

South Cavalcade Superfund Site
Houston, Texas

Constituent	Exposure Limits [b]	STEL [c]	IDLH [d]	Vapor Pressure [e]	Ionization Potential [f]
Coal Tar Pitch Volatiles (PAHs)[a]	0.2 mg/m^3	---	80 mg/m^3	Varies	Varies
Naphthalene	10 ppm	15 ppm	250 ppm	0.08 mm	8.12 eV
Benzene	0.5 ppm	5 ppm	500 ppm	75 mm	9.24 eV
Ethylbenzene	100 ppm	125 ppm	800 ppm	7 mm	8.76 eV
Toluene	50 ppm	---	500 ppm	21 mm	8.82 eV
Xylene	100 ppm	150 ppm	900 ppm	9 mm	8.56 eV

Constituent	Carcinogen [g]	Skin Exposure [h]	LEL/UEL [i]	Odor Threshold [j]	3M/NIOSH Respirator Selection [k]
Coal Tar Pitch Volatiles (PAHs)	YES	YES	---	---	*R95 or P95*
Naphthalene	YES	NO	0.9 - 5.9%	0.015 ppm	OV
Benzene	YES	NO	1.2 - 7.8%	8.65 ppm	OV
Ethylbenzene	NO	NO	0.8 - 6.7%	2.3 ppm	OV
Toluene	NO	YES	1.1 - 7.1%	0.16 ppm	OV
Xylene	NO	NO	1.0 – 7.0%	0.324 ppm	OV

Notes:

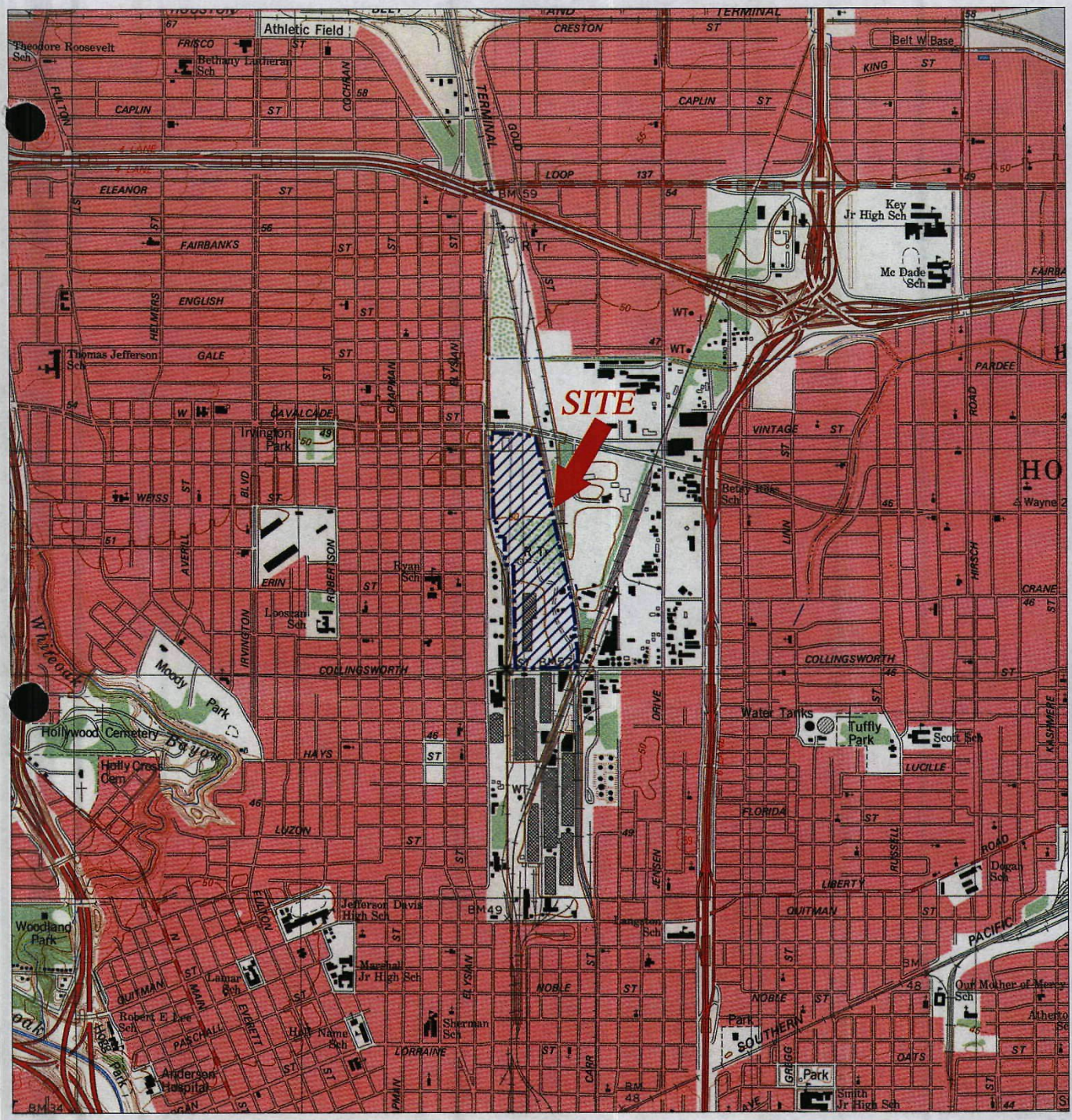
[a] OSHA has not established individual exposure limits for most PAHs. Coal Tar Pitch Volatiles is a category containing several compounds, most of which are classified as PAHs; so Coal Tar Pitch Volatiles can be used as a surrogate for PAHs.
[b] Exposure Limit: 8-hour Time Weighted Average (TWA) from the 2004 Threshold Limit Values of the ACGIH, or OSHA Permissible Exposure Limit (PEL), whichever is lower.
[c] STEL: Short Term Exposure Limit, denotes a 15 minute average that may not be exceeded.
[d] IDLH: Immediately Dangerous to Life or Health - Maximum concentration from which one could escape within 30 minutes without a respirator and without experiencing any irreversible health effects.
[e] Vapor Pressure: From NIOSH Pocket Guide to Chemical Hazards. Water = 0 mm. Above 1 mm is considered volatile; above 100 mm is considered highly volatile
[f] Ionization Potential: Expressed in electron volts (eV) from NIOSH Pocket Guide to Chemical Hazards. Used to determine *type of detector bulb for the HNu.*
[g] Carcinogen: "Yes" indicates compound is a confirmed or suspected human carcinogen by NIOSH, OSHA or ACGIH.
[h] Skin Exposure: "Yes" indicates potential significant exposure through skin and mucous membranes, either by airborne or, more particularly, by direct contact to ambient vapors.
[I] LEL/UEL: Lower and upper explosive limits. Percent of material needed in air for ignition when exposed to an ignition source.
[j] Odor Threshold: Air concentration at which most people can smell the chemical.
[k] 3M/NIOSH Respirator Selection: Type of respirator recommended by the 3M 2004 Respirator Selection Guide or the NIOSH Pocket Guide to Chemical Hazards. SA = Supplied Air (Level B); OV = Organic Vapor Respirator (Level C); N, R, or P 95, 97, or 100 = Dust and mist respirator (Level C).

TABLE 2

Task-Specific Hazard Assessment with Proposed Initial Levels of Protection and Air Monitoring Requirements South Cavalcade Superfund Site Houston, Texas

Task	Chemical Hazard Assessment	Estimated Initial Level of Protection	Air Monitoring VOCs
Soil Borings:			
Complete borings w/ Geoprobe	Low	D	YES
Soil recovery and data logging	Low	D	NO
Screen soil samples for VOCs	Low	D	YES
Collect soil samples for analysis	Low	D	NO
Groundwater Sampling:			
Install wells	Low	D	YES
Seal wells	Low	D	NO
Purge wells	Low	D	NO
Containerize purge water	Low	D	NO
Collect groundwater samples	Low	D	Initial collection only
Measure field parameters	Low	D	NO
Package and send samples	Low	D	NO
Abandon Wells:			
Remove PVC pipe	Low	D	NO
Backfill holes with bentonite	Low	D	NO
Grout holes	Low	D	NO
Restore pavement	Low	D	NO
Survey boreholes and wells	Low	D	NO
Well Sampling:			
See above groundwater collection; in addition:	Low	D	NO
Measure depth to water, depth to DNAPL, total depth	Low-Med	D	Initial measurem ents only
Collect water samples	Low	D	NO
Purge and sample wells	Low	D	NO
Decon equipment	Low	D	NO
Containerize purge water	Low	D	NO
Stage IDW on-site and collect soil sample for analysis.	Low	D	NO

FIGURES



BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA

DRAWN: BKC	DATE: 5-19-05	KEY ENVIRONMENTAL INCORPORATED
CHKD: JRH	DATE: 5-19-05	
APPD: JSZ	DATE: 5-19-05	
SCALE: 1" = 2000'		

HEALTH AND SAFETY PLAN
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE OF SETTEGAST, TEXAS – 1982

KEY ENVIRONMENTAL, INC.

ISSUE DATE:

ROSSLYN FARMS INDUSTRIAL PARK
1200 ARCH ST., SUITE 200
CARNEGIE, PA 15106

SITE LOCATION MAP

DRAWING NUMBER
05-070
FIGURE 1

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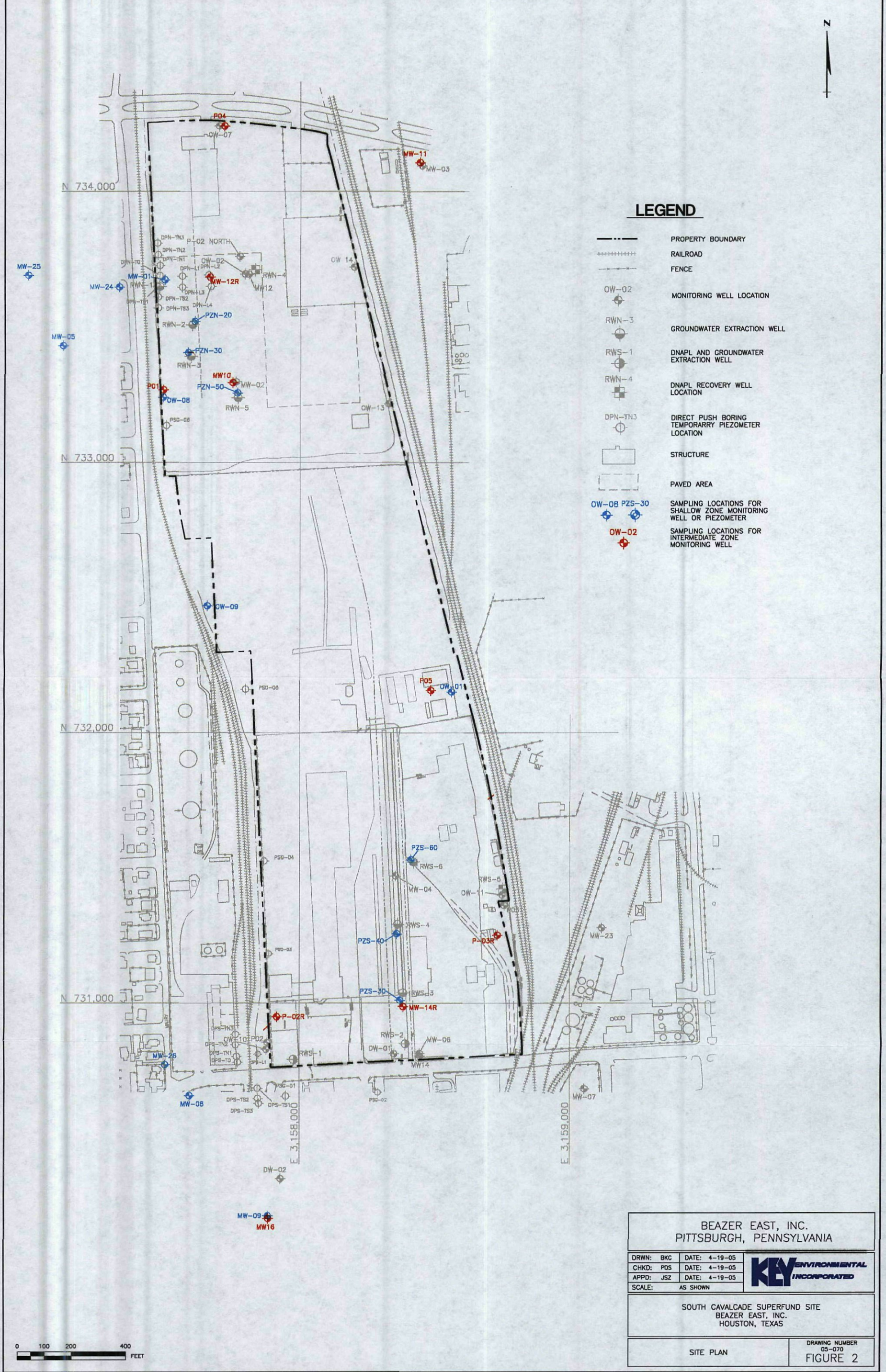
EDITED BY: | DATE: | MACH: ETF | VERSION: ACAD 14 | FILE: Y:\SOUTH CAVALCADE\04-919\FIG_3-PS.DWG



BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA

DRWN:	BKC	DATE:	4-19-05
CHKD:	PDS	DATE:	4-19-05
APPD:	JSZ	DATE:	4-19-05
SCALE:	AS SHOWN		

KEY ENVIRONMENTAL INCORPORATED

SOUTH CAVALCADE SUPERFUND SITE
BEAZER EAST, INC.
HOUSTON, TEXAS

SITE PLAN

DRAWING NUMBER 05-070
FIGURE 2

APPENDIX A

LIST OF HAZARDOUS CHEMICALS AND MATERIAL SAFETY DATA SHEETS

LIST OF HAZARDOUS CHEMICALS – July 2005
South Cavalcade Superfund Site

Chemical	Container/Amount	Manufacturer /Distributor	Use
Potential Site Constituents:			
Coal Tar Creosote/PAHs	Soil/groundwater	NA	NA
Naphthalene	Soil/groundwater	NA	NA
Benzene	Soil/groundwater	NA	NA
Toluene	Soil/groundwater	NA	NA
Ethylbenzene	Soil/groundwater	NA	NA
Xylene	Soil/groundwater	NA	NA
Chemicals that may be brought on site:			
Alconox liquid/solution			Clean sampling equipment
Acetone			Clean sampling equipment
Isopropyl Alcohol			Clean sampling equipment
Hexane			Clean sampling equipment
Nitric Acid	A few milliliters in sample jars		Sample preservative
Hydrochloric Acid	A few milliliters in sample jars		Sample preservative
Sulfuric Acid	A few milliliters in sample jars		Sample preservative
Zinc Acetate/Sodium Hydroxide Solution (two MSDSs)	A few milliliters in sample jars		Sample preservative
pH 10 Buffer Solution			Water testing
pH 4 Buffer Solution			Water testing
pH 7 Buffer Solution			Water testing
Conductivity Standard			Water testing
Bentonite (example MSDS)			Sealing Wells
Portland Cement (example MSDS)			Sealing Wells

The following Material Safety Data Sheets (MSDSs) are provided for general information on the chemical and physical properties and potential health hazards of constituents that may be present at the Site. The use of manufacturer names does not imply that these products were in fact used at the Site; nor imply or infer any liability on the part of the manufacturer of any product represented, or the preparer of the MSDS.

MSDS Number: **A0446** * * * * * *Effective Date:* ***05/20/04*** * * * * * *Supercedes:* ***02/12/04***

MSDS **Material Safety Data Sheet**

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

Mallinckrodt CHEMICALS J.T.Baker

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.

ACETONE

1. Product Identification

Synonyms: Dimethylketone; 2-propanone; dimethylketal
CAS No.: 67-64-1
Molecular Weight: 58.08
Chemical Formula: (CH3)2CO
Product Codes:
J.T. Baker: 5008, 5018, 5356, 5580, 9001, 9002, 9003, 9004, 9005, 9006, 9007, 9008, 9009, 9010, 9015, 9024, 9036, 9125, 9254, 9271, A134, V655
Mallinckrodt: 0018, 2432, 2435, 2437, 2438, 2440, 2443, 2445, 2850, H451, H580, H981

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Acetone	67-64-1	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 0 - None
Contact Rating: 3 - Severe
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache. Higher concentrations can produce central nervous system depression, narcosis, and unconsciousness.
Ingestion:
Swallowing small amounts is not likely to produce harmful effects. Ingestion of larger amounts may produce abdominal pain, nausea and vomiting. Aspiration into lungs can produce severe lung damage and is a medical emergency. Other symptoms are expected to parallel inhalation.
Skin Contact:
Irritating due to defatting action on skin. Causes redness, pain, drying and cracking of the skin.
Eye Contact:
Vapors are irritating to the eyes. Splashes may cause severe irritation, with stinging, tearing, redness and pain.
Chronic Exposure:
Prolonged or repeated skin contact may produce severe irritation or dermatitis.
Aggravation of Pre-existing Conditions:
Use of alcoholic beverages enhances toxic effects. Exposure may increase the toxic potential of chlorinated hydrocarbons, such as chloroform, trichloroethane.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention.

---

5. Fire Fighting Measures

Fire:

Flash point: -20C (-4F) CC
Autoignition temperature: 465C (869F)
Flammable limits in air % by volume:
lel: 2.5; uel: 12.8
Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Contact with strong oxidizers may cause fire. Sealed containers may rupture when heated. This material may produce a floating fire hazard. Sensitive to static discharge.
Fire Extinguishing Media:
Dry chemical, alcohol foam or carbon dioxide. Water may be ineffective. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.
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. Remove all sources of ignition. 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. Use non-sparking tools and equipment. Collect liquid in an appropriate container or 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! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. 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 SOLUSORB® solvent adsorbent is recommended for spills of this product.

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7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. 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:
Acetone:
-OSHA Permissible Exposure Limit (PEL):
1000 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):
500 ppm (TWA), 750 ppm (STEL) 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 and engineering controls are not feasible, a half-face organic vapor respirator 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 organic vapor respirator 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-face piece 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.

Physical and Chemical Properties

Appearance:
Clear, colorless, volatile liquid.
Odor:
Fragrant, mint-like
Solubility:
Miscible in all proportions in water.
Specific Gravity:
0.79 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
56.5C (133F) @ 760 mm Hg
Melting Point:
-95C (-139F)
Vapor Density (Air=1):
2.0
Vapor Pressure (mm Hg):
400 @ 39.5C (104F)
Evaporation Rate (BuAc=1):
ca. 7.7

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Concentrated nitric and sulfuric acid mixtures, oxidizing materials, chloroform, alkalis, chlorine compounds, acids, potassium t-butoxide.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 5800 mg/kg; Inhalation rat LC50: 50,100mg/m3; Irritation eye rabbit, Standard Draize, 20 mg severe; investigated as a tumorigen, mutagen, reproductive effector.

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

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Acetone (67-64-1)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be moderately degraded by photolysis. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.
Environmental Toxicity:
This material is not expected to be toxic to aquatic life. The LC50/96-hour values for fish are over 100 mg/l.

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: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 188L

International (Water, I.M.O.)

Proper Shipping Name: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 188L

---

15. Regulatory Information

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

Ingredient	TSCA	EC	Japan	Australia
Acetone (67-64-1)	Yes	Yes	Yes	Yes

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

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Acetone (67-64-1)	Yes	Yes	No	Yes

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

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Acetone (67-64-1)	No	No	Yes	No

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

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Acetone (67-64-1)	5000	U002	No

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

Australian Hazchem Code: 2[Y]E
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: **1** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.
Label First Aid:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.
Disclaimer:
****

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****

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

MSDS Number: **A2052** * * * * * *Effective Date:* ***05/14/03*** * * * * * *Supercedes:* ***02/18/03***

MSDS **Material Safety Data Sheet**

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.

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

J.T.Baker®

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

ALCONOX®

1. Product Identification

Synonyms: Proprietary blend of sodium linear alkylaryl sulfonate, alcohol sulfate, phosphates, and carbonates.
CAS No.: Not applicable.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Not applicable to mixtures.
Product Codes: A461

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Alconox® proprietary detergent mixture	N/A	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

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

Health Rating: 1 - Slight
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.
Ingestion:
May cause irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea.
Skin Contact:
No adverse effects expected.
Eye Contact:
May cause irritation, redness and pain.
Chronic Exposure:
No information found.
Aggravation of Pre-existing Conditions:
No information found.

First Aid Measures

Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Wash exposed area with soap and water. Get medical advice if irritation develops.
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 expected to be a fire hazard.
Explosion:
No information found.
Fire Extinguishing Media:
Dry chemical, foam, water or carbon dioxide.
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. 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. When mixed with water, material foams profusely. Small amounts of residue may be flushed to sewer with plenty of water.

---

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Moisture may cause material to cake. 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.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
None established.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. 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):
For conditions of use where exposure to dust or mist is apparent and engineering controls are not feasible, a particulate respirator (NIOSH type N95 or better filters) may be worn. 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-face positive-pressure, air-supplied respirator.
WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear protective gloves and clean body-covering clothing.
Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
White powder interspersed with cream colored flakes.
Odor:
No information found.
Solubility:
Moderate (1-10%)
Specific Gravity:
No information found.
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0

Boiling Point:
No information found.
Melting Point:
No information found.
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:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
No information found.
Conditions to Avoid:
No information found.

---

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

```
--------\Cancer Lists\-------------------------------------------------------
                                          ---NTP Carcinogen---
Ingredient                                Known    Anticipated    IARC Category
-----------------------------------       -----    -----------    -------------
Alconox®                                   No          No            None
proprietary detergent mixture
```

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12. Ecological Information

Environmental Fate:
This product is biodegradable.
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 disposal 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

Not regulated.

15. Regulatory Information

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

Ingredient	TSCA	EC	Japan	Australia
Alconox® proprietary detergent mixture	Yes	No	No	No

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

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Alconox® proprietary detergent mixture	No	No	Yes	No

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

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Alconox® proprietary detergent mixture	No	No	No	No

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

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Alconox® proprietary detergent mixture	No	No	No

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

Australian Hazchem Code: None allocated.
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: **0** Flammability: **0** Reactivity: **0**
Label Hazard Warning:

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

Label Precautions:
Avoid contact with eyes.
Keep container closed.
Use with adequate ventilation.
Avoid breathing dust.
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. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. In all cases, get medical attention.

Product Use:
Laboratory Reagent.

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

Disclaimer:
****

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****

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

HILL & GRIFFITH CO -- WESTERN BENTONITE (SODIUM BENTONITE) -- 6810-00N036330

==========

MSDS Safety Information

==========

FSC: 6810
MSDS Date: 04/23/1990
MSDS Num: BQLYG
LIIN: 00N036330
Tech Review: 11/11/1992
Product ID: WESTERN BENTONITE (SODIUM BENTONITE)
Responsible Party
Cage: 28711
Name: HILL & GRIFFITH CO
Address: 1262 STATE AVE
City: CINCINNATI OH 45204 US
Info Phone Number: 800-543-0425
Emergency Phone Number: 800-424-9300(CHEMTREC)
Preparer's Name: STEVE NELTNER
Review Ind: N

==========

Contractor Summary

==========

Cage: 28711
Name: HILL & GRIFFITH CO
Address: 1262 STATE AVE
City: CINCINNATI OH 45204 US
Phone: 800-543-0425

==========

Ingredients

==========

Cas: 7631-86-9
Name: SILICON DIOXIDE. PEL/TLV AS SILICON.
% by Wt: 2-6
OSHA PEL: 10 MG/M3 TDUST
ACGIH TLV: 10 MG/M3 TDUST
Ozone Depleting Chemical: N

Name: DUST, NUISANCE; (INERT NUISANCE DUST)
Other REC Limits: PEL:15 MG/M3 (MFR)
OSHA PEL: 10 MG/M3
ACGIH TLV: 10 MG/M3 TDUST

==========

Health Hazards Data

==========

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry Inds - Inhalation: YES
Skin: NO
Ingestion: NO
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: ACUTE:OVEREXP COULD RESULT IN TEMPORARY MUCOUS MEMBRANE OR RESPIRATORY TRACT IRRITATION. CHRONIC:OVEREXP COULD RESULT IN IRREVERSIBLE MUCOUS MEMBRANE OR RESPIRATORY TRACT DAMAGE. TARGET ORGANS:LUNGS.
Explanation Of Carcinogenicity: NOT RELEVANT
Signs And Symptions Of Overexposure: OVEREXPOSURE COULD RESULT IN COUGHING, SNEEZING, SHORTNESS OF BREATH OR OTHER RESPIRATORY PROBLEMS. OTHER SYMPTOMS MAY RESULT.
Medical Cond Aggravated By Exposure: MAY AGGRAVATE PRE-EXISTING MEDICAL CONDITIONS.
First Aid: INHAL:IMMEDIATELY REMOVE FROM EXPOSURE & SEEK MEDICAL ATTENTION. SKIN:WASH THOROUGHLY W/SOAP & WATER. IF IRRITATION DEVELOPS, SEEK MEDICAL ATTENTION. EYE:FLUSH W/CLEAR FLOWING WATER FOR AT LEAST 15 MI NUTES. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION. INGEST:DO NOT INDUCE VOMITING; CALL MD IMMEDIATELY.

==========
Handling and Disposal
==========
Spill Release Procedures: AVOID DUSTING WHEN POSSIBLE. USE A VACUUM W/FINE PARTICULATE FILTER TO CLEAN SPILL. A NIOSH/MSHA APPROVED DUST MASK FOR POWDERS IS RECOM. NOTIFY PROPER AUTHS IF NEED EXISTS.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Methods: WASTE GENERATED DURING APPLICATION, DEMOLITION, BREAKAGE/SPILLAGE ARE NOT HAZ WASTES AS DEFINED BY RCRA (40 CFR 261). PLACE WASTE & SPILLAGE IN CLSD CNTNRS. DISP OF IN APPRVD LANDFILL I/A/W FED, STATE & LOCAL REGULATIONS.
Handling And Storage Precautions: ALWAYS SEGREGATE MATLS BY MAJOR HAZ CLASS. DO NOT TRANSFER CONTENTS TO UNLABELED CNTNRS. COMPLY W/ALL FED, STATE & LOC REGS.
Other Precautions: MINIMIZE BRTHG VAPS, MISTS, FUMES/DUSTS. AVOID PRLNG/RPTD CONT W/SKIN. KEEP CNTNRS & STOR CNTNRS CLSD WHEN NOT IN USE. SPECIAL CONSIDERATIONS FOR REPAIR/MAINT OF CONTAM EQUIP: PROVIDE ADEQ NIOSH/MSHA APPRVD RESP, EYE/SKIN PROT.
==========
Fire and Explosion Hazard Information
==========
Flash Point Method: COC
Extinguishing Media: MEDIA SUITABLE FOR SURROUNDING FIRE (FP N).
Fire Fighting Procedures: WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire/Explosion Hazard: NONE
==========
Control Measures
==========
Respiratory Protection: USE NIOSH/MSHA APPROVED ORGANIC CARTRIDGE TYPE 7 RESPIRATOR.
Ventilation: PROVIDE VENTILATION SUFFICIENT TO PREVENT EXCEEDING RECOMMENDED EXPOSURE LIMITS.
Protective Gloves: CHEMICAL-RESISTANT GLOVES.
Eye Protection: CHEM WORK GOGG/FULL LGTH FCSHLD (FP N).
Other Protective Equipment: OTHER CLOTHING & EQUIPMENT AS REQUIRED TO PREVENT CONTACT.
Work Hygienic Practices: REMOVE CONTAMINATED CLOTHES, LAUNDER BEFORE REUSE. REMOVE CONTAMINATED SHOES; CLEAN BEFORE REUSE.
Supplemental Safety and Health: NONE SPECIFIED BY MANUFACTURER.
==========
Physical/Chemical Properties
==========
HCC: N1
Spec Gravity: 2.5 (H*2O=1)
Solubility in Water: NEGLIGIBLE
Appearance and Odor: PALE YELLOW TO WHITE W/EARTHY ODOR.
==========
Reactivity Data
==========
Stability Indicator: YES
Stability Condition To Avoid: DUSTING.
Materials To Avoid: NOT ESTABLISHED.
Hazardous Decomposition Products: NONE
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NOT RELEVANT
==========
Toxicological Information
==========
==========
Ecological Information
==========
==========
MSDS Transport Information
==========
==========

Regulatory Information
==========
==========
Other Information
==========
==========
Transportation Information
==========
Responsible Party Cage: 28711
Trans ID NO: 40731
Product ID: WESTERN BENTONITE (SODIUM BENTONITE)
MSDS Prepared Date: 04/23/1990
Review Date: 04/28/1993
Article W/O MSDS: N
Multiple KIT Number: 0
Unit Of Issue: NK
Container QTY: NK
Additional Data: NOT REGULATED FOR TRANSPORTATION
==========
Detail DOT Information
==========
DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
==========
Detail IMO Information
==========
IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION
==========
Detail IATA Information
==========
IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
==========
Detail AFI Information
==========
AFI Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
==========
HAZCOM Label
==========
Product ID: WESTERN BENTONITE (SODIUM BENTONITE)
Cage: 28711
Company Name: HILL & GRIFFITH CO
Street: 1262 STATE AVE
City: CINCINNATI OH
Zipcode: 45204 US
Health Emergency Phone: 800-424-9300(CHEMTREC)
Date Of Label Review: 12/16/1998
Label Date: 12/16/1998
Hazard And Precautions: ACUTE:OVEREXP COULD RESULT IN TEMPORARY MUCOUS MEMBRANE OR RESPIRATORY TRACT IRRITATION. CHRONIC:OVEREXP COULD RESULT IN IRREVERSIBLE MUCOUS MEMBRANE OR RESPIRATORY TRACT DAMAGE. TARGET ORGANS:LUNGS.
OVEREXPOSURE COULD RESULT IN COUGHING, SNEEZING, SHORTNESS OF BREATH OR OTHER RESPIRATORY PROBLEMS. OTHER SYMPTOMS MAY RE SULT.
==========
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other government situation.

Material Safety Data Sheet

Benzene

ACC# 02610

Section 1 - Chemical Product and Company Identification

MSDS Name: Benzene
Catalog Numbers: AC167660000, AC167660010, AC167660025, AC167660250, AC167665000, AC168650025, AC168650250, AC295330000, AC295330010, AC295330025, AC295330250, AC296880000, AC296880010, AC296880025, AC296880250, AC610230010, AC610231000, AC610510190, AC610510500, AC610511150, AC610512000, AC610710000, AC610710190, AC610710500, AC610711150, AC610712000, AC611001000, B243-4, B245-4, B245-500, B245J4, B411-1, B411-4, B412-1, B414-1, BP2601-100, S79920ACS
Synonyms: Benzol; Cyclohexatriene; Phenyl hydride.
Company Identification:
Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
71-43-2	Benzene	> 99	200-753-7

Hazard Symbols: T F
Risk Phrases: 11 45 48/23/24/25

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: clear colorless liquid. Flash Point: -11 deg C. **Danger!** May cause blood abnormalities. Cancer hazard. May cause central nervous system effects. Aspiration hazard if swallowed. Can enter lungs and cause damage. Extremely flammable liquid and vapor. Vapor may cause flash fire. Harmful if swallowed, inhaled, or absorbed through the skin. Causes eye, skin, and respiratory tract irritation.
Target Organs: Blood, central nervous system, respiratory system, eyes, bone marrow, immune system, skin.

Potential Health Effects
Eye: Causes eye irritation.
Skin: Causes skin irritation. Harmful if absorbed through the skin. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis.
Ingestion: May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May cause effects similar to those for inhalation exposure. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.
Inhalation: Causes respiratory tract irritation. May cause drowsiness, unconsciousness, and central nervous system depression. Exposure may lead to irreversible bone marrow injury. Exposure may lead to aplastic anemia. Potential symptoms of overexposure by inhalation are dizziness, headac he, vomiting, visual disturbances, staggering gait, hilarity, fatigue, and other symptoms of CNS depression.
Chronic: May cause bone marrow abnormalities with damage to blood forming tissues. May cause anemia and

other blood cell abnormalities. Chronic exposure to benzene has been associated with an increased incidence of leukemia and multiple myeloma (tumor composed of cells of the type normally found in the bone marrow). Immunodepressive effects have been reported. This substance has caused adverse reproductive and fetal effects laboratory animals.

Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.
Skin: In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion: Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.
Inhalation: If inhaled, remove to fresh air. 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. Use water spray to keep fire-exposed containers cool. Extremely flammable liquid and vapor. Vapor may cause flash fire. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. This liquid floats water and may travel to a source of ignition and spread fire. May accumulate static electricity.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: -11 deg C (12.20 deg F)
Autoignition Temperature: 498 deg C (928.40 deg F)
Explosion Limits, Lower:1.3 vol %
Upper: 7.1 vol %
NFPA Rating: (estimated) Health: 2; Flammability: 3; 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. Remove all sources of ignition. Provide ventilation. Approach spill from upwind. Use water spray to cool and disperse vapors, protect personnel, and dilute spills to form nonflammable mixtures.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Take precautionary measures against static discharges. Keep container tightly closed. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame. Avoid breathing vapor.
Storage: Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. See 29CFR 1910.1028 for the regulatory requirements for the control of employee exposure to benzene.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Benzene	0.5 ppm TWA; 2.5 ppm STEL; skin - potential for cutaneous absorption	0.1 ppm TWA 500 ppm IDLH	10 ppm TWA (apply only to exempt industry segments); 25 ppm Ceiling; 1 ppm PEL; 5 ppm STEL; 0.5 ppm Action Level (Cancer hazard,

OSHA Vacated PELs: Benzene: 10 ppm TWA (unless specified in 1910.1028)

Personal Protective Equipment

Eyes: Wear chemical goggles.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: clear colorless
Odor: sweetish odor - aromatic odor
pH: Not applicable.
Vapor Pressure: 75 mm Hg @ 20 deg C
Vapor Density: 2.8 (air=1)
Evaporation Rate: Not available.
Viscosity: 0.647mPa @ 20 deg C
Boiling Point: 80.1 deg C
Freezing/Melting Point:5.5 deg C
Decomposition Temperature: Not available.
Solubility: 0.180 g/100 ml @ 25°C
Specific Gravity/Density:0.8765 @ 20°C
Molecular Formula:C_6H_6
Molecular Weight:78.11

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Ignition sources, excess heat, confined spaces.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 71-43-2: CY1400000
LD50/LC50:
CAS# 71-43-2:
Dermal, guinea pig: LD50 = >9400 uL/kg;
Draize test, rabbit, eye: 88 mg Moderate;
Draize test, rabbit, eye: 2 mg/24H Severe;
Draize test, rabbit, skin: 20 mg/24H Moderate;
Inhalation, mouse: LC50 = 9980 ppm;
Inhalation, rat: LC50 = 10000 ppm/7H;
Oral, mouse: LD50 = 4700 mg/kg;
Oral, rat: LD50 = 930 mg/kg;
Skin, rabbit: LD50 = >9400 uL/kg;
Carcinogenicity:
CAS# 71-43-2:
ACGIH: A1 - Confirmed Human Carcinogen
California: carcinogen, initial date 2/27/87
NIOSH: potential occupational carcinogen
NTP: Known carcinogen
OSHA: Select carcinogen
IARC: Group 1 carcinogen
Epidemiology: IARC has concluded that epidemiological studies have establ ished the relationship between benzene exposure and the deve lopment of acute myelogenous leukemia, and that there is sufficient evidence that benzene is carcinogenic to hum ans.
Teratogenicity: Inhalation, rat: TCLO = 50 ppm/24H (female 7-14 day(s) after conception) Effects on Embryo or Fetus - extra-embryonic structures (e.g., placenta, umbilical cord) and Effects on Embryo or Fetus - fetotoxicity (except death, e.g., stunted fetus).; Inhalation,mouse: TCLo = 5 ppm (female 6-15 day(s) after conception) Effects on Embryo or Fetus - cytological changes (including somatic cell genetic material) and Specific Developmental Abnormalities - blood and lymphatic systems (including spleen and marrow).
Reproductive Effects: Inhalation, rat: TCLO = 670 mg/m3/24H (female 15 day(s) pre-mating and female 1-22 day(s) after conception) female fertility index (e.g. # females pregnant per # sperm positive females; # females pregnant per # females mated).; Oral, mouse: TDLo = 12 gm/kg (female 6-15 day(s) after conception) Fertility - post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants).
Neurotoxicity: See actual entry in RTECS for complete information.
Mutagenicity: DNA Inhibition: Human, Leukocyte = 2200 umol/L.; DNA Inhibition: Human, HeLa cell = 2200 umol/L.; Mutation Test Systems - not otherwise specified: Human, Lymphocyte = 5 umol/L.; Cytogenetic Analysis: Inhalation, Human = 125 ppm/1Y.; Cytogenetic Analysis: Human, Leukocyte = 1 mmol/L/72H.; Cytogenetic Analysis: Human, Lymphocyte = 1 mg/L.
Other Studies: No data available.

Section 12 - Ecological Information

Ecotoxicity: Fish: Mosquito Fish: TLm = 395 mg/L; 24 Hr; UnspecifiedFish: Goldfish: LC50 =46 mg/L; 24 Hr; Modified ASTM D 1345Fish: Fathead Minnow: LC50 = 15.1 mg/L; 96 Hr; Flow-through at 25°C (pH 7.9-8.0)Fish: Rainbow trout: LC50 = 5.3 mg/L; 96 Hr; Flow-through at 25°C (pH 7.9-8.0)Fish: Bluegill/Sunfish: LD50 = 20 mg/L; 24-48 Hr; Unspecified If benzene is released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. If benzene is released to water, it will be subject to rapid volatilization. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation.
Environmental: If benzene is released to the atmosphere, it will exist predominantly in the vapor phase. Gas-phase benzene will not be subject to direct photolysis but it will react with photochemically produced hydroxyl radicals with a half-life of 13.4 days. The reaction time in polluted atmospheres which contain nitrogen oxides or sulfur dioxide is accelerated with the half-life being reported as 4-6 hours. Benzene is fairly soluble in water and is removed from the atmosphere in rain.
Physical: Products of photooxidation include phenol, nitrophenols, nitrobenzene, formic acid, and peroxyacetyl nitrate.
Other: 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: CAS# 71-43-2: waste number U019 (Ignitable waste, Toxic waste).

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	BENZENE				BENZENE
Hazard Class:	3				3(9.2)
UN Number:	UN1114				UN1114
Packing Group:	II				II
Additional Info:					FLASHPOINT -11 C

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 71-43-2 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.
SARA

CERCLA Hazardous Substances and corresponding RQs
CAS# 71-43-2: 10 lb final RQ (receives an adjustable RQ of 10 lbs based on potential carc
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 71-43-2: acute, chronic, flammable.
Section 313
This material contains Benzene (CAS# 71-43-2, 99%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 71-43-2 is listed as a hazardous air pollutant (HAP). This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 71-43-2 is listed as a Hazardous Substance under the CWA. CAS# 71-43-2 is listed as a Priority Pollutant under the Clean Water Act. CAS# 71-43-2 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 71-43-2 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water

Act: WARNING: This product contains Benzene, a chemical known to the state of California to cause cancer. WARNING: This product contains Benzene, a chemical known to the state of California to cause birth defects or other reproductive harm. California No Significant Risk Level: CAS# 71-43-2: 7 æg/day NSRL

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T F

Risk Phrases:

R 11 Highly flammable.
R 45 May cause cancer.
R 48/23/24/25 Toxic : danger of serious damage to health by prolonged exposure through inhalation, contact with skin and if swallowed.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.

WGK (Water Danger/Protection)

CAS# 71-43-2: 3

Canada - DSL/NDSL

CAS# 71-43-2 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of B2, D2A, D2B.

Canadian Ingredient Disclosure List

CAS# 71-43-2 is listed on the Canadian Ingredient Disclosure List.

Exposure Limits

CAS# 71-43-2: OEL-AUSTRALIA:TWA 5 ppm (16 mg/m3);Carcinogen OEL-BELGIUM:TWA 10 ppm (32 mg/m3);Carcinogen JAN9 OEL-CZECHOSLOVAKIA:TWA 10 mg/m3;STEL 20 mg/m3 OEL-DENMARK:TWA 5 ppm (16 mg/m3);Skin;Carcinogen OEL-FINLAND:TWA 5 ppm (15 mg/m3);STEL 10 ppm (30 mg/m3);Skin;CAR OEL-FRANCE:TWA 5 ppm (16 mg/m3);Carcinogen OEL-GERMANY;Skin;Carcinogen OEL-HUNGARY:STEL 5 mg/m3;Skin;Carcinogen OEL-INDIA:TWA 10 ppm (30 mg/m3);Carcinogen OEL-JAPAN:TWA 10 ppm (32 mg/m3);STEL 25 ppm (80 mg/m3);CAR OEL-THE NETHERLANDS:TWA 10 ppm (30 mg/m3);Skin OEL-THE PHILIPPINES:TWA 25 ppm (80 mg/m3);Skin OEL-POLAND:TWA 30 mg/m3;Skin OEL-RUSSIA:TWA 10 ppm (5 mg/m3);STEL 25 ppm (15 mg/m3);Skin;CAR OEL-SWEDEN:TWA 1 ppm (3 mg/m3);STEL 5 ppm (16 mg/m3);Skin;CAR OEL-SWITZERLAND:TWA 5 ppm (16 mg/m3);Skin;Carcinogen OEL-THAILAND:TWA 10 ppm (30 mg/m3);STEL 25 ppm (7 mg/m3) OEL-TURKEY:TWA 20 ppm (64 mg/m3);Skin OEL-UNITED KINGDOM:TWA 10 ppm (30 mg/m3) OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

Section 16 - Additional Information

MSDS Creation Date: 6/11/1999
Revision #6 Date: 1/29/2004

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.

KOPPERS

Material Safety Data Sheet

MATERIAL SAFETY DATA SHEET

K O P P E R S

MEDICAL EMERGENCIES: 1 800 553-5631
OUTSIDE U.S.A.: 412 227-2001
GENERAL INFORMATION: 412 227-2424

KOPPERS INC.
436 SEVENTH AVENUE
PITTSBURGH, PA. 15219-1800

CHEMTREC ASSISTANCE 1 800 424-9300
CANUTEC: 1 613 996-6666

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: Coal Tar Creosote (Pressure Applications)

SYNONYM: P1/P13

PRODUCT USE: Wood preservative

CHEMICAL FAMILY: Coal tar distillate

FORMULA: Complex mixture of aromatic and heterocyclic hydrocarbons

CAS NUMBER: 8001-58-9

NFPA 704M/HMIS RATING: 2/2 HEALTH 1/1 FLAMMABILITY 1/1 REACTIVITY
0 = Least 1 = Slight 2 = Moderate 3 = High 4 = Extreme

CANADIAN PRODUCT CLASSIFICATION: Class D, Division 2, Subdivision A, Very Toxic Material

SECTION II - HEALTH/SAFETY ALERT

CHRONIC OVEREXPOSURE (as defined by OSHA recommended standards)
MAY CAUSE CANCER
WARNING
MAY BE FATAL IF SWALLOWED
HARMFUL TO THE SKIN OR IF INHALED
CAUSES EYE AND SKIN IRRITATION
AVOID PROLONGED OR REPEATED CONTACT
OBSERVE GOOD HYGIENE AND SAFETY PRACTICES WHEN HANDLING THIS PRODUCT
DO NOT USE THIS PRODUCT UNTIL MSDS & PRODUCT LABEL HAVE BEEN READ/UNDERSTOOD.
WARNING: THIS PRODUCT CONTAINS A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

SECTION III - HEALTH HAZARD INFORMATION

EYE: Direct contact with liquid or vapor may cause moderate irritation.

SKIN: Contact with skin can result in severe irritation which when accentuated by sunlight may result in phototoxic skin reaction. This material or similar materials when administered throughout the major portion of their lifetime has caused cancer in laboratory animals. Contact with heated material may cause thermal burns.

INHALATION: Acute overexposure to vapor may result in respiratory tract irritation. Repeated and/or prolonged contact to high concentrations of vapor may result in respiratory difficulties, central nervous system (CNS) effects characterized by headache, drowsiness, dizziness, weakness, incoordination, circulatory collapse, coma and possible death.

INGESTION: Ingestion of material may cause gastrointestinal disturbances including irritation, nausea, vomiting, abdominal pain. Systemic effects are similar to those described under INHALATION.

OTHER: See Section XIII (Comments) for additional information on health effects.

SECTION IV - EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Immediately flush with large amounts of water for 15 minutes. Seek medical aid.

SKIN CONTACT: Remove contaminated clothing. Wipe material from skin. Wash thoroughly with soap and water or waterless hand cleaner. If irritation persists, seek medical aid.

INHALATION: Remove from exposure. If breathing has stopped or is difficult, administer artificial respiration or oxygen as indicated. Seek medical aid.

INGESTION: If victim is conscious and alert, give 1-2 glasses of water or milk. Induce vomiting using ipecac syrup as directed on the label. After vomiting, the victim may be given a slurry of 100 g of activated charcoal in 8 oz. of water. Seek medical aid.

NOTE TO PHYSICIAN: Due to the possibility of sensitization of the myocardium following extreme acute overexposures, cardiorespiratory support should be available.

INGESTION: DO NOT INDUCE VOMITING OR GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

SECTION V - FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT & METHOD: >93 C (>200 F) PMCC AUTOIGNITION TEMP: Not Deter

FLAMMABLE LIMITS (% BY VOLUME/AIR): LOWER: ND UPPER: ND

TDG FLAMMABILITY CLASSIFICATION: None

EXTINGUISHING MEDIA: Use dry chemical, carbon dioxide, foam or water spray. Water or foam may cause frothing, if molten.

FIRE-FIGHTING PROCEDURES: Wear complete fire service protective equipment, including full-face NIOSH certified Self-Contained breathing apparatus. Use water to cool fire-exposed container/structure/protect personnel. Toxic vapors may be given off in a fire.

FIRE AND EXPLOSION HAZARDS: When heated (fire conditions), vapors/decomposition products may be released forming flammable/explosive mixtures in air. Closed containers may explode when exposed to extreme heat(fire).

SENSITIVITY TO MECHANICAL IMPACT: ND

SENSITIVITY TO STATIC DISCHARGE: ND

SECTION VI - SPILL, LEAK AND DISPOSAL INFORMATION

SPILL OR LEAK PROCEDURES (PRODUCT): Stop leak if no risk involved. Stay upwind. Solidified spills: Shovel into dry containers and cover. Flush area with water. Small wet spills: Take up with sand or other noncombustible absorbent material. Flush area with water. Dike large spills for later disposal. Contain runoff from fire control and dilution water. This product released into the environment must be reported to the National Response Center (1 800-424-8802). When this product is spilled or leaked, the CERCLA reportable quantity is 1 pound.

---------- DOT REPORTABLE QUANTITIES ----------

1 pound	Creosote
1 pound	Benzo(b)fluoranthene

WASTE DISPOSAL: This product is a US EPA defined toxic waste. Dispose of as a toxic waste in accordance with local, state and federal regulations.

SECTION VII - RECOMMENDED EXPOSURE LIMIT/HAZARDOUS INGREDIENTS

EXPOSURE LIMIT (PRODUCT):

*For coal tar pitch volatiles, OSHA-PEL is 0.2 mg/m3 averaged over an 8 hour work shift, benzene soluble fraction of total particulate including dust, fumes and mists.

**skin

***OSHA-Action Level - 0.5 ppm 8-hr. TWA

#Suspected Human Carcinogen. Percent by weight are the maximum levels of constituents.

HAZARDOUS INGREDIENTS	CAS NUMBER	%BY WT.	EXPOSURE LIMIT (PPM;MG/M3)		
Creosote	8001-58-9	100%	OSHA-TWA	-	0.2*
Phenanthrene	85-01-8	14.13	OSHA-TWA		0.2*
Fluoranthene	206-44-0	7.41	None		
Pyrene	129-00-0	5.14	OSHA-TWA		0.2*
Acenaphthene	83-32-9	6	None		
Fluorene	86-73-7	4.39	None		
Naphthalene	91-20-3	16.11	OSHA-TWA	10	50
Dibenzofuran	132-64-9	3.13	None		
Anthracene	120-12-7	3.76	OSHA-TWA		0.2*
Benzo(a)anthracene	56-55-3	1.40	None		
Chrysene	218-01-9	1.22	OSHA-TWA		0.2*
Biphenyl	95-52-4	1.03	OSHA-TWA	0.2	1
Indeno(1,2,3-c,d)pyrene	193-39-5	0.12	None		
Quinoline	91-22-5	0.90	None		
Benzo(a)pyrene	50-32-8	0.39	OSHA-TWA		0.2*

Benzene	71-43-2	0.13	OSHA-TWA	1	3***
			OSHA-STEL	5	15
Benzo(g,h,i)perylene	191-24-2	0.17	None		
M & P Xylene 108-38-3&106-42-3	mixture	0.13	OSHA-TWA	100	435
Styrene	100-42-5	0.06	OSHA-TWA	100	
			OSHA-STEL	200	
Dibenzo(a,h)anthracene	53-70-3	0.04	None		
Phenol	108-95-2	0.06	OSHA-TWA	5	19**
Toluene	108-88-3	0.15	OSHA-TWA	100	
			OSHA-STEL	150	
Benzofuran (Coumarone)	271-89-6	0.19	None		
Ethylbenzene	100-41-4	0.04	OSHA-TWA	100	435
O Xylene	95-47-6	0.04	OSHA-TWA	100	435
Indene	95-13-6	1.02	None		
2 Methylnaphthalene	91-57-6	4.84	None		
1 Methylnaphthalene	90-12-0	1.80	None		
Benzo(b)fluoranthene	205-99-2	0.42	None		
Benzo(j)fluoranthene	205-82-3	0.30	None		
Benzo(k)fluoranthene	207-08-9	0.28	None		

---------- SARA TITLE III SECTION 313 CHEMICALS ----------
(SEE SECTION VII FOR CAS NUMBERS AND PERCENTAGES)

Creosote	Chrysene
Benzene	Dibenzofuran
Toluene	Benzo(a)pyrene
Ethylbenzene	Indeno(1,2,3-c,d)pyrene
Styrene	Dibenzo(a,h)anthracene
Phenol	Benzo(g,h,i)perylene
Anthracene	Benzo(b)fluoranthene
Fluoranthene	Benzo(j)fluoranthene
Naphthalene	Benzo(k)fluoranthene
Quinoline	
Phenanthrene	
Benzo(a)anthracene	
M,O & P Xylene	

SECTION VIII - PERSONAL PROTECTION INFORMATION

EYE PROTECTION: Industrial safety glasses, minimum. As necessary to comply with OSHA 1910.133 and work area conditions: use side shields, goggles or face shield. Chemical goggles; face shield (if splashing is possible).

SKIN PROTECTION: As required, chemical resistant gloves. Depending on working conditions, i.e., contact potential, wear chemical resistant protective garments such as head/neck cover, aprons, jackets, coveralls, or long sleeved shirts and long pants, boots,long pants, chemical resistant overshoes, etc. See Section XIII - Comments for additional information on skin protection recommendations.

RESPIRATORY PROTECTION: Not required under normal use conditions. If ventilation does not maintain inhalation exposures below TLV(PEL), use NIOSH certified air purifying respirators equipped with combination filter/organic vapor cartridge in accordance with OSHA Respiratory Protection Standard 1910.134 and manufacture's "Instructions" and "Warnings".

VENTILATION: Provide sufficient general/local exhaust ventilation in pattern/volume to control inhalation exposures below current exposure limits and areas below flammable vapor concentrations. Local exhaust is necessary for use in enclosed or confined spaces. See OSHA 29 CFR 1910.146 Permit Required Confined Space.

SECTION IX - PERSONAL HANDLING INSTRUCTIONS

HANDLING: Avoid prolonged or repeated breathing of vapors, mists or fumes. Avoid prolonged or repeated contact with skin or eyes. Observe good personal hygiene practices and recommended procedures. Application of certain skin creams (sun screen in conjunction with a general purpose protective cream) - before working/several times during work may be beneficial.

STORAGE: Keep in a closed, labeled container. Protect from physical damage. Keep containers closed when material is not in use. Maintain good housekeeping.

OTHER: Not for use or storage in or around the home. DO NOT TAKE INTERNALLY. Do not use until manufacturer's precautions and product label have been read and understood. Wash exposed areas promptly and thoroughly after skin contact and before eating, drinking, using tobacco products or rest rooms.

SECTION X - REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY: Overheating

INCOMPATIBILITY: none known

HAZARDOUS REACTIONS/DECOMPOSITION/COMBUSTION PRODUCTS: Oxides of carbon

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION: none

SECTION XI - PHYSICAL DATA

BOILING POINT:	>180 C (>355 F)	SPECIFIC GRAVITY:	1.060 g/ml @ 20C*
MELTING POINT:	NA	% VOLATILE BY VOL:	NA
VAPOR PRESSURE:	0.42mm Hg @70f	EVAPORATION RATE(ETHER=1):	slow
VAPOR DENSITY(AIR=1):	>1	VISCOSITY:	7.4 @ 70f
SOLUBILITY: (WATER)	slight	pH:	ND

VOC: 475 g/l

COEFFICIENT OF WATER/OIL DISTRIBUTION: slightly H2O soluble

APPEARANCE/ODOR: brown to black liquid with creosote or tarry odor
*Specific Gravity + 8.76 lb/gal

SECTION XII - TRANSPORT INFORMATION

--------- PRODUCT PACKAGED IN BARGE ---------

RQ ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S.
(CREOSOTE)
CLASS 9 UN3082 PG III

PLACARDED: CLASS 9

--------- PRODUCT PACKAGED IN TANK CAR ---------

RQ ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S.
(CREOSOTE)
CLASS 9 UN3082 PG III

COAL TAR CREOSOTE, OR DISTILLATE, OR SOLUTION

PLACARDED: CLASS 9

--------- PRODUCT PACKAGED IN TANK TRUCK ---------

RQ ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S.
(CREOSOTE)
CLASS 9 UN3082 PG III

PLACARDED: CLASS 9

--------- PRODUCT PACKAGED IN DRUM (TIGHT HEAD) ---------

RQ ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S.
(CREOSOTE)
CLASS 9 UN3082 PG III
MARINE POLLUTANT
PLACARDED: CLASS 9

--------- PRODUCT PACKAGED IN PAIL (REMOVABLE HEAD) ---------

RQ ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S.
(CREOSOTE)
CLASS 9 UN3082 PG III
MARINE POLLUTANT
PLACARDED: CLASS 9

SECTION XIII - COMMENTS

Persons with pre-existing disease in or a history of ailments involving the skin or blood-forming organs may be at a greater risk of developing adverse health effects when exposed to this material.

The IARC monographs (Vol. 35) states that there is sufficient evidence for the carcinogenicity of creosote in experimental animals. The NTP Annual Report on Carcinogens states that creosote oils are carcinogenic in experimental animals. Creosote does not appear in the OSHA Subpart Z Table.

Epidemiological studies of workers in the woodtreating industry have shown no significant health effects due to occupational exposure to creosote. The application of a commercially available sun-blocking lotion is recommended to greatly reduce the phototoxicity of coal tar derived materials associated sun burning. The sun block should be applied prior to the application of a protective cream and should have a sun protection factor(SPF) greater than 15. Application of a general purpose protective cream or a cream specifically formulated for protection coal tar based products from contacting skin before working/several times during work may be beneficial.

EPA Reg. No. 61468-1.

Coal Tar Creosote (Pressure Applications) is an EPA registered pesticide regulated by the Federal Insecticide Fungicide Rodenticide Act (FIFRA) and failure to follow the label directions is a violation of Federal Law. The label addresses issues of personal hygiene practices, personal protective equipment use, the use, care and disposal of protective clothing and material handling precautions. Please refer to the label for more details.

This product containes benzene. The IARC monographs (vol. 29) states that there is sufficient evidence for the carcinogenicity in humans and limited evidence for the carcinogenicity in animals. Benzene is also listed in the NTP Annual Report on Carcinogens and in the OSHA Subpart Z Table (Specifically Regulated Substances).

Reviewed and revised May 2001.

No known ingredients which occur at greater than 0.1%, other than those listed above, are listed as a carcinogen in the IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, the NTP Annual Report on Carcinogens or OSHA 29 CFR 1910.1001-1047 subpart Z Toxic and Hazardous Substances (Specifically Regulated Substances).

SKIN PROTECTION (protective material): Permeation/degradation values of chemical mixtures cannot be predicted from pure components or chemical classes. Thus, these materials are normally best estimates based on available pure component data. A significant difference in chemical breakthrough time has been reported for generically similar gloves from different manufacturers (AIHA J., 48, 941-947 1987).

Do not use until manufacturer's precautions have been read/understood. Wash exposed areas promptly and thoroughly after skin contact from working with this product and before eating, drinking, using tobacco products or rest rooms.

Prepared By: Safety and Health Department

REVISION DATE: 05/01
SPECIFICATION SHEET NUMBER: TP-1203-10
SUPPLIER INFORMATION: Same as manufacturer.

CODE NUMBER: IND00003MY0139
REPLACES SHEET: IND00003AP0138

NOTICE: While the information and recommendations set forth herein are believed to be accurate as of the date hereof, Koppers makes no res from reliance thereon.

Print Date: 09/25/2001

Material Safety Data Sheet
Conductivity standards

Section 1 - Chemical Product and Company Identification

MSDS Name:

Conductivity standards

Catalog Numbers:

LC18760, LC18765, LC18771, LC18772, LC18773, LC18774, LC18777, LC18779, LC18780

Synonyms:

Company Identification:

LabChem, Inc.
2000 William Pitt Way
Pittsburgh, PA 15238

Company Phone Number:

(412) 826-5230

Emergency Phone Number:

(412) 826-5230

CHEMTREC Phone Number:

800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7732-18-5	Water	balance
7447-40-7	Potassium chloride	0.26-0.733

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: colorless
Expected to be non-hazardous.
Target Organs: none known.

Potential Health Effects

Eye:

Non-irritating to the eyes.

Skin:

Non-irritating to the skin.

Ingestion:

Not hazardous expected during normal use.

Inhalation:

No hazard expected during normal use.

Chronic:

No information found.

Section 4 - First Aid Measures

Eyes:

If irritation develops, get medical aid.

Skin:

Get medical aid if irritation develops or persists.

Ingestion:

Do NOT induce vomiting. Get medical aid.

Inhalation:

No specific treatment is necessary since this material is not likely to be hazardous by inhalation.

Notes to Physician:

Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:

Negligible fire and explosion hazard when exposed to heat or flame.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature:

No information found.

Flash Point:

No information found.

NFPA Rating:

CAS# 7732-18-5: Not published.
CAS# 7447-40-7: Not published.

Explosion Limits:

Lower: Upper:

Section 6 - Accidental Released Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spill using an absorbent, non-combustible material such as earth, sand, diatomaceous earth, vermiculite, or other suitable absorbent.

Print Date: 9/25/2001

Material Safety Data Sheet
Conductivity standards

Section 7 - Handling and Storage

Handling:

Wash thoroughly after handling.

Storage:

Store capped at room temperature.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Good general ventilation should be sufficient to control airborne levels.

Exposure Limits

Chemical Name:	ACGIH	NIOSH	OSHA
Water	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.
Potassium chloride	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.

OSHA Vacated PELs

Personal Protective Equipment

Eyes:

Wear safety glasses and chemical goggles if splashing is possible. Provide an eye-wash fountain in the immediate work area. Do not wear contact lenses when working with chemicals. Do not wear contact lenses when working with chemicals.

Skin:

Wear impervious gloves.

Clothing:

Protective overalls are recommended.

Respirators:

Not required for normal use.

Section 9 - Physical and Chemical Properties

Physical State:	Liquid
Color:	colorless
Odor:	odorless
pH:	No information found.
Vapor Pressure:	14 mmHg @ 20C
Vapor Density:	0.7 (water)
Evaporation Rate:	<ether
Viscosity:	No information found.
Boiling Point:	212°F (100.00°C)
Freezing/Melting Point:	32°F (0.00°C)

Material Safety Data Sheet
Conductivity standards

Decomposition Temperature: No information found.
Solubility in water: Soluble.
Specific Gravity/Density: 1
Molecular Formula: No information found.
Molecular Weight No information found.

Section 10 - Stability and Reactivity

Chemical Stability:
Stable under normal temperatures and pressures.

Conditions to Avoid:
Temperatures above recommended temperatures.

Incompatibilities with Other Materials
None reported.

Hazardous Decomposition Products
No information found.

Hazardous Polymerization
Will not occur.

Section 11 - Toxicological Information

RTECS:
CAS# 7732-18-5: ZC0110000.
CAS# 7447-40-7: TS8050000.

LD50/LC50:
CAS# 7732-18-5:
Oral, rat: LD50 = >90 mL/kg.
CAS# 7447-40-7:
Oral, mouse: LD50 = 1500 mg/kg
Oral, rat: LD50 = 2600 mg/kg.

Carcinogenicity:
CAS# 7732-18-5: Not listed as an carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 7447-40-7: Not listed as an carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

Epidemiology:
potassium chloride solutions of less than 1 % have not been investigated for toxicity.

Teratogenicity:

Reproductive:

Mutagenicity

Neurotoxicity

Section 12 - Ecological Information

No information found.

Material Safety Data Sheet
Conductivity standards

Section 13 - Disposal Considerations

Dispose of in accordance with federal, state, and local regulations.

Section 14 - Transport Information

US DOT

Shipping Name:	No information found.
Hazard Class:	
UN Number:	
Packing Group:	

Section 15 - Regulatory Information

US Federal

TSCA

CAS# 7732-18-5 is listed on the TSCA Inventory.
CAS# 7447-40-7 is listed on the TSCA Inventory.

SARA Reportable Quantities (RQ)

None of the components are on this list.

CERCLA/SARA Section 313

None of the components are on this list.

OSHA - Highly Hazardous

None of the components are on this list.

US State

State Right to Know

California Regulations

European/International Regulations

Canadian DSL/NDSL

CAS# 7732-18-5 is listed on Canada's DSL List.
CAS# 7447-40-7 is listed on Canada's DSL List.

Canada Ingredient Disclosure List

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.
CAS# 7447-40-7 is not listed on Canada's Ingredient Disclosure List.

Section 16 - Other Information

MSDS Creation Date: November 6, 1997
Revision Date: August 7, 2001

Print Date: 9/25/2001

Material Safety Data Sheet

Conductivity standards

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for this application.

Material Safety Data Sheet

Ethyl Benzene

ACC# 08780

Section 1 - Chemical Product and Company Identification

MSDS Name: Ethyl Benzene
Catalog Numbers: O2751 1, O2751-1, O27511
Synonyms: Ethylbenzol; Phenylethane
Company Identification:
Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
100-41-4	Ethylbenzene	100	202-849-4

Hazard Symbols: XN F
Risk Phrases: 11 20

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: clear, colorless liquid. Flash Point: 21 deg C. **Warning!** Aspiration hazard if swallowed. Can enter lungs and cause damage. Causes skin irritation. Causes eye irritation. Causes digestive and respiratory tract irritation. May cause central nervous system depression. **Flammable liquid and vapor.** May be absorbed through intact skin.
Target Organs: Central nervous system.

Potential Health Effects
Eye: Causes moderate eye irritation. Vapors may cause eye irritation.
Skin: Causes skin irritation. Prolonged and/or repeated contact may cause irritation and/or dermatitis. May be absorbed through the skin. Contact with the liquid may cause erythema (redness), exfoliation and vesiculation (blistering).
Ingestion: May cause irritation of the digestive tract. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.
Inhalation: Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. Causes respiratory tract irritation. Vapors may cause dizziness or suffocation.
Chronic: Chronic inhalation may cause effects similar to those of acute inhalation.

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 immediately.
Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.
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: Containers can build up pressure if exposed to heat and/or fire. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Vapors can travel to a source of ignition and flash back. Use water spray to keep fire-exposed containers cool. Flammable liquid and vapor. 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: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. Use water spray to cool fire-exposed containers. Water may be ineffective. For large fires, use water spray, fog or alcohol-resistant foam. Contact professional fire-fighters immediately. Cool containers with flooding quantities of water until well after fire is out.
Flash Point: 21 deg C (69.80 deg F)
Autoignition Temperature: 810 deg F (432.22 deg C)
Explosion Limits, Lower:0.8
Upper: 6.7
NFPA Rating: (estimated) Health: 3; Flammability: 4; 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. Remove all sources of ignition. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Ground and bond containers when transferring material. 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. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Ethylbenzene	100 ppm TWA; 125 ppm STEL	100 ppm TWA; 435 mg/m3 TWA 800 ppm IDLH	100 ppm TWA; 435 mg/m3 TWA

OSHA Vacated PELs: Ethylbenzene: 100 ppm TWA; 435 mg/m3 TWA
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 and clothing to prevent skin exposure.
Clothing: Wear appropriate protective gloves and clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: clear, colorless
Odor: aromatic odor
pH: Not available.
Vapor Pressure: 7.1 mm Hg @ 20 C
Vapor Density: 3.7
Evaporation Rate:<1 (butyl acetate=1)
Viscosity: 0.63 mPa s 20 C
Boiling Point: 277 deg F
Freezing/Melting Point:-139 deg F
Decomposition Temperature: Not available.
Solubility: Insoluble.
Specific Gravity/Density:0.9
Molecular Formula:C8H10
Molecular Weight:106.07

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Incompatible materials, ignition sources, excess heat.
Incompatibilities with Other Materials: Oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 100-41-4: DA0700000
LD50/LC50:
CAS# 100-41-4:
Draize test, rabbit, eye: 500 mg Severe;
Oral, rat: LD50 = 3500 mg/kg;
Skin, rabbit: LD50 = 17800 uL/kg;
Carcinogenicity:
CAS# 100-41-4:
ACGIH: A3 - Confirmed animal carcinogen with unknown relevance to humans
OSHA: Possible Select carcinogen
IARC: Group 2B carcinogen
Epidemiology: No information available.

Teratogenicity: No information available.
Reproductive Effects: No information available.
Neurotoxicity: No information available.
Mutagenicity: Mutation in mammalian somatic cells(Rodent,mouse) Lymphocyte = 80 mg/L.
Other Studies: Standard Draize Test: Administration into the eye (rabbit) = 500 mg (Severe). Standard Draize Tes (Rabbit, Skin) = 15 mg/L; Mild.

Section 12 - Ecological Information

Ecotoxicity: Fish: Rainbow trout: 14.0 mg/L; 96 Hr.; StaticFish: Fathead Minnow: 12.1 mg/L; 96 Hr.; Flow-throughFish: Bluegill/Sunfish: LC50 =150.0 mg/L; 96 Hr.; Flow-throughWater flea EC50 =2.1 mg/L; 48 Hr.; StaticBacteria: EC50 =9.8 mg/L; 30 minutes; Micotox TestWater flea EC50 =75.0 mg/L; 48 minutes; Static, pH6.7-8.1, 72.0 mg/L CaCO3 Shrimp (mysidoposis bahia), LC50=87.6 mg/L/96hr. Sheepshead minnow LC50=275 mg/L/96hr. Fathead minnow LC50=42.3 mg/L/96hr in hard water &48.5 mg/L/96hr in softwater.
Environmental: Experimental data on the bioconcentration of ethylbenzene include a log BCF of 1.9 in goldfish and the log BCF of 0.67 for clams exposed to the water-soluble fraction of crude oil. Using its octanol/water partition coefficient (log Kow= 3.15) and using a recommended regression equation, one can calculate a log BCF in fish of 2.16 indicating that ethylbenzene should not significantly bioconcentrate in aquatic organisms. Ethylbenzene has a moderate adsorption for soil. The measured Koc for silt loam was 164
Physical: The predominant photochemical reaction of ethylbenzene in the atmosphere is with hydroxyl radicals; the tropospheric half-life for this reaction is 5.5 and 24 hr in the summer and winter, actively. Degradation is somewhat faster under photochemical smog situations. Photooxidation products which have been identified include ethylphenol, benzaldehyde, acetophenone and m- and p-ethylnitrobenzene. Ethylbenzene is resistant to hydrolysis. Ethylbenzene does not significantly absorb light above 290 nm in methanol solution.
Other: 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	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	ETHYLBENZENE				ETHYL BENZENE
Hazard Class:	3				3
UN Number:	UN1175				UN1175
Packing Group:	II				II
Additional Info:					FLASHPOINT 15C

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 100-41-4 is listed on the TSCA inventory.
Health & Safety Reporting List
CAS# 100-41-4: Effective 6/19/87; Sunset 6/19/97

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.
SARA

CERCLA Hazardous Substances and corresponding RQs
CAS# 100-41-4: 1000 lb final RQ; 454 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 100-41-4: acute, chronic, flammable.
Section 313
This material contains Ethylbenzene (CAS# 100-41-4, 100%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 100-41-4 is listed as a hazardous air pollutant (HAP). This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 100-41-4 is listed as a Hazardous Substance under the CWA. CAS# 100-41-4 is listed as a Priority Pollutant under the Clean Water Act. CAS# 100-41-4 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 100-41-4 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.
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:
XN F
Risk Phrases:
R 11 Highly flammable.
R 20 Harmful by inhalation.

Safety Phrases:
S 16 Keep away from sources of ignition - No smoking.
S 24/25 Avoid contact with skin and eyes.
S 29 Do not empty into drains.

WGK (Water Danger/Protection)
CAS# 100-41-4: 1
Canada - DSL/NDSL
CAS# 100-41-4 is listed on Canada's DSL List.
Canada - WHMIS
This product has a WHMIS classification of B2, D2B.
Canadian Ingredient Disclosure List
CAS# 100-41-4 is listed on the Canadian Ingredient Disclosure List.
Exposure Limits
CAS# 100-41-4: OEL-AUSTRALIA:TWA 100 ppm (435 mg/m3);STEL 125 ppm (5 mg/m3) OEL-BELGIUM:TWA 100 ppm (434 mg/m3);STEL 125 ppm (543 mg/m3 OEL-CZECHOSLOVAKIA:TWA 200 mg/m3;STEL 1000 mg/m3 OEL-DENMARK:TWA 5 0 ppm (217 mg/m3) OEL-FINLAND:TWA 100 ppm (435 mg/m3);STEL 150 ppm (6 55 mg/m3) OEL-FRANCE:TWA 100 ppm (435 mg/m3) OEL-GERMANY:TWA 100 ppm (440 mg/m3);Skin OEL-HUNGARY:TWA 100 mg/m3;STEL 200 mg/m3;Skin OEL-JAPAN:TWA 100 ppm (430 mg/m3) OEL-THE NETHERLANDS:TWA 100 ppm (435 mg /m3) OEL-THE PHILIPPINES:TWA 100 ppm (435 mg/m3) OEL-POLAND:TWA 100

mg/m3 OEL-RUSSIA:TWA 100 ppm;STEL 50 mg/m3 OEL-SWEDEN:TWA 50 ppm (20 0 mg/m3);STEL 100 ppm (450 mg/m3) OEL-SWITZERLAND:TWA 100 ppm (435 mg /m3);STEL 500 ppm OEL-TURKEY:TWA 100 ppm (435 mg/m3) OEL-UNITED KING DOM:TWA 100 ppm (435 mg/m3);STEL 125 ppm OEL IN BULGARIA, COLOMBIA, J ORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM c heck ACGI TLV

Section 16 - Additional Information

MSDS Creation Date: 4/28/1999
Revision #3 Date: 3/18/2003

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.

MSDS Number: **H2381** * * * * * *Effective Date: 08/10/04* * * * * *Supercedes: 11/02/01*

MSDS Material Safety Data Sheet

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.

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

J.T.Baker®

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

HEXANE

1. Product Identification

Synonyms: Hexanes,Normal Hexane; Hexyl Hydride; Hexane 95%
CAS No.: 110-54-3 (n-hexane)
Molecular Weight: 86.18
Chemical Formula: CH3(CH2)4CH3 n-hexane
Product Codes: 9262, 9304, 9308, N168

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hexane	110-54-3	85 - 100%	Yes
Methylcyclopentane	96-37-7	1 - 2%	Yes
Trace amount of Benzene (10 ppm)	071-43-2	*	No

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL AND PERIPHERAL NERVOUS SYSTEMS.

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

Health Rating: 2 - Moderate
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 0 - None
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

The health hazards addressed are for the major component: n-hexane.

Inhalation:
Inhalation of vapors irritates the respiratory tract. Overexposure may cause lightheadedness, nausea, headache, and blurred vision. Greater exposure may cause muscle weakness, numbness of the extremities, unconsciousness and death.
Ingestion:
May produce abdominal pain, nausea. Aspiration into lungs can produce severe lung damage and is a medical emergency. Other symptoms expected to parallel inhalation.
Skin Contact:
May cause redness, irritation, with dryness, cracking.
Eye Contact:
Vapors may cause irritation. Splashes may cause redness and pain.
Chronic Exposure:
Repeated or prolonged skin contact may defat the skin and produce irritation and dermatitis. Chronic inhalation may cause peripheral nerve disorders and central nervous system effects.
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. May affect the developing fetus.

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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:
Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Remove any contaminated clothing. Wipe off excess from skin. Wash skin with soap and water for at least 15 minutes. Get medical attention if irritation develops or persists.
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:
BEI=2,5-hexadione in urine, sample at end of shift at workweeks end, 5 mg/g creatine. Also, measure n-hexane in expired air. Analgesics may be necessary for pain management, there is no specific antidote. Monitor arterial blood gases in cases of severe aspiration.

5. Fire Fighting Measures

Fire:
Flash point: -23C (-9F) CC
Autoignition temperature: 224C (435F)
Flammable limits in air % by volume:
lel: 1.2; uel: 7.7
Extremely Flammable Liquid and Vapor! Vapor may cause flash fire. Dangerous fire hazard when exposed to heat or flame.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with oxidizing materials may cause extremely violent combustion.Explodes when mixed @ 28C with dinitrogen tetraoxide. Sensitive to static discharge.
Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water may be ineffective.
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. Water spray may be used to keep fire exposed containers cool. Vapors can flow along surfaces to distant ignition source and flash back. Vapor explosion hazard exists indoors, outdoors, or in sewers.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. 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. Use non-sparking tools and equipment. Collect liquid in an appropriate container or 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! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. 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 SOLUSORB® solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from direct sunlight and any area where the fire hazard may be acute. Store in tightly closed containers (preferably under nitrogen atmosphere). Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment. 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:
N-Hexane [110-54-3]:
-OSHA Permissible Exposure Limit (PEL): 500 ppm (TWA)
-ACGIH Threshold Limit Value (TLV): 50 ppm (TWA), Skin
other isomers of hexane
-ACGIH Threshold Limit Value (TLV): 500 ppm (TWA),1000ppm (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 and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134).
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, colorless liquid.
Odor:
Light odor.
Solubility:
Insoluble in water.
Specific Gravity:
0.66
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
ca. 68C (ca. 154F)
Melting Point:
ca. -95C (ca. -139F)
Vapor Density (Air=1):
3.0
Vapor Pressure (mm Hg):
130 @ 20C (68F)
Evaporation Rate (BuAc=1):
9

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Heat will contribute to instability.
Hazardous Decomposition Products:
May produce acrid smoke and irritating fumes when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizers.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

N-Hexane: Oral rat LD50: 28710 mg/kg. Irritation eye rabbit: 10 mg mild. Investigated as a tumorigen, mutagen and reproductive effector.

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

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Hexane (110-54-3)	No	No	None
Methylcyclopentane (96-37-7)	No	No	None
Trace amount of Benzene (10 ppm) (071-43-2)	Yes	No	1

12. Ecological Information

Environmental Fate:
When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material is not expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. This material has an estimated bioconcentration factor (BCF) of less than 100. This material has a log octanol-water partition coefficient of greater than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.
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 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: HEXANES
Hazard Class: 3
UN/NA: UN1208
Packing Group: II
Information reported for product/size: 215L

International (Water, I.M.O.)

Proper Shipping Name: HEXANES
Hazard Class: 3
UN/NA: UN1208
Packing Group: II
Information reported for product/size: 215L

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15. Regulatory Information

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

Ingredient	TSCA	EC	Japan	Australia
Hexane (110-54-3)	Yes	Yes	Yes	Yes
Methylcyclopentane (96-37-7)	Yes	Yes	No	Yes
Trace amount of Benzene (10 ppm) (071-43-2)	Yes	Yes	Yes	Yes

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

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Hexane (110-54-3)	Yes	Yes	No	Yes
Methylcyclopentane (96-37-7)	Yes	Yes	No	Yes
Trace amount of Benzene (10 ppm) (071-43-2)	Yes	Yes	No	Yes

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

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Hexane (110-54-3)	No	No	Yes	No
Methylcyclopentane (96-37-7)	No	No	No	No
Trace amount of Benzene (10 ppm) (071-43-2)	No	No	Yes	No

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

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Hexane (110-54-3)	5000	No	No
Methylcyclopentane (96-37-7)	No	No	No
Trace amount of Benzene (10 ppm) (071-43-2)	10	U019	No

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

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 3[Y]E
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: **1** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL AND PERIPHERAL NERVOUS SYSTEMS.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor or mist.
Avoid contact with eyes, skin and clothing.
Label First Aid:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. In all cases call a physician.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.
Disclaimer:
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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **H3880** * * * * * *Effective Date:* ***09/24/04*** * * * * * *Supercedes:* ***05/07/03***

MSDS **Material Safety Data Sheet**

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

Mallinckrodt CHEMICALS J.T.Baker

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, 5861, 5894, 5962, 5972, 5994, 6900, 7831, 9529, 9530, 9534, 9535, 9536, 9537, 9538, 9539, 9540, 9544, 9548
Mallinckrodt: 2062, 2515, 2612, 2624, 2626, 3861, 5583, 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.

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 & 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.

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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.

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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.

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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.

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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.

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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.

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

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
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- RQ	TPQ	------SARA 313------ 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- 261.33	-TSCA- 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.

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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: 3.

Disclaimer:

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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.

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

MSDS Number: **I8840** * * * * * *Effective Date: 05/07/03* * * * * * *Supercedes: 01/14/02*

MSDS **Material Safety Data Sheet**

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

Mallinckrodt CHEMICALS J.T.Baker

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.

ISOPROPYL ALCOHOL (90 - 100%)

1. Product Identification

Synonyms: 2-Propanol; sec-propyl alcohol; isopropanol; sec-propanol; dimethylcarbinol
CAS No.: 67-63-0
Molecular Weight: 60.10
Chemical Formula: (CH3)2 CHOH
Product Codes:
J.T. Baker: 5082, 9037, 9080, U298
Mallinckrodt: 0562, 3027, 3031, 3032, 3035, 3037, 3043, 4359, 6569, H604, H982, V555, V566, V681

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Isopropyl Alcohol	67-63-0	90 - 100%	Yes
Water	7732-18-5	0 - 10%	No

3. Hazards Identification

Emergency Overview

WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. MAY CAUSE IRRITATION TO SKIN.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 2 - Moderate
Contact Rating: 3 - Severe
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Inhalation of vapors irritates the respiratory tract. Exposure to high concentrations has a narcotic effect, producing symptoms of dizziness, drowsiness, headache, staggering, unconsciousness and possibly death.
Ingestion:
Can cause drowsiness, unconsciousness, and death. Gastrointestinal pain, cramps, nausea, vomiting, and diarrhea may also result. The single lethal dose for a human adult = about 250 mls (8 ounces).
Skin Contact:
May cause irritation with redness and pain. May be absorbed through the skin with possible systemic effects.
Eye Contact:
Vapors cause eye irritation. Splashes cause severe irritation, possible corneal burns and eye damage.
Chronic Exposure:
Chronic exposure may cause skin effects.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or impaired liver, kidney, or pulmonary function may be more susceptible to the effects of this agent.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Give large amounts of water to drink. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes. Call a physician if irritation develops.
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:
Flash point: 12C (54F) CC
Autoignition temperature: 399C (750F)

Flammable limits in air % by volume:
lel: 2.0; uel: 12.7
Listed fire data is for Pure Isopropyl Alcohol.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with strong oxidizers may cause fire or explosion. Vapors can flow along surfaces to distant ignition source and flash back. Sensitive to static discharge.
Fire Extinguishing Media:
Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.
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.

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6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. 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. Use non-sparking tools and equipment. Collect liquid in an appropriate container or 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! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

---

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. 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. Small quantities of peroxides can form on prolonged storage. Exposure to light and/or air significantly increases the rate of peroxide formation. If evaporated to a residue, the mixture of peroxides and isopropanol may explode when exposed to heat or shock.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Isopropyl Alcohol (2-Propanol):
-OSHA Permissible Exposure Limit (PEL):
400 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):

200 ppm (TWA), 400 ppm (STEL), 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 organic vapor 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:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene and nitrile rubber are recommended materials.

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, colorless liquid.

Odor:

Rubbing alcohol.

Solubility:

Miscible in water.

Specific Gravity:

0.79 @ 20C/4C

pH:

No information found.

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

100

Boiling Point:

82C (180F)

Melting Point:

-89C (-128F)

Vapor Density (Air=1):

2.1

Vapor Pressure (mm Hg):

44 @ 25C (77F)

Evaporation Rate (BuAc=1):

2.83

---

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Heat and sunlight can contribute to instability.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:
Will not occur.
Incompatibilities:
Heat, flame, strong oxidizers, acetaldehyde, acids, chlorine, ethylene oxide, hydrogen-palladium combination, hydrogen peroxide-sulfuric acid combination, potassium tert-butoxide, hypochlorous acid, isocyanates, nitroform, phosgene, aluminum, oleum and perchloric acid.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 5045 mg/kg; skin rabbit LD50: 12.8 gm/kg; inhalation rat LC50: 16,000 ppm/8-hour; investigated as a tumorigen, mutagen, reproductive effector.

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

Ingredient	NTP Carcinogen Known	NTP Carcinogen Anticipated	IARC Category
Isopropyl Alcohol (67-63-0)	No	No	3
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to quickly evaporate. When released into the soil, this material may leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. When released into water, this material may biodegrade to a moderate extent. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.
Environmental Toxicity:
The LC50/96-hour values for fish are over 100 mg/l. This material is not 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 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: ISOPROPANOL
Hazard Class: 3
UN/NA: UN1219
Packing Group: II
Information reported for product/size: 355LB

International (Water, I.M.O.)

Proper Shipping Name: ISOPROPANOL
Hazard Class: 3
UN/NA: UN1219
Packing Group: II
Information reported for product/size: 355LB

---

15. Regulatory Information

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

Ingredient	TSCA	EC	Japan	Australia
Isopropyl Alcohol (67-63-0)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

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

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Isopropyl Alcohol (67-63-0)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

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

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Isopropyl Alcohol (67-63-0)	No	No	Yes	No
Water (7732-18-5)	No	No	No	No

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

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Isopropyl Alcohol (67-63-0)	No	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: Yes Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2[S]2
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.

6. Other Information

NFPA Ratings: Health: **2** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. MAY CAUSE IRRITATION TO SKIN.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor or mist.
Avoid contact with eyes, skin and clothing.
Label First Aid:
If swallowed, give large amounts of water to drink. 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 case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8.
Disclaimer:
****

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

Material Safety Data Sheet

Naphthalene

ACC# 16120

Section 1 - Chemical Product and Company Identification

MSDS Name: Naphthalene
Catalog Numbers: AC164210000, AC164210010, AC164210025, AC180200000, AC180200010, AC180200050, AC180202500, AC180900000, AC180900010, AC180902500, S76307, S763071, N134-500, N7-500
Synonyms: Coal tar camphor; Tar camphor; Naphthalin; White tar; Naphthene; Moth flakes: Moth balls.
Company Identification:
Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
91-20-3	Naphthalene	>98	202-049-5

Hazard Symbols: XN N
Risk Phrases: 22

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: white solid. Flash Point: 78 deg C. **Warning!** May cause blood abnormalities. Hygroscopic (absorbs moisture from the air). Flammable solid. May be harmful if absorbed through the skin. Harmful if inhaled or swallowed. Causes eye, skin, and respiratory tract irritation.
Target Organs: Blood, respiratory system, eyes, skin.

Potential Health Effects
Eye: Naphthalene is an eye irritant. The vapor causes eye irritation at 15 ppm. Eye contact with the solid material may result in conjunctivitis, superficial injury to the cornea, diminished visual acuity, and other effects. It may cause cataracts.
Skin: Causes mild skin irritation. May be absorbed through the skin in harmful amounts. Incidence of skin hypersensitivity is not widespread in the general population &, based on the long history of use of naphthalene as a consumer product, this effect is mostly confined to industrial exposure where coal tar contamination may be present.
Ingestion: Harmful if swallowed. May cause liver and kidney damage. May cause methemoglobinemia, cyanosis (bluish discoloration of skin due to deficient oxygenation of the blood), convulsions, and death. May cause severe gastrointestinal tract irritation with abdominal pain, nausea, vomiting and diarrhea. Ingestion of large quantities may cause severe hemolytic anemia and hemoglobinuria.
Inhalation: Harmful if inhaled. Causes respiratory tract irritation. Readily absorbed when inhaled. Material volatilizes at room temperature. Hemolytic anemia (destruction of red blood cells) is the primary healt h concern for humans exposed to naphthalene for either short or long p eriods of time. Other effects may include nausea, profuse perspiration , vomiting, kidney damage and liver damage. Optic neuritis (inflammati on of the optic nerve) has been observed. Cataracts have also occurred .

Chronic: Prolonged or repeated skin contact may cause dermatitis. May cause liver and kidney damage. May cause anemia and other blood cell abnormalities. Animal studies have reported that fetal effects/abnormalities may occur when maternal toxicity is seen. Effects may be delayed. Chronic exposure may cause lung damage. Laboratory experiments have resulted in mutagenic effects. Chronic exposure may cause corneal injury, optical neuritis, blurred vision, and possible cataract formation. Chronic inhalation, skin absorption or ingestion of naphthalene have caused severe hemolytic anemia.

Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.
Skin: In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion: If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Individuals with a glucose-6-phosphate dehyrogenase deficiency are hypersensitive to the effects of naphthalene.

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. Water runoff can cause environmental damage. Dike and collect water used to fight fire. 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. Flammable solid. Dusts may be an explosion hazard if mixed with air at critical proportions and in the prescence of an ignition source. Volatile solid that gives off flammable vapors when heated.
Extinguishing Media: Water or foam may cause frothing. Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: 78 deg C (172.40 deg F)
Autoignition Temperature: 526 deg C (978.80 deg F)
Explosion Limits, Lower:0.90 vol %
Upper: 5.90 vol %
NFPA Rating: (estimated) Health: 2; Flammability: 2; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Scoop up with a nonsparking tool, then place into a suitable container for disposal. Avoid generating dusty conditions. Remove all sources of ignition. Provide ventilation. Do not let this chemical enter the environment.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Avoid breathing dust, vapor, mist, or gas. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Use only with adequate ventilation.
Storage: Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Storage under a nitrogen blanket has been recommended. Store protected from moisture. Separate from oxidizing materials.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Naphthalene	10 ppm TWA; 15 ppm STEL; skin - potential for cutaneous absorption	10 ppm TWA; 50 mg/m3 TWA 250 ppm IDLH	10 ppm TWA; 50 mg/m3 TWA

OSHA Vacated PELs: Naphthalene: 10 ppm TWA; 50 mg/m3 TWA

Personal Protective Equipment

Eyes: Wear chemical goggles.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance: white

Odor: Distinctive mothball-like.

pH: Not available.

Vapor Pressure: 0.05 mm Hg @ 20 deg C

Vapor Density: 4.4 (air=1)

Evaporation Rate:<1.0 (butyl acetate=1)

Viscosity: Not available.

Boiling Point: 218 deg C

Freezing/Melting Point:79 - 82 deg C

Decomposition Temperature:540 deg C

Solubility: Insoluble.

Specific Gravity/Density:0.9900g/cm3

Molecular Formula:C10H8

Molecular Weight:128.17

Section 10 - Stability and Reactivity

Chemical Stability: Stable at room temperature in closed containers under normal storage and handling conditions.

Conditions to Avoid: Ignition sources, dust generation, moisture, excess heat, exposure to moist air or water, steam.

Incompatibilities with Other Materials: Strong oxidizing agents.

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

Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#:

CAS# 91-20-3: QJ0525000
LD50/LC50:
CAS# 91-20-3:
Draize test, rabbit, eye: 100 mg Mild;
Inhalation, rat: LC50 = >340 mg/m3/1H;
Oral, mouse: LD50 = 316 mg/kg;
Oral, rat: LD50 = 490 mg/kg;
Skin, rabbit: LD50 = >20 gm/kg;
Skin, rat: LD50 = >2500 mg/kg;
Carcinogenicity:
CAS# 91-20-3:
California: carcinogen, initial date 4/19/02
IARC: Group 2B carcinogen
Epidemiology: Incidents in which blankets or clothing containing naphthal ene caused acute hemolysis in infants, in some cases f atal, have been described. The percutaneous absorption a nd systemic intoxication with naphthalene can be facilitated by oily vehicles.
Teratogenicity: Naphthalene and its metabolites have been reported to cross the human placenta in amounts sufficient to cause fetal toxicity. Oral, rat: TDLo = 4500 mg/kg (female 6-15 day(s) after conception) Effects on Embryo or Fetus - fetotoxicity (except death, e.g., stunted fetus) and Specific Developmental Abnormalities - other developmental abnormalities.; Intraperitoneal, rat: TDLo = 5925 mg/kg (female 1-15 day(s) after conception) Specific Developmental Abnormalities - musculoskeletal system and cardiovascular (circulatory) system.
Reproductive Effects: No information available.
Neurotoxicity: No information available.
Mutagenicity: Micronucleus Test: Human, Lymphocyte = 30 mg/L.; Cytogenetic Analysis: Hamster, Ovary = 30 mg/L.; Sister Chromatid Exchange: Hamster, Ovary = 15 mg/L.
Other Studies: Standard Draize Test: Administration onto the skin (rabbit) = 495 mg (Mild).; Standard Draize Test: Administration int o the eye (rabbit) = 100 mg (Mild).

Section 12 - Ecological Information

Ecotoxicity: Fish: Rainbow trout: LC50 = 1.60 mg/L; 96 Hr; Flow-through at 15 CFish: Fathead Minnow: LC50 = 6.14 mg/L; 96 Hr; Flow-through at 24.5 CWater flea Daphnia: EC50 = 2.16-8.60 mg/L; 48 Hr; UnspecifiedBacteria: Phytobacterium phosphoreum: EC50 = 0.93 mg/L; 30 min; Microtox testFish: Pink salmon: LC50 = 1.24 mg/L; 96 Hr; (fry) Static bioassay at 12°C Releases into water are lost due to volatilization, photolysis, adsorption, and biodegradation. The principal loss processes will depend on local conditions but half-lives can be expected to range from a couple of days to a few months. When adsorbed to sediment, biodegradation occurs much more rapidly than in the overlying water column. When spilled on land, naphthalene is adsorbed moderately to soil and undergoes biodegradation. However, in some cases it will appear in the groundwater where biodegradation still may occur if conditions are aerobic.
Environmental: Bioconcentration occurs to a moderate extent but since depuration and metabolism readily proceed in aquatic organisms, this is a short term problem. transport and disposal of fuel oil, coal tar, etc. In the atmosphere, naphthalene rapidly photodegrades (half-life 3-8 hr). Naphthalene shows low biological oxygen demand and is expected to cause little O2 depletion in aquatic systems.
Physical: Log P (oct) = 3.01 - 3.59
Other: Harmful to aquatic life in very low concentrations.

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: CAS# 91-20-3: waste number U165.

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	NAPHTHALENE, CRUDE				NAPHTHALENE
Hazard Class:	4.1				4.1
UN Number:	UN1334				UN1334
Packing Group:	III				III

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 91-20-3 is listed on the TSCA inventory.
Health & Safety Reporting List
CAS# 91-20-3: Effective 6/1/87; Sunset 6/1/97
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.
SARA

CERCLA Hazardous Substances and corresponding RQs
CAS# 91-20-3: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 91-20-3: acute, chronic, flammable.
Section 313
This material contains Naphthalene (CAS# 91-20-3, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 91-20-3 is listed as a hazardous air pollutant (HAP). This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 91-20-3 is listed as a Hazardous Substance under the CWA. CAS# 91-20-3 is listed as a Priority Pollutant under the Clean Water Act. CAS# 91-20-3 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 91-20-3 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act: WARNING: This product contains Naphthalene, a chemical known to the state of California to cause cancer.
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:
N
Risk Phrases:
R 22 Harmful if swallowed.
R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 36/37 Wear suitable protective clothing and gloves.
S 60 This material and its container must be disposed of as hazardous waste.
S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

WGK (Water Danger/Protection)
CAS# 91-20-3: 2
Canada - DSL/NDSL
CAS# 91-20-3 is listed on Canada's DSL List.
Canada - WHMIS
This product does not have a WHMIS classification.
Canadian Ingredient Disclosure List
CAS# 91-20-3 is listed on the Canadian Ingredient Disclosure List.
Exposure Limits
CAS# 91-20-3: OEL-ARAB Republic of Egypt:TWA 10 ppm (50 mg/m3) OEL-AUSTRALIA:TWA 10 ppm (50 mg/m3);STEL 15 ppm (75 mg/m3) OEL-BELGIUM:TWA 10 ppm (52 mg/m3);STEL 15 ppm (79 mg/m3) OEL-DENMARK:TWA 10 ppm (50 mg/m3) OEL-FINLAND:TWA 10 ppm (50 mg/m3);STEL 20 ppm (10 mg/m3) OEL-FRANCE:TWA 10 ppm (50 mg/m3) OEL-GERMANY:TWA 10 ppm (50 mg/m3) OEL-HUNGARY:TWA 40 mg/m3;STEL 80 mg/m3;Skin OEL-THE NETHERLANDS:TWA 10 ppm (50 mg/m3) OEL-THE PHILIPPINES:TWA 10 ppm (50 mg/m3) OEL-POLAND:TWA 20 mg/m3 OEL-RUSSIA:STEL 20 mg/m3 OEL-SWITZERLAND:TWA 10 ppm (50 mg/m3) OEL-UNITED KINGDOM:TWA 10 ppm (50 mg/m3);STEL 15 ppm (75 mg/m3) OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

Section 16 - Additional Information

MSDS Creation Date: 5/14/1999
Revision #6 Date: 2/06/2004

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.

MSDS Number: **N3660** * * * * * *Effective Date: 07/02/02* * * * * *Supercedes: 07/13/00*

MSDS **Material Safety Data Sheet**

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

Mallinckrodt CHEMICALS J.T.Baker

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.

NITRIC ACID, 50-70%

1. Product Identification

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 50%; Nitric Acid 65%; nitric acid 69-70%
CAS No.: 7697-37-2
Molecular Weight: 63.01
Chemical Formula: HNO3
Product Codes:
J.T. Baker: 411D, 412D, 5371, 5796, 5801, 5826, 5856, 5876, 5896, 9597, 9598, 9600, 9601, 9602, 9603, 9604, 9606, 9607, 9608, 9610, 9616, 9617, 9670
Mallinckrodt: 1409, 2704, 2716, 6623, H862, H993, H998, V077, V633, V650

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	50 - 70%	Yes
Water	7732-18-5	30 - 50%	No

3. Hazards Identification

Emergency Overview

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

LUNG AND TOOTH DAMAGE.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 3 - Severe (Oxidizer)
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

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

Inhalation:
Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.
Ingestion:
Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.
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 and lung damage. 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.

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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. 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:
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:
Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.
Fire Extinguishing Media:
Water spray may be used to keep fire exposed containers cool. Do not get water inside container.
Special Information:
Increases the flammability of combustible, organic and readily oxidizable materials. 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. 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. 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:
-OSHA Permissible Exposure Limit (PEL):

2 ppm (TWA), 4 ppm (STEL)
-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, airlined hood, or full-facepiece self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal. 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.

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9. Physical and Chemical Properties

Appearance:
Colorless to yellowish liquid.
Odor:
Suffocating, acrid.
Solubility:
Infinitely soluble.
Specific Gravity:
1.41
pH:
1.0 (0.1M solution)
% Volatiles by volume @ 21C (70F):
100 (as water and acid)
Boiling Point:
122C (252F)
Melting Point:
-42C (-44F)
Vapor Density (Air=1):
2-3
Vapor Pressure (mm Hg):
48 @ 20C (68F)
Evaporation Rate (BuAc=1):
No information found.

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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 nitrogen oxides fumes and hydrogen nitrate. Will react with water or steam to produce heat and toxic and corrosive fumes.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.
Conditions to Avoid:
Light and heat.

11. Toxicological Information

Nitric acid: Inhalation rat LC50: 244 ppm (NO2)/30M; Investigated as a mutagen, reproductive effector. Oral (human) LDLo: 430 mg/kg.

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

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
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 NOT MORE THAN 70% NITRIC ACID)
Hazard Class: 8

UN/NA: UN2031
Packing Group: II
Information reported for product/size: 150LB

International (Water, I.M.O.)

Proper Shipping Name: NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 150LB

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

Proper Shipping Name: NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 150LB

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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	Korea	--Canada-- 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- RQ	TPQ	------SARA 313------ 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- 261.33	-TSCA- 8(d)
Nitric Acid (7697-37-2)	1000	No	No
Water (7732-18-5)	No	No	No

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

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16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0** Other: **Oxidizer**
Label Hazard Warning:
POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR 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.
Keep from contact with clothing and other combustible materials.
Do not store near combustible materials.
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: 3.
Disclaimer:
****

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****

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

Print Date: 09/25/2001

Material Safety Data Sheet

Buffer solutions, pH 3.00, 4.00, and 5.00, Carbon Standard 1000ppm (organic), Potassium Hydrogen Phthalate Solutions

Section 1 - Chemical Product and Company Identification

MSDS Name:

Buffer solutions, pH 3.00, 4.00, and 5.00, Carbon Standard 1000ppm (organic), Potassium Hydrogen Phthalate Solutions

Catalog Numbers:

LC12250, LC12270, LC12280, LC12300, LC12910, LC18700

Synonyms:

acid phthalate buffers, potassium biphthalate buffers, potassium dihydrogen phthalate buffers, neutralized phthalate buffers, potassium acid phthalate.

Company Identification:

LabChem, Inc.
200 William Pitt Way
Pittsburgh, PA 15238

Company Phone Number:

(412) 826-5230

Emergency Phone Number:

(412) 826-5230

CHEMTREC Phone Number:

800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7732-18-5	Water	balance
877-24-7	Potassium hydrogen phthalate	>1
50-00-0	Formaldehyde	0.04
7647-01-0	Hydrogen chloride	0-0.1
1310-73-2	Sodium hydroxide	0-0.1

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: colorless - may be color coded (dye) according to pH
Caution! May cause eye and skin irritation.
Target Organs: none known.

Potential Health Effects

Material Safety Data Sheet

Buffer solutions, pH 3.00, 4.00, and 5.00, Carbon Standard 1000ppm (organic), Potassium Hydrogen Phthalate Solutions

Eye:

May cause eye irritation.

Skin:

May cause skin irritation.

Ingestion:

Causes gastrointestinal irritation with nausea, vomiting and diarrhea.

Inhalation:

May cause respiratory tract irritation.

Chronic:

May cause dermatitis and conjunctivitis.

Section 4 - First Aid Measures

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids until no evidence of chemical remains. Get medical aid at once.

Skin:

Get medical aid. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes.

Ingestion:

Give conscious victim 2-4 cupfuls of milk or water. Get medical aid at once. Induce vomiting (touch finger to back of throat) keeping head lower than hips (prevent aspiration into lungs).

Inhalation:

Give artificial respiration if necessary. Get medical aid. Keep victim warm, at rest. Move victim to fresh air.

Notes to Physician:

Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:

Negligible fire and explosion hazard when exposed to heat or flame. Move container if possible, avoid breathing vapors or dust.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature:

No information found.

Flash Point:

No information found.

NFPA Rating:

CAS# 7732-18-5: Not published.
CAS# 877-24-7: Not published.
CAS# 60-00-0 gas: health-3; flammability-4; reactivity-0; 87% methanol-free: health-3; flamma
CAS# 7647-01-0: Not published.
CAS# 1310-73-2: Not published.

Explosion Limits:

Lower: Upper:

Print Date: 9/25/2001

Material Safety Data Sheet

Buffer solutions, pH 3.00, 4.00, and 5.00, Carbon Standard 1000ppm (organic), Potassium Hydrogen Phthalate Solutions

Section 6 - Accidental Released Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spills with absorbent (vermiculite, sand, fuller's earth) and place in plastic bags for later disposal. Keep out of sewers/drains.

Section 7 - Handling and Storage

Handling:

Wash thoroughly after handling. Avoid breathing dust, vapor, mist, or gas.

Storage:

Store capped at room temperature. Protect from heat and incompatibles.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Provide local exhaust or general dilution ventilation.

Exposured Limits

Chemical Name:	ACGIH	NIOSH	OSHA
Water	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.
Potassium hydrogen phthalate	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.
Formaldehyde	None of the components are on this list.	0.016 ppm TWA; NIOSH Potential Occupational Carcinogen - see Appendix A	0.75 ppm TWA PEL; 2 ppm STEL; 0.5 ppm TWA action level; irritant and potential c;
Hydrogen chloride	None of the components are on this list.	None of the components are on this list.	C 5 ppm; C 7 mg/m3;
Sodium hydroxide	None of the components are on this list.	None of the components are on this list.	2 mg/m3 TWA;

OSHA Vacated PELs

Formaldehyde: 3 ppm TWA (unless specified in 1910.1048)
Formaldehyde: 3 ppm TWA (unless specified in 1910.1048)
Formaldehyde: 3 ppm TWA (unless specified in 1910.1048)

Personal Protective Equipment

Eyes:

Do not wear contact lenses when working with chemicals. An eye wash fountain should be available in the immediate work area. Wear splash-proof safety goggles.

Skin:

Wear appropriate protective gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Material Safety Data Sheet

Buffer solutions, pH 3.00, 4.00, and 5.00, Carbon Standard 1000ppm (organic), Potassium Hydrogen Phthalate Solutions

Respirators:

Not required for normal use. Firefighting--any self-contained breathing apparatus with full facepiece operated in pressure-demand mode.

Section 9 - Physical and Chemical Properties

Physical State:	Clear liquid
Color:	colorless - may be color coded (dye) according to pH
Odor:	odorless
pH:	No information found.
Vapor Pressure:	14mm Hg @ 20°C
Vapor Density:	0.7 (water)
Evaporation Rate:	< ether
Viscosity:	No information found.
Boiling Point:	> 212°F (> 100.00°C)
Freezing/Melting Point:	< 32°F (< 0.00°C)
Decomposition Temperature:	No information found.
Solubility in water:	Soluble.
Specific Gravity/Density:	1.0
Molecular Formula:	No information found.
Molecular Weight	No information found.

Section 10 - Stability and Reactivity

Chemical Stability:

Stable under normal temperatures and pressures up to boiling point.

Conditions to Avoid:

Incompatible materials.

Incompatibilities with Other Materials

Oleum, sodium, water reactive substances (e.g. sulfuric acid, sodium metal, potassium metal, calcium carbide).

Hazardous Decomposition Products

Chlorine, formaldehyde.

Hazardous Polymerization

Has not been reported

Section 11 - Toxicological Information

RTECS:

CAS# 7732-18-5: ZC0110000.
CAS# 877-24-7 unlisted.
CAS# 60-00-0: LP8925000.
CAS# 7647-01-0: MW4025000.
CAS# 1310-73-2: WB4900000.

Material Safety Data Sheet

Buffer solutions, pH 3.00, 4.00, and 5.00, Carbon Standard 1000ppm (organic), Potassium Hydrogen Phthalate Solutions

LD50/LC50:

CAS# 7732-18-5:
Oral, rat: LD50 = >90 mL/kg.
CAS# 877-24-7:
No information found. CAS# 60-00-0:
Inhalation, mouse: LC50 = 400 mg/m3/2H
Inhalation, rat: LC50 = 203 mg/m3
Oral, mouse: LD50 = 42 mg/kg
Oral, rat: LD50 = 100 mg/kg
Skin, rabbit: LD50 = 270 mg/kg.
CAS# 7647-01-0:
Inhalation, mouse: LC50 = 1108 ppm/1H
Inhalation, rat: LC50 = 3124 ppm/1H
Oral, rabbit: LD50 = 900 mg/kg.
CAS# 1310-73-2:
No information found.

Carcinogenicity:

CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 877-24-7: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 60-00-0
ACGIH: A2 - suspected human carcinogen
California: carcinogen; initial date 1/1/88
NIOSH: occupational carcinogen
NTP: Suspect carcinogen
OSHA: Possible Select carcinogen
IARC: Group 2A carcinogen
CAS# 7647-01-0
ACGIH: Not listed.
California: Not listed.
NIOSH: Not listed.
NTP: Not listed.
OSHA: Not listed.
IARC: Group 3
CAS# 1310-73-2: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

Epidemiology:

Potassium hydrogen phthalate is an eye, skin, and mucous membrane irritant.

Teratogenicity:

Reproductive:

Mutagenicity

Neurotoxicity

Section 12 - Ecological Information

No information found.

Material Safety Data Sheet

Buffer solutions, pH 3.00, 4.00, and 5.00, Carbon Standard 1000ppm (organic), Potassium Hydrogen Phthalate Solutions

Section 13 - Disposal Considerations

Dispose of in accordance with federal, state, and local regulations.

Section 14 - Transport Information

US DOT

Shipping Name: No information found.

Hazard Class:

UN Number:

Packing Group:

Section 15 - Regulatory Information

US Federal

TSCA

CAS# 7732-18-5 is listed on the TSCA inventory.
CAS# 877-24-7 is listed on the TSCA inventory.
CAS# 50-00-0 is listed on the TSCA inventory.
CAS# 7647-01-0 is listed on the TSCA inventory.
CAS# 1310-73-2 is listed on the TSCA inventory.

SARA Reportable Quantities (RQ)

CAS# 50-00-0: final RQ = 100 pounds (45.4 kg)
CAS# 7647-01-0: final RQ = 5000 pounds (2270 kg)
CAS# 1310-73-2: final RQ = 1000 pounds (454 kg)

CERCLA/SARA Section 313

Formaldehyde is not at a high enough concentration to be reportable under Section 313.
This material contains Hydrogen chloride (CAS# 7647-01-0, 0-0.1%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

OSHA - Highly Hazardous

CAS# 50-00-0 is considered highly hazardous by OSHA.
CAS# 7647-01-0 is considered highly hazardous by OSHA.

US State

State Right to Know

Formaldehyde can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
Hydrogen chloride can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
Sodium hydroxide can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California Regulations

European/International Regulations

Print Date: 9/25/2001

Material Safety Data Sheet

Buffer solutions, pH 3.00, 4.00, and 5.00, Carbon Standard 1000ppm (organic), Potassium Hydrogen Phthalate Solutions

Canadian DSL/NDSL

CAS# 7732-18-5 is listed on Canada's DSL List.
CAS# 877-24-7 is listed on Canada's DSL List.
CAS# 50-00-0 is listed on Canada's DSL List.
CAS# 7647-01-0 is listed on Canada's DSL List.
CAS# 1310-73-2 is listed on Canada's DSL List.

Canada Ingredient Disclosured List

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosured List.
CAS# 877-24-7 is not listed on Canada's Ingredient Disclosured List.
CAS# 50-00-0 is listed on Canada's Ingredient Disclosured List.
CAS# 7647-01-0 is listed on Canada's Ingredient Disclosured List.
CAS# 1310-73-2 is listed on Canada's Ingredient Disclosured List.

Section 16 - Other Information

MSDS Creation Date: February 14, 1998
Revision Date: August 7, 2001

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for this application.

Print Date: 9/25/2001

Material Safety Data Sheet
Buffer Solution pH 10.0

Section 1 - Chemical Product and Company Identification

MSDS Name:

Buffer Solution pH 10.0

Catalog Numbers:

LC12500, LC12510

Synonyms:

Company Identification:

LabChem, Inc.
200 William Pitt Way
Pittsburgh, PA 15238

Company Phone Number:

(412) 826-5230

Emergency Phone Number:

(412) 826-5230

CHEMTREC Phone Number:

800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7732-18-5	Water	balance
1310-73-2	Sodium hydroxide	<1
1303-96-4	Borates, tetra, sodium salts, decahydrate	0.48
Not available.	Blue dye added to LC12510	

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: colorless LC12510 color coded blue
Caution! May cause eye and skin irritation. May cause respiratory and digestive tract irritation.
Target Organs: none known.

Potential Health Effects

Eye:

May cause eye irritation.

Skin:

May cause skin irritation.

Material Safety Data Sheet
Buffer Solution pH 10.0

Ingestion:

Ingestion may cause severe abdominal pain, vomiting, irritation and burns to gastrointestinal tract.

Inhalation:

May cause respiratory tract irritation.

Chronic:

May cause dermatitis and conjunctivitis. Prolonged inhalation may cause bronchial irritation, coughing, and bronchial pneumonia. Sodium borate--prolonged inhalation may cause bronchitis, daryngitis. Repeated ingestion may cause anorexia, irritation to gastrointestinal tract, nausea, vomiting, diarrhea, skin rashes.

Section 4 - First Aid Measures

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids until no evidence of chemical remains. Get medical aid at once.

Skin:

Get medical aid. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes.

Ingestion:

Do NOT induce vomiting. Get medical aid. Give conscious victim large quantities of water to dilute.

Inhalation:

Give artificial respiration if necessary. Get medical aid. Keep victim warm, at rest. Move victim to fresh air.

Notes to Physician:

Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:

Negligible fire and explosion hazard when exposed to heat or flame. Move container if possible, avoid breathing vapors or dust. May produce toxic vapors of sodium oxide.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature:

No information found.

Flash Point:

No information found.

NFPA Rating:

CAS# 7732-18-5: Not published.
CAS# 1310-73-2: Not published.
CAS# 1303-96-4: Not published.
CAS# Not available.: Not published.

Explosion Limits:

Lower: Upper:

Print Date: 9/25/2001

Material Safety Data Sheet
Buffer Solution pH 10.0

Section 6 - Accidental Released Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spills with absorbent (vermiculite, sand, fuller's earth) and place in plastic bags for later disposal.

Section 7 - Handling and Storage

Handling:

Wash thoroughly after handling. Avoid breathing dust, vapor, mist, or gas.

Storage:

Store capped at room temperature. Protect from heat and incompatibles.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Provide local exhaust or general dilution ventilation.

Exposure Limits

Chemical Name:	ACGIH	NIOSH	OSHA
Water	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.
Sodium hydroxide	None of the components are on this list.	None of the components are on this list.	2 mg/m3 TWA;
Borates, tetra, sodium salts, decahydrate	1 mg/m3 TWA (anhydrous); 5 mg/m3 TWA (decahydrate); 1 mg/m3 TWA (pentahydrate)	5 mg/m3 TWA	None of the components are on this list.

OSHA Vacated PELs

Borates, tetra, sodium salts, decahydrate: 10 mg/m3 TWA
Borates, tetra, sodium salts, decahydrate: 10 mg/m3 TWA

Personal Protective Equipment

Eyes:

Do not wear contact lenses when working with chemicals. An eye wash fountain should be available in the immediate work area. Wear splash-proof safety goggles.

Skin:

Wear neoprene, natural nitril rubber, or PVC gloves.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Self contained breathing apparatus with full facepiece. Use mist respirator, routine levels.

Material Safety Data Sheet
Buffer Solution pH 10.0

Section 9 - Physical and Chemical Properties

Physical State: Clear liquid
Color: colorless - LC12510 color coded blue
Odor: odorless
pH: 10
Vapor Pressure: No information found.
Vapor Density: No information found.
Evaporation Rate: No information found.
Viscosity: No information found.
Boiling Point: >100°C (>212.00°F)
Freezing/Melting Point: <0°C (<32.00°F)
Decomposition Temperature: No information found.
Solubility in water: Soluble.
Specific Gravity/Density: 1.0
Molecular Formula: No information found.
Molecular Weight No information found.

Section 10 - Stability and Reactivity

Chemical Stability:
Stable under normal temperatures and pressures.

Conditions to Avoid:
Incompatible materials.

Incompatibilities with Other Materials
Water reactive substances (e.g. sulfuric acid, sodium metal, potassium metal, calcium carbide).

Hazardous Decomposition Products
Sodium oxide.

Hazardous Polymerization
Has not been reported

Section 11 - Toxicological Information

RTECS:
CAS# 7732-18-5: ZC0110000.
CAS# 1310-73-2: WB4900000.
CAS# 1303-96-4: VZ2275000.

LD50/LC50:
CAS# 7732-18-5:
Oral, rat: LD50 = >90 mL/kg.
CAS# 1310-73-2:
No information found. CAS# 1303-96-4:
Oral, mouse: LD50 = 2 gm/kg
Oral, rat: LD50 = 2660 mg/kg.

Carcinogenicity:

CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 1310-73-2: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 1303-96-4: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

Epidemiology:

Teratogenicity:

Reproductive:

Mutagenicity

Neurotoxicity

Section 12 - Ecological Information

No information found.

Section 13 - Disposal Considerations

Dispose of in accordance with federal, state, and local regulations.

Section 14 - Transport Information

US DOT

Shipping Name: No information found.

Hazard Class:

UN Number:

Packing Group:

Section 15 - Regulatory Information

US Federal

TSCA

CAS# 7732-18-5 is listed on the TSCA Inventory.
CAS# 1310-73-2 is listed on the TSCA Inventory.
CAS# 1303-96-4 is listed on the TSCA Inventory.
CAS# Not available. is not listed on the TSCA Inventory. It is for research and development use only.

SARA Reportable Quantities (RQ)

CAS# 1310-73-2: final RQ = 1000 pounds (454 kg)

CERCLA/SARA Section 313

None of the components are on this list.

OSHA - Highly Hazardous

None of the components are on this list.

US State

Material Safety Data Sheet
Buffer Solution pH 10.0

State Right to Know

Sodium hydroxide can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
Borates, tetra, sodium salts, decahydrate can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California Regulations

European/International Regulations

Canadian DSL/NDSL

CAS# 7732-18-5 is listed on Canada's DSL List.
CAS# 1310-73-2 is listed on Canada's DSL List.
CAS# 1303-96-4 is listed on Canada's DSL List.

Canada Ingredient Disclosure List

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.
CAS# 1310-73-2 is listed on Canada's Ingredient Disclosure List.
CAS# 1303-96-4 is listed on Canada's Ingredient Disclosure List.
CAS# Not available. is not listed on Canada's Ingredient Disclosure List.

Section 16 - Other Information

MSDS Creation Date: July 14, 1998
Revision Date: August 07, 2001

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for this application.

Print Date: 09/25/2001

Material Safety Data Sheet

Buffer solution ph 6.0 through 8.0 and pH 13

Section 1 - Chemical Product and Company Identification

MSDS Name:

Buffer solution ph 6.0 through 8.0 and pH 13

Catalog Numbers:

LC12330, LC12350, LC12370, LC12380, LC12400, LC12410, LC12420, LC18520, LC18560

Synonyms:

phosphate buffer solutions, pH adjusted

Company Identification:

LabChem, Inc.
200 William Pitt Way
Pittsburgh, PA 15238

Company Phone Number:

(412) 826-5230

Emergency Phone Number:

(412) 826-5230

CHEMTREC Phone Number:

800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7732-18-5	Water	balance
7558-79-4	Sodium phosphate dibasic	<1
7778-77-0	Dihydrogen potassium phosphate	<1
1310-73-2	Sodium hydroxide	<1

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: colorless - may be color coded (dye) according to pH
Caution! May cause eye and skin irritation. May cause respiratory tract irritation.
Target Organs: none known.

Potential Health Effects

Eye:

May cause eye irritation. May result in corneal injury.

Skin:

May cause skin irritation.

Material Safety Data Sheet
Buffer solution ph 6.0 through 8.0 and pH 13

Ingestion:

Ingestion can result in abdominal pain, vomiting, diarrhea, shock, coma, and death.

Inhalation:

Mild exposure may cause irritation of the nose (coughing, sneezing).

Chronic:

May cause dermatitis and conjunctivitis. Repeated or prolonged exposure may cause irritation to respiratory tract. Chronic intoxication from sodium/potassium phosphates has not been reported in humans.

Section 4 - First Aid Measures

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids until no evidence of chemical remains. Get medical aid at once.

Skin:

Get medical aid. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes.

Ingestion:

Get medical aid at once. Medical personnel may do esophagoscopy, irrigate injured area with 1% acetic acid to neutralize alkali. Give conscious victim water or milk immediately to dilute alkali, allowing vomiting to occur. Do not use gastric lavage or emesis if tissue corrosion has occurred. Medical personnel should examine for corrosive injury to mouth or throat.

Inhalation:

Give artificial respiration if necessary. Get medical aid. Keep victim warm, at rest. Move victim to fresh air.

Notes to Physician:

Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:

Negligible fire and explosion hazard when exposed to heat or flame. Move container if possible, avoid breathing vapors or dust.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature:

No information found.

Flash Point:

No information found.

NFPA Rating:

CAS# 7732-18-5: Not published.
CAS# 7558-79-4: Not published.
CAS# 7778-77-0: Not published.
CAS# 1310-73-2: Not published.

Explosion Limits:

Lower: Upper:

Print Date: 09/25/2001

Material Safety Data Sheet

Buffer solution ph 6.0 through 8.0 and pH 13

Section 6 - Accidental Released Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spills with absorbent (vermiculite, sand, fuller's earth) and place in plastic bags for later disposal. Small spills may be diluted with water and flushed away.

Section 7 - Handling and Storage

Handling:

Wash thoroughly after handling. Avoid breathing dust, vapor, mist, or gas.

Storage:

Store capped at room temperature. Protect from heat and incompatibles.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Provide local exhaust or general dilution ventilation.

Exposure Limits

Chemical Name:	ACGIH	NIOSH	OSHA
Water	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.
Sodium phosphate dibasic	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.
Dihydrogen potassium phosphate	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.
Sodium hydroxide	None of the components are on this list.	None of the components are on this list.	2 mg/m3 TWA;

OSHA Vacated PELs

Personal Protective Equipment

Eyes:

Do not wear contact lenses when working with chemicals. An eye wash fountain should be available in the immediate work area. Wear splash-proof safety goggles.

Skin:

Wear appropriate protective gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Not required for normal use. Firefighting--any self-contained breathing apparatus with full facepiece operated in pressure-demand mode.

Print Date: 09/25/2001

Material Safety Data Sheet
Buffer solution ph 6.0 through 8.0 and pH 13

Section 9 - Physical and Chemical Properties

Physical State:	Clear liquid
Color:	colorless - may be color coded (dye) according to pH
Odor:	odorless
pH:	6-8
Vapor Pressure:	14mm Hg @ 20°C
Vapor Density:	0.7 (H20=1)
Evaporation Rate:	>1 (ether=1)
Viscosity:	No information found.
Boiling Point:	> 212°F (> 100.00°C)
Freezing/Melting Point:	< 32°F (< 0.00°C)
Decomposition Temperature:	No information found.
Solubility in water:	Soluble.
Specific Gravity/Density:	1.0
Molecular Formula:	No information found.
Molecular Weight	No information found.

Section 10 - Stability and Reactivity

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

Incompatible materials.

Incompatibilities with Other Materials

Metals.

Hazardous Decomposition Products

Oxides of phosphorus, toxic fumes of sodium oxide.

Hazardous Polymerization

Has not been reported

Section 11 - Toxicological Information

RTECS:

CAS# 7732-18-5: ZC0110000.
CAS# 7558-79-4: WC4500000.
CAS# 7778-77-0 unlisted.
CAS# 1310-73-2: WB4900000.

Material Safety Data Sheet
Buffer solution ph 6.0 through 8.0 and pH 13

LD50/LC50:

CAS# 7732-18-5:
Oral, rat: LD50 = >90 mL/kg.
CAS# 7558-79-4:
Oral, rat: LD50 = 17 gm/kg.
CAS# 7778-77-0:
Not information found. CAS# 1310-73-2:
Not information found.

Carcinogenicity:

CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 7558-79-4: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 7778-77-0: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 1310-73-2: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

Epidemiology:

Solutions containing sodium phosphate dibasic and potassium phosphate monobasic are skin, eye, and mucous membrane irritants.

Teratogenicity:

Reproductive:

Mutagenicity

Neurotoxicity

Section 12 - Ecological Information

Not information found.

Section 13 - Disposal Considerations

Dispose of in accordance with federal, state, and local regulations.

Section 14 - Transport Information

US DOT

Shipping Name: Not information found.
Hazard Class:
UN Number:
Packing Group:

Section 15 - Regulatory Information

US Federal

Material Safety Data Sheet
Buffer solution ph 6.0 through 8.0 and pH 13

TSCA

CAS# 7732-18-5 is listed on the TSCA inventory.
CAS# 7558-79-4 is listed on the TSCA inventory.
CAS# 7778-77-0 is listed on the TSCA inventory.
CAS# 1310-73-2 is listed on the TSCA inventory.

SARA Reportable Quantities (RQ)

CAS# 7558-79-4: final RQ = 5000 pounds (2270 kg)
CAS# 1310-73-2: final RQ = 1000 pounds (454 kg)

CERCLA/SARA Section 313

None of the components are on this list.

OSHA - Highly Hazardous

None of the components are on this list.

US State

State Right to Know

Sodium phosphate dibasic can be found on the following state Right-to-Know lists: California, New Jersey, Pennsylvania, Massachusetts.
Sodium hydroxide can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California Regulations

European/International Regulations

Canadian DSL/NDSL

CAS# 7732-18-5 is listed on Canada's DSL List.
CAS# 7558-79-4 is listed on Canada's DSL List.
CAS# 7778-77-0 is listed on Canada's DSL List.
CAS# 1310-73-2 is listed on Canada's DSL List.

Canada Ingredient Disclosure List

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.
CAS# 7558-79-4 is not listed on Canada's Ingredient Disclosure List.
CAS# 7778-77-0 is not listed on Canada's Ingredient Disclosure List.
CAS# 1310-73-2 is listed on Canada's Ingredient Disclosure List.

Section 16 - Other Information

MSDS Creation Date: February 15, 1998
Revision Date: August 7, 2001

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for this application.

LONE STAR INDUSTRIES INC -- PORTLAND CEMENT -- 5610-00-242-3792

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MSDS Safety Information

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FSC: 5610
NIIN: 00-242-3792
MSDS Date: 08/10/1994
MSDS Num: CHKFN
Tech Review: 07/01/1998
Product ID: PORTLAND CEMENT
Responsible Party
Cage: LONES
Name: LONE STAR INDUSTRIES INC
Address: 8902 VINCENNES CIRCLE SUITE A
Box: 681250
City: INDIANAPOLIS IN 46268-1250 US
Info Phone Number: 800-782-7236
Emergency Phone Number: 317-653-6766
Review Ind: N

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Contractor Summary

==========

Cage: LONES
Name: LONE STAR INDUSTRIES INC
Box: 681250
City: INDIANAPOLIS IN 46268-1250 US
Phone: 713-875-5005
Cage: LSTAR
Name: LONE STAR INDUSTRIES INC
Box: UNKNOW
City: UNKNOWN NK 00000
Country: NK

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Item Description Information

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Item Manager: GSA
Item Name: CEMENT,PORTLAND
Specification Number: NK
Type/Grade/Class: NK
Unit of Issue: BG
Quantitative Expression: 00000000094LB
UI Container Qty: 0

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Ingredients

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Cas: 12168-85-3
Name: TRICALCIUM SILICATE; (3CAO.SIO*2)
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)
Ozone Depleting Chemical: N

Cas: 10034-77-2
Name: DICALCIUM SILICATE; (2CAO.SIO*2)
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)
Ozone Depleting Chemical: N

Cas: 12042-78-3
Name: TRICALCIUM ALUMINATE; (3CAO.AL*2O*3)
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)
Ozone Depleting Chemical: N

Cas: 12068-35-8
Name: TETRACALCIUM ALUMINOFERRATE; (CALCIUM ALUMINOFERRITE, A SOLID SOLUTION)

OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)
Ozone Depleting Chemical: N

Cas: 13397-24-5
RTECS #: MG2360000
Name: GYPSUM; (CASO*4-2H*2O)
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)
Ozone Depleting Chemical: N

Name: HYDRATED LIME
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Cas: 1305-78-8
RTECS #: EW3100000
Name: CALCIUM OXIDE; (CAO)
OSHA PEL: 5 MG/M3
ACGIH TLV: 2 MG/M3
Ozone Depleting Chemical: N

Cas: 1309-48-4
RTECS #: OM3850000
Name: MAGNESIUM OXIDE; (MGO)
OSHA PEL: 15 MG/M3 PARTICULATE
ACGIH TLV: 10 MG/M3 FUME
Ozone Depleting Chemical: N

Cas: 7757-82-6
RTECS #: WE1650000
Name: SODIUM SULFATE; (NA*2SO*4)
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)
Ozone Depleting Chemical: N

Cas: 7778-80-5
RTECS #: TT5900000
Name: POTASSIUM SULFATE; (K*2SO*4)
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)
Ozone Depleting Chemical: N

Name: PORTLAND CEMENT MAY CONTAIN INGREDIENT 12 - 14.
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Name: INSOLUBLE MATTER; (INSOLUBLE RESIDUE)
% by Wt: 0.75
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Cas: 60676-86-0
RTECS #: VV7328000
Name: SILICA, CRYSTALLINE-FUSED; (FREE CRYSTALLINE SILICA)
% by Wt: 0.1
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)
Ozone Depleting Chemical: N

Cas: 7440-47-3
RTECS #: GB4200000
Name: CHROMIUM (SARA 313) (CERCLA)
% by Wt: TRACE
OSHA PEL: 1 MG/M3
ACGIH TLV: 0.5 MG/M3

EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB
Ozone Depleting Chemical: N

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Health Hazards Data
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LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry Inds - Inhalation: YES
Skin: YES
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: YES
OSHA: NO
Effects of Exposure: ACUTE:WET PORTLAND CEMENT LIME BLEND, ESPECIALLY AS INGREDIENT IN PLASTIC (UNHARDENED) CONCRETE, MORTAR OR SLURRIES, CAN DRY SKIN AND CAUSE SEVERE ALKALI BURNS. PORTLAND/LIME DUST CAN IRRITATE EYES AN D UPPER RESPIRATORY SYSTEM. CHRONIC:PORTLAND CEMENT LIME BLEND DUST CAN CAUSE INFLAMMATION OF LINING (EFTS OF OVEREXP)
Explanation Of Carcinogenicity: CRYSTALLINE SILICA-FUSED:IARC MONOGRAPHS, SUPPLEMENT, VOL 7, PG 341, 1987:GROUP 2A.
Signs And Symptions Of Overexposure: HLTH HAZ:TISSUE OF INTERIOR OF NOSE AND INFLAMMATION OF CORNEA. INDIVIDUALS WHO ARE ALLERGIC TO CHROMIUM MAY DEVELOP AN ALLERGIC DERMATITIS. FREE CRYSTALLINE SILICA CAN CAUSE CANCER. EXPOSURE TO PORTL AND/LIME CEMENT CAN AFFECT THE SKIN, EYES AND MUCOUS MEMBRANES.
Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.
First Aid: INGEST:CALL MD IMMEDIATELY (FP N). INHAL:REMOVE TO FRESH AIR. SUPPORT BREATHING (GIVE O*2/ARTF RESP) (FP N). EYES:IRRIGATE (FLOOD) IMMEDIATELY & REPEATEDLY W/CLEAN WATER FOR AT LEAST 15 MINUTES. GET P ROMPT MEDICAL ATTENTION. SKIN:WASH EXPOSED AREAS W/SOAP & WATER. APPLY STERILE DRESSINGS. GET PROMPT MEDICAL ATTENTION.

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Handling and Disposal
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Spill Release Procedures: IF PORTLAND CEMENT LIME BLEND IS SPILLED, IT CAN BE CLEANED UP USING DRY METHODS THAT DO NOT DISPERSE DUST INTO THE AIR. AVOID BREATHING DUST. EMERGENCY PROCEDURES ARE NOT REQUIRED.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Methods: DISPOSAL MUST BE I/A/W FEDERAL, STATE & LOCAL REGULATIONS (FP N). PORTLAND CEMENT LIME BLEND CAN BE TREATED AS A COMMON WASTE FOR DISPOSAL, OR RETURNED TO CONTAINER FOR LATER USE IF IT IS NOT CONTAMIN ATED OR WET.
Handling And Storage Precautions: NONE SPECIFIED BY MANUFACTURER.
Other Precautions: NONE SPECIFIED BY MANUFACTURER.

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Fire and Explosion Hazard Information
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Extinguishing Media: MEDIA SUITABLE FOR SURROUNDING FIRE (FP N).
Fire Fighting Procedures: USE NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire/Explosion Hazard: PORTLAND CEMENT LIME BLEND IS NON-COMBUSTIBLE & NOT EXPLOSIVE. THEREFORE THERE ARE NO FLAMMABLE OR EXPLOSIVE LIMITS NOR UNUSUAL FIRE & EXPLOSION HAZARDS.

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Control Measures
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Respiratory Protection: IN DUSTY ENVIRONMENTS, THE USE OF A NIOSH APPROVED RESPIRATOR IS RECOMMENDED.
Ventilation: LOCAL EXHAUST CAN BE USED, IF NECESSARY, TO CONTROL AIRBORNE DUST LEVELS.
Protective Gloves: IMPERVIOUS GLOVES.
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS (FP N).
Other Protective Equipment: ANSI APPROVED EYE WASH FOUNTAIN & DELUGE SHOWER (FP N). USE OF BARRIER CREAMS, BOOTS & CLTHG TO PROT SKIN FROM (SUPDAT)
Work Hygienic Practices: FOLLOWING WORK W/PORTLAND CEMENT LIME BLEND,

WORKERS SHOULD SHOWER W/SOAP & WATER.
Supplemental Safety and Health: MATLS TO AVOID:REACT IN WET MORTAR OR CONCRETE, LIBERATING HYDROGEN GAS. OTHER PROT EQUIP:CONTACT W/WET PORTLAND CEMENT IS RECOMMENDED.

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Physical/Chemical Properties

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Spec Gravity: 2.98-3.05
Solubility in Water: SLIGHT (0.1-1%)
Appearance and Odor: GRAY COLORED POWDER W/NO ODOR.

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Reactivity Data

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Stability Indicator: YES
Stability Condition To Avoid: KEEP PORTLAND CEMENT LIME BLEND DRY UNTIL USED TO PRESERVE PRODUCT UTILITY.
Materials To Avoid: PORTLAND CEMENT LIME BLEND IS INCOMPAT W/ALUMINUM POWDER & OTHER ALKALI & ALKALINE EARTH ELEMENTS WHICH CAN (SUPP DATA)
Hazardous Decomposition Products: HYDROGEN GAS.
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NOT RELEVANT

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Toxicological Information

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Ecological Information

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MSDS Transport Information

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Regulatory Information

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Other Information

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Transportation Information

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Responsible Party Cage: LONES
Trans ID NO: 59906
Product ID: PORTLAND CEMENT
MSDS Prepared Date: 08/10/1994
Review Date: 10/19/1998
Article W/O MSDS: N
Multiple KIT Number: 0
Unit Of Issue: BG
Container QTY: 0

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Detail DOT Information

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DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION

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Detail IMO Information

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IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION

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Detail IATA Information

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IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION

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Detail AFI Information

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AFI Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION

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HAZCOM Label

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Product ID: PORTLAND CEMENT
Cage: LONES
Company Name: LONE STAR INDUSTRIES INC
PO Box: 681250
City: INDIANAPOLIS IN
Zipcode: 46268-1250 US
Health Emergency Phone: 317-653-6766
Date Of Label Review: 07/01/1998
Label Date: 07/01/1998
Chronic Hazard IND: Y
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: WARNING
Respiratory Protection IND: YES
Health Hazard: Moderate
Contact Hazard: Moderate
Fire Hazard: None
Reactivity Hazard: None
Hazard And Precautions: ACUTE:WET PORTLAND CEMENT LIME BLEND, ESPECIALLY AS INGREDIENT IN PLASTIC (UNHARDENED) CONCRETE, MORTAR OR SLURRIES, CAN DRY SKIN AND CAUSE SEVERE ALKALI BURNS. PORTLAND/LIME DUST CAN IRRITATE EYES AN D UPPER RESPIRATORY SYSTEM. CHRONIC:CANCER HAZARD. CONTAINS CRYSTALLINE SILICA WHICH IS LISTED AS AN ANIMAL LUNG CARCINOGEN (FP N). PORTLAND CEMENT LIME BLEND DUST CAN CAUSE INFLAMMATION OF LINING TIS SUE OF INTERIOR OF NOSE AND INFLAMMATION OF CORNEA. MAY CAUSE ALLERGIC DERMATITIS.
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Disclaimer (provided with this information by the compiling agencies): This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever expressly or implied warrants, states, or intends said information to have any application, use or viability by or to any person or persons outside the Department of Defense nor any person or persons contracting with any instrumentality of the United States of America and disclaims all liability for such use. Any person utilizing this instruction who is not a military or civilian employee of the United States of America should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation regardless of similarity to a corresponding Department of Defense or other government situation.

ISO9001 - 2000 certified

Material Safety Data Sheet

Sodium hydroxide solutions, 1-50%

Section 1 - Chemical Product and Company Identification

MSDS Name:

Sodium hydroxide solutions, 1-50%

Catalog Numbers:

LC23950, LC24000, LC24040, LC24060, LC24070, LC24075, LC24090, LC24100, LC24110, LC24120, LC24140, LC24150, LC24200, LC24220, LC24230, LC24250, LC24270, LC24280, LC24300, LC24305, LC24307, LC24310, LC24320, LC24330, LC24350, LC24380, LC24400, LC24420, LC24450, LC24460, LC24500

Synonyms:

Caustic Soda, Soda Lye, Sodium Hydrate

Company Identification:

LabChem, Inc.
200 William Pitt Way
Pittsburgh, PA 15238

Company Phone Number:

(412) 826-5230

Emergency Phone Number:

(800) 424-9300

CHEMTREC Phone Number:

(800) 424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7732-18-5	Water	balance
1310-73-2	Sodium hydroxide	0.04-50

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: Clear
Danger! Corrosive. Causes skin burns. Causes eye burns. Causes digestive tract burns. Causes respiratory tract burns.
Target Organs: None.

Potential Health Effects

Eye:

Causes severe eye burns.

Skin:

Causes skin burns. May cause deep, penetrating ulcers of the skin.

Ingestion:

Causes gastrointestinal tract burns. Causes severe pain, nausea, vomiting, diarrhea, and shock.

Inhalation:

Irritation may lead to chemical pneumonitis and pulmonary edema. Causes severe irritation of upper respiratory tract with coughing, burns, breathing difficulty, and possible coma.

Chronic:

Prolonged or repeated skin contact may cause dermatitis.

Section 4 - First Aid Measures

Eyes:

Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids until chemical is gone. Get medical aid at once.

Skin:

Get medical aid at once. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing to reduce further exposure.

Ingestion:

Do NOT induce vomiting. Give conscious victim 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid at once.

Inhalation:

Move victim to fresh air immediately. Give artificial respiration if necessary. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:

Wear appropriate protective clothing to prevent contact with skin and eyes. Wear a self-contained breathing apparatus (SCBA) to prevent contact with thermal decomposition products. Use water with caution and in flooding amounts.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature:

Not applicable.

Flash Point:

Not applicable.

NFPA Rating:

CAS# 7732-18-5: Not published.
CAS# 1310-73-2: Not published.

Explosion Limits:

Lower: No information Upper: No information

Section 6 - Accidental Release Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spills with absorbent (vermiculite, sand, fuller's earth) and place in plastic bags for later disposal.

Section 7 - Handling and Storage

Handling:

Wash thoroughly after handling. Use with adequate ventilation. Do not get in eyes, on skin, or on clothing. Do not ingest or inhale.

Storage:

Store in a cool, dry, well-ventilated area away from incompatible substances. Keep away from strong acids. Keep away from metals. Keep away from flammable liquids. Keep away from organic halogens.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name:	ACGIH	NIOSH	OSHA
Water	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.
Sodium hydroxide	None of the components are on this list.	None of the components are on this list.	2 mg/m3 TWA;

OSHA Vacated PELs

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.

Skin:

Wear appropriate 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. Always use an NIOSH-approved respirator when necessary.

Section 9 - Physical and Chemical Properties

Physical State:	Liquid
Color:	Clear
Odor:	Not available.
pH:	Alkaline
Vapor Pressure:	14 mmHg
Vapor Density:	No information found.

Material Safety Data Sheet
Sodium hydroxide solutions, 1-50%

Evaporation Rate: No information found.
Viscosity: >1 (ether=1)
Boiling Point: 212°F (100.00°C)
Freezing/Melting Point: 32°F (0.00°C)
Decomposition Temperature: No information found.
Solubility in water: No information found.
Specific Gravity/Density: 1.0
Molecular Formula: NaOH
Molecular Weight 40

Section 10 - Stability and Reactivity

Chemical Stability:

Stable.

Conditions to Avoid:

Incompatible materials, acids.

Incompatibilities with Other Materials

Reacts with mineral acids to form corresponding salts; reacts with weak acids; gases like hydrogen sulfide, sulfur dioxide, and carbon dioxide; ignites when in contact with cinnamaldehyde or zinc; and reacts explosively with a mixture of chloroform and methane. Corrosive to metals such as aluminum, tin, and zinc as well as to alloys such as steel, and may cause formation of flammable hydrogen gas.

Hazardous Decomposition Products

Toxic fumes of sodium oxide, sodium peroxide fumes.

Hazardous Polymerization

Has not been reported.

Section 11 - Toxicological Information

RTECS:

CAS# 7732-18-5: ZC0110000.
CAS# 1310-73-2: WB4900000.

LD50/LC50:

CAS# 7732-18-5:
Oral, rat: LD50 = >90 mL/kg.
CAS# 1310-73-2:
No information found.

Carcinogenicity:

CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 1310-73-2: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

Epidemiology:

No information reported.

Teratogenicity:

No information reported.

Reproductive:

No information reported.

Mutagenicity

Mutation data reported.

Neurotoxicity

No information reported.

Section 12 - Ecological Information

Ecotoxicity:

TLm, mosquito fish, 125 ppm/96hr. (fresh water); TLm, bluegill, 99 mg/48hr. (tap water).

Environmental:

Once liquid, sodium hydroxide leaches rapidly into the soil.

Physical:

No information found.

Other:

No information found.

Section 13 - Disposal Considerations

Dispose of in accordance with federal, state, and local regulations.

Section 14 - Transport Information

US DOT

	< 0.5%	Between 0.5% and 2.0%	> 2.0%
Shipping Name:	Not regulated.	Sodium hydroxide solution	Sodium hydroxide solution
Hazard Class:		8	8
UN Number:		UN1824	UN1824
Packing Group:		PG II	PG I

Section 15 - Regulatory Information

US Federal

TSCA

CAS# 7732-18-5 is listed on the TSCA Inventory.
CAS# 1310-73-2 is listed on the TSCA Inventory.

SARA Reportable Quantities (RQ)

CAS# 1310-73-2: final RQ = 1000 pounds (454 kg)

CERCLA/SARA Section 313

None of the components are on this list.

OSHA - Highly Hazardous

None of the components are on this list.

State

State Right to Know

Sodium hydroxide can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California Regulations

European/International Regulations

Canadian DSL/NDSL

CAS# 7732-18-5 is listed on Canada's DSL List.
CAS# 1310-73-2 is listed on Canada's DSL List.

Canada Ingredient Disclosure List

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.
CAS# 1310-73-2 is listed on Canada's Ingredient Disclosure List.

Section 16 - Other Information

MSDS Creation Date: July 6, 1998
Revision Date: August 16, 2004

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for his application.

MSDS Number: **S8234** * * * * * *Effective Date:* ***02/04/05*** * * * * * *Supercedes:* ***11/04/04***

MSDS **Material Safety Data Sheet**

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

Mallinckrodt CHEMICALS J.T.Baker

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.

SULFURIC ACID, 52 - 100 %

1. Product Identification

Synonyms: Oil of vitriol; Babcock acid; sulphuric acid
CAS No.: 7664-93-9
Molecular Weight: 98.08
Chemical Formula: H2SO4 in H2O
Product Codes:
J.T. Baker: 5030, 5137, 5374, 5802, 5815, 5858, 5859, 5868, 5889, 5897, 5961, 5971, 5997, 6902, 9671, 9673, 9674, 9675, 9676, 9679, 9680, 9681, 9682, 9684, 9687, 9691, 9693, 9694
Mallinckrodt: 21201, 2468, 2876, 2878, 2900, 2904, 3780, 4222, 5524, 5557, H644, H850, H976, H996, V651, XL003

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sulfuric Acid	7664-93-9	52 - 100%	Yes
Water	7732-18-5	0 - 48%	No

Hazards Identification

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.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
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.

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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 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) -
0.2 mg/m3(T) (TWA) for sulfuric acid - A2 Suspected Human Carcinogen for sulfuric acid contained in strong inorganic 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 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.

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9. Physical and Chemical Properties

Appearance:
Clear oily liquid.

Odor:
Odorless.

Solubility:
Miscible with water, liberates much heat.

Specific Gravity:
1.84 (98%), 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:
Stable under ordinary conditions of use and storage. 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.

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

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
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 MORE THAN 51% ACID)
Hazard Class: 8
UN/NA: UN1830
Packing Group: II
Information reported for product/size: 440LB

International (Water, I.M.O.)

Proper Shipping Name: SULFURIC ACID (WITH MORE THAN 51% ACID)
Hazard Class: 8
UN/NA: UN1830
Packing Group: II
Information reported for product/size: 440LB

15. Regulatory Information

--------\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

--------\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

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

Ingredient	-SARA 302- RQ	TPQ	List	------SARA 313------ Chemical Catg.
Sulfuric Acid (7664-93-9)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

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

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Sulfuric Acid (7664-93-9)	1000	No	No
Water (7732-18-5)	No	No	No

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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)
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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.

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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: 8.
Disclaimer:
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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **T3913** * * * * * *Effective Date: **08/03/04*** * * * * *Supercedes: **11/02/01***

MSDS Material Safety Data Sheet

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

Mallinckrodt CHEMICALS J.T.Baker

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.

TOLUENE

1. Product Identification

Synonyms: Methylbenzene; Toluol; Phenylmethane
CAS No.: 108-88-3
Molecular Weight: 92.14
Chemical Formula: C6H5-CH3
Product Codes:
J.T. Baker: 5375, 5812, 9336, 9351, 9364, 9456, 9457, 9459, 9460, 9462, 9466, 9472, 9476
Mallinckrodt: 4483, 8092, 8604, 8608, 8610, 8611, V560

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Toluene	108-88-3	100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. VAPOR HARMFUL. FLAMMABLE LIQUID AND VAPOR. MAY AFFECT LIVER, KIDNEYS, BLOOD SYSTEM, OR CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate (Life)
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Inhalation may cause irritation of the upper respiratory tract. Symptoms of overexposure may include fatigue, confusion, headache, dizziness and drowsiness. Peculiar skin sensations (e. g. pins and needles) or numbness may be produced. Very high concentrations may cause unconsciousness and death.
Ingestion:
Swallowing may cause abdominal spasms and other symptoms that parallel over-exposure from inhalation. Aspiration of material into the lungs can cause chemical pneumonitis, which may be fatal.
Skin Contact:
Causes irritation. May be absorbed through skin.
Eye Contact:
Causes severe eye irritation with redness and pain.
Chronic Exposure:
Reports of chronic poisoning describe anemia, decreased blood cell count and bone marrow hypoplasia. Liver and kidney damage may occur. Repeated or prolonged contact has a defatting action, causing drying, redness, dermatitis. Exposure to toluene may affect the developing fetus.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or impaired liver or kidney function may be more susceptible to the effects of this substance. Alcoholic beverage consumption can enhance the toxic effects of this substance.

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4. First Aid Measures

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. CALL A PHYSICIAN IMMEDIATELY.
Ingestion:
Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately. If vomiting occurs, keep head below hips to prevent aspiration into lungs.
Skin Contact:
In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician 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.

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5. Fire Fighting Measures

Fire:
Flash point: 7C (45F) CC
Autoignition temperature: 422C (792F)
Flammable limits in air % by volume:
lel: 3.3; uel: 19
Flammable liquid and vapor!
Dangerous fire hazard when exposed to heat or flame. Vapors can flow along surfaces to distant ignition source and flash back.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with strong oxidizers may cause fire or explosion. Sensitive to static discharge.
Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water may be used to flush spills away from exposures and to dilute spills to non-flammable mixtures.
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. Water spray may be used to keep fire exposed containers cool.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. 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. Use non-sparking tools and equipment. Collect liquid in an appropriate container or 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! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. 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 SOLUSORB® solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. 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.

Exposure Controls/Personal Protection

Airborne Exposure Limits:
Toluene:
- OSHA Permissible Exposure Limit (PEL):

200 ppm (TWA); 300 ppm (acceptable ceiling conc.); 500 ppm (maximum conc.).
- ACGIH Threshold Limit Value (TLV):
50 ppm (TWA) skin, 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 and engineering controls are not feasible, a half-face organic vapor respirator 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 organic vapor respirator 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-face piece 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.

Physical and Chemical Properties

Appearance:
Clear, colorless liquid.

Odor:
Aromatic benzene-like.

Solubility:
0.05 gm/100gm water @ 20C (68F).

Specific Gravity:
0.86 @ 20C / 4 C

pH:
No information found.

% Volatiles by volume @ 21C (70F):
100

Boiling Point:
111C (232F)

Melting Point:
-95C (-139F)

Vapor Density (Air=1):
3.14

Vapor Pressure (mm Hg):
22 @ 20C (68F)

Evaporation Rate (BuAc=1):
2.24

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Heat, flame, strong oxidizers, nitric and sulfuric acids, chlorine, nitrogen tetraoxide; will attack some forms of plastics, rubber, coatings.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:
Oral rat LD50: 636 mg/kg; skin rabbit LD50: 14100 uL/kg; inhalation rat LC50: 49 gm/m3/4H; Irritation data: skin rabbit, 500 mg, Moderate; eye rabbit, 2 mg/24H, Severe. Investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
Has shown some evidence of reproductive effects in laboratory animals.

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

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Toluene (108-88-3)	No	No	3

12. Ecological Information

Environmental Fate:
When released into the soil, this material may evaporate to a moderate extent. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released into water, this material may evaporate to a moderate extent. When released into water, this material may biodegrade to a moderate extent. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of less than 1 day. This material is not expected to significantly bioaccumulate. This material has a log octanol-water partition coefficient of less than 3.0. Bioconcentration factor = 13.2 (eels).
Environmental Toxicity:
This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

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: TOLUENE
Hazard Class: 3
UN/NA: UN1294
Packing Group: II
Information reported for product/size: 390LB

International (Water, I.M.O.)

Proper Shipping Name: TOLUENE
Hazard Class: 3
UN/NA: UN1294
Packing Group: II
Information reported for product/size: 390LB

15. Regulatory Information

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

Ingredient	TSCA	EC	Japan	Australia
Toluene (108-88-3)	Yes	Yes	Yes	Yes

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

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Toluene (108-88-3)	Yes	Yes	No	Yes

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

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Toluene (108-88-3)	No	No	Yes	No

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

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Toluene (108-88-3)	1000	U220	No

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

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 3[Y]E
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: **2** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. VAPOR HARMFUL. FLAMMABLE LIQUID AND VAPOR. MAY AFFECT LIVER, KIDNEYS, BLOOD SYSTEM, OR CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.
Label First Aid:
Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If vomiting occurs, keep head below hips to prevent aspiration into lungs. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician immediately.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 3.
Disclaimer:
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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Material Safety Data Sheet

Xylenes, reagent ACS

ACC# 01718

Section 1 - Chemical Product and Company Identification

MSDS Name: Xylenes, reagent ACS
Catalog Numbers: AC422680000, AC422680020, AC422680040, AC422680200, AC422685000
Synonyms: Dimethylbenzenes.
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
1330-20-7	Xylenes (o-, m-, p- isomers)	> 98.5	215-535-7

Hazard Symbols: XN
Risk Phrases: 10 20/21 38

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: clear, colorless liquid. Flash Point: 25 deg C. **Flammable liquid and vapor.** May cause central nervous system depression. May cause liver and kidney damage. Aspiration hazard if swallowed. Can enter lungs and cause damage. Causes respiratory tract irritation. **Warning!** Causes eye irritation. Prolonged or repeated contact may dry the skin and cause irritation. May be harmful if absorbed through skin or if inhaled. This substance has caused adverse reproductive and fetal effects in animals.
Target Organs: Blood, kidneys, central nervous system, liver, lungs, eyes, skin, mucous membranes.

Potential Health Effects
Eye: Causes severe eye irritation. Splashes of xylene in human eyes generally cause transient superficial injury.
Skin: May be harmful if absorbed through the skin. Xylene contact causes defatting of the skin with irritation, dryness, and cracking. Blistering may occur, particularly if exposure to concentrated xylene is prolonged and the exposed area of skin is occluded.
Ingestion: Aspiration hazard. May cause irritation of the digestive tract. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May cause effects similar to those of acute inhalation.
Inhalation: Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. Prolonged exposure may result in dizziness and general weakness. Irritation may lead to chemical pneumonitis and pulmonary edema. May cause liver and kidney damage. Causes irritation of mucous membrane. Exposure may cause blood abnormalities. Odor is not an adequate warning for overexposure to xylene.
Chronic: Chronic exposure to xylene may cause defatting dermatitis, reversible eye damage, dyspnea (labored breathing), confusion, dizziness, apprehension, memory loss, headache, tremors, weakness, anorexia, nausea, ringing in the ears, irritability, thirst, mild changes in liver function, kidney impairment, anemia, and hyperplasia, but not destruction, of the bone marrow.

Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.
Skin: In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion: Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.
Inhalation: If inhaled, remove to fresh air. 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. Flammable liquid and vapor. Vapors may form an explosive mixture with air. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. This liquid floats on water and may travel to a source of ignition and spread fire. May accumulate static electricity.
Extinguishing Media: Use water spray to cool fire-exposed containers. Water may be ineffective. This material is lighter than water and insoluble in water. The fire could easily be spread by the use of water in an area where the water cannot be contained. Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: 25 deg C (77.00 deg F)
Autoignition Temperature: 527 deg C (980.60 deg F)
Explosion Limits, Lower: 1.1%
Upper: 7.0%
NFPA Rating: (estimated) Health: 2; Flammability: 3; 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. Remove all sources of ignition. Provide ventilation. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces. U.S. regulations require reporting spills and releases to soil, water and air in excess of reportable quantities. This material creates a fire hazard because it floats on water. If possible, try to contain floating material.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame. Avoid breathing vapor or mist.
Storage: Keep away from sources of ignition. Keep container closed when not in use. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances. Keep away from strong acids.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Xylenes (o-, m-, p- isomers)	100 ppm TWA; 150 ppm STEL	none listed	100 ppm TWA; 435 mg/m3 TWA

OSHA Vacated PELs: Xylenes (o-, m-, p- isomers): 100 ppm TWA; 435 mg/m3 TWA

Personal Protective Equipment

Eyes: Wear chemical goggles.

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. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: clear, colorless
Odor: Aromatic odor
pH: Not applicable.
Vapor Pressure: 6.72 mm Hg @ 21 deg C
Vapor Density: 3.66 (Air=1)
Evaporation Rate:0.77
Viscosity: <32.6 SUS
Boiling Point: 138.5-141.5 deg C
Freezing/Melting Point:-47.4 deg C
Decomposition Temperature: Not available.
Solubility: Insoluble.
Specific Gravity/Density:0.864 @ 20°/4°C
Molecular Formula:C8H10
Molecular Weight:106.17

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: High temperatures, ignition sources.
Incompatibilities with Other Materials: Strong oxidizing agents, strong acids, acetic acid, nitric acid.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#:
CAS# 1330-20-7: ZE2100000
LD50/LC50:
CAS# 1330-20-7:
Draize test, rabbit, eye: 87 mg Mild;
Draize test, rabbit, eye: 5 mg/24H Severe;
Draize test, rabbit, skin: 100% Moderate;
Draize test, rabbit, skin: 500 mg/24H Moderate;
Inhalation, rat: LC50 = 5000 ppm/4H;
Oral, mouse: LD50 = 2119 mg/kg;

Oral, rat: LD50 = 4300 mg/kg;
Skin, rabbit: LD50 = >1700 mg/kg;
Carcinogenicity:
CAS# 1330-20-7:
ACGIH: A4 - Not Classifiable as a Human Carcinogen
IARC: IARC Group 3 - not classifiable
Epidemiology: No information available.
Teratogenicity: No information available.
Reproductive Effects: There is ample evidence that xylene produces embryotoxicity (reduced body weight, retarded ossification, retarded kidney development, increased extra rib) and fetotoxicity in mice and rats, but xylene is not considered teratogenic.
Neurotoxicity: No information available.
Mutagenicity: No information available.
Other Studies: Standard Draize Test: Administration into the eye (rabbit) = 5 mg/24H (Severe). Standard Draize Test: Administrat ion onto the skin (rabbit) = 500 mg (Moderate).

Section 12 - Ecological Information

Ecotoxicity: Fish: Rainbow trout: LC50 = 13.5 mg/L; 96 Hr; Unspecified Goldfish: LD50 = 13 mg/L; 24 Hr; Unspecified Fathead Minnow: LC50 = 46 mg/L; 1 Hr; Static bioassay Acute and long-term toxicity to fish and invertebrates: LD50 for goldfish is 13 mg/L/24 Hr.Cas#1330-20-7:LC50(96Hr.) rainbow trout = 8.05 mg/L, Static condition;LC50(96Hr.) fathead minnow = 16.1 mg/L, flow-through conditions; LC50(96Hr.) bluegill = 16.1 mg/L, flow-through;EC50 (48 Hr.) water flea = 3.82 mg/L, flow-through conditions;EC50(24 Hr.) photobacterium phosphoreum = 0.0084 mg/L, Microtox test.
Environmental: In air, xylenes degrade by reacting with photochemically produced hydroxyl radicals. In soil it will volatilize and leach into groundwater. Little bioconcentration is expected.
Physical: ATMOSPHERIC FATE: According to a model of gas/particle partitioning of semivolatile organic compounds in the atmosphere, xylene, which has an experimental vapor pressure of 7.99 mm Hg at 25 deg C, will exist solely as a vapor in the ambient atmosphere. Vapor-phase xylene is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the atmospheric lifetime of xylene is about 14-26 hours. Ambient levels of xylene are detected in the atmosphere due to large emissions of this compound.
Other: None

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: CAS# 1330-20-7: waste number U239 (Ignitable waste, Toxic waste).

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	XYLENES				No information available.
Hazard Class:	3				
UN Number:	UN1307				
Packing Group:	III				

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 1330-20-7 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.
SARA

CERCLA Hazardous Substances and corresponding RQs
CAS# 1330-20-7: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 1330-20-7: acute, chronic, flammable.
Section 313
This material contains Xylenes (o-, m-, p- isomers) (CAS# 1330-20-7, 98 5%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 1330-20-7 is listed as a hazardous air pollutant (HAP). This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 1330-20-7 is listed as a Hazardous Substance 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# 1330-20-7 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.
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:
XN
Risk Phrases:
R 10 Flammable.
R 20/21 Harmful by inhalation and in contact with skin.
R 38 Irritating to skin.

Safety Phrases:
S 25 Avoid contact with eyes.

WGK (Water Danger/Protection)
CAS# 1330-20-7: 2
Canada - DSL/NDSL
CAS# 1330-20-7 is listed on Canada's DSL List.
Canada - WHMIS
This product has a WHMIS classification of B2, D2B.
Canadian Ingredient Disclosure List
CAS# 1330-20-7 is not listed on the Canadian Ingredient Disclosure List.
Exposure Limits
CAS# 1330-20-7: OEL-ARAB Republic of Egypt:TWA 0.5 ppm (0.9 mg/m3)
OEL-AUSTRALIA:TWA 80 ppm (330 mg/m3);STEL 150 ppm (655 mg/m3) OEL-BEL

GIUM:TWA 100 ppm (434 mg/m3);STEL 150 ppm (651 mg/m3) OEL-CZECHOSLOVAKIA:TWA 200 mg/m3;STEL 1000 mg/m3 OEL-DENMARK:TWA 50 ppm (217 mg/m3); Skin OEL-FINLAND:TWA 100 ppm (435 mg/m3);STEL 150 ppm;Skin OEL-FRANCE:TWA 100 ppm (435 mg/m3);STEL 150 ppm (650 mg/m3) OEL-GERMANY:TWA 100 ppm (440 mg/m3) OEL-HUNGARY:TWA 100 mg/m3;STEL 300 mg/m3 OEL-JAPAN:TWA 100 ppm (430 mg/m3) OEL-THE NETHERLANDS:TWA 100 ppm (435 mg/m3); Skin OEL-THE PHILIPPINES:TWA 0.1 mg/m3 OEL-POLAND:TWA 100 mg/m3 OEL-SWEDEN:TWA 50 ppm (200 mg/m3);STEL 100 ppm (450 mg/m3);Skin OEL-SWITZERLAND:TWA 100 ppm (436 mg/m3);STEL 200 ppm (870 mg/m3) OEL-THAILAND:TWA 100 ppm (435 mg/m3) OEL-TURKEY:TWA 100 ppm (435 mg/m3) OEL-UNITED KINGDOM:TWA 100 ppm (435 mg/m3);STEL 150 ppm;Skin OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

Section 16 - Additional Information

MSDS Creation Date: 6/22/1999
Revision #6 Date: 6/21/2001

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.

MSDS Number: **Z1140** * * * * * *Effective Date: **08/10/04*** * * * * *Supercedes: **10/29/01***

MSDS **Material Safety Data Sheet**

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.

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

Mallinckrodt CHEMICALS J.T.Baker

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

ZINC ACETATE

1. Product Identification

Synonyms: Acetic acid, zinc salt, dihydrate; zinc diacetate; zinc acetate dihydrate
CAS No.: 557-34-6 (Anhydrous) 5970-45-6 (Hydrate)
Molecular Weight: 219.50
Chemical Formula: (CH3COO)2Zn 2H2O
Product Codes:
J.T. Baker: 4296, 4304, 5658
Mallinckrodt: 8740

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Zinc Acetate	557-34-6	98 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

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

Health Rating: 1 - Slight
Flammability Rating: 1 - Slight
Reactivity Rating: 0 - None
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath.
Ingestion:
Irritation of the mucous membranes due to hydrolysis and formation of acid in the stomach can occur. Large amounts can produce stomach cramps, stricture of the esophagus, nausea, and vomiting.
Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain.
Eye Contact:
Causes irritation, redness, and pain.
Chronic Exposure:
No information found.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders 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. Get medical attention.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes 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.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.
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. 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. 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, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances. 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.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
None established.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. 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):
For conditions of use where exposure to dust or mist is apparent and engineering controls are not feasible, a particulate respirator (NIOSH type N95 or better filters) may be worn. 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-face positive-pressure, air-supplied respirator.
WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear protective gloves and clean body-covering clothing.
Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
White crystals or powder.
Odor:
Slight acetic acid (vinegar) odor.
Solubility:
43g in 100g water.
Density:

1.74
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
Decomposes.
Melting Point:
237C (459F)
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:
Loses water of hydration above 100C.

Hazardous Decomposition Products:
Freshly-formed zinc oxide or zinc oxide fumes at high temperatures (over 800C).
Hazardous Polymerization:
Will not occur.
Incompatibilities:
No incompatibility data found. Oxidizing agents, zinc salts in general, alkalis and their carbonates, oxalates, phosphates, sulfides.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat: LD50: 2510 mg/kg. Reproductive effects cited. Mutation references cited.

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

Ingredient	NTP Carcinogen Known	NTP Carcinogen Anticipated	IARC Category
Zinc Acetate (557-34-6)	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 disposal 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

Not regulated.

15. Regulatory Information

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

Ingredient	TSCA	EC	Japan	Australia
Zinc Acetate (557-34-6)	Yes	Yes	Yes	Yes

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

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Zinc Acetate (557-34-6)	Yes	Yes	No	Yes

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

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Zinc Acetate (557-34-6)	No	No	No	Zinc compoun

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

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Zinc Acetate (557-34-6)	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: No (Pure / Solid)

Australian Hazchem Code: None allocated.
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: **1** Flammability: **0** Reactivity: **0**

Label Hazard Warning:

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

Label Precautions:

Avoid contact with eyes, skin and clothing.
Avoid breathing dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove 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. If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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

APPENDIX B

RESPIRATOR CARTRIDGE CHANGE RATIONALE

RESPIRATOR CARTRIDGE CHANGEOUT SCHEDULE RATIONALE

South Cavalcade Superfund Site
Houston, Texas

The following describes the information, data, and sources relied upon to determine the respirator cartridge changeout schedule for respirator usage at the South Cavalcade Superfund Site located in Houston, Texas.

1. The information and data used to estimate respirator cartridge service life was obtained from four main sources:

   - The Mine Safety Appliance (MSA) Cartridge Life Expectancy Calculator, 2004.
   - The 3M Respirator Service Life Calculator, Version 3.0.
   - The Wood Math Model Table (from the OSHA webSite)
   - The Rule of Thumb for estimating respirator cartridge service life found in Chapter 36 of the AIHA publication *The Occupational Environment - Its Evaluation and Control* (and OSHA webSite)
   - The OSHA Benzene Standard, 29 CFR 1910.1028.

2. The changeout schedule is based on additional information including the cartridges selected, expected workrate of workers, the expected temperature and humidity during the project, and the upper range of air concentration of potential Site constituents allowed before upgrading to a supplied air system for respiratory protection.

   MSA Comfo GMA, and 3M 7000 Series, organic vapor cartridges are expected to be used for this project. If other cartridges or other manufacturer's respirators and cartridges are used this changeout schedule must be reevaluated.

3. The maximum concentration allowed in this HASP for using a cartridge respirator is 50 ppm of toluene, ethylbenzene, xylene, or naphthalene, or a combination thereof. Information from the MSA Cartridge Life Expectance Calculator gives a service life of approximately 16 hours for ethylbenzene, toluene, and xylene at 86°F, 60% relative humidity, a heavy workrate, and a concentration of 50 ppm. A similar result would be expected for benzene because it is in the same class (aromatics). However, the OSHA benzene standard, 29 CFR 1910.1028, only allows up to 8 hours of use for an organic vapor cartridge at concentrations up to 10 ppm.

   The Wood Math Model Table lists service lives for aromatics (BTEX) as approximately 16 hours at a moderate workrate, 72 degrees Fahrenheit, and relative humidity of 50%.

   Site specific conditions are expected to be moderate workrates, temperatures around 85 degrees Fahrenheit, and relative humidities around 50-60%. Based on the MSA and 3M respirator cartridge service life calculators, the Wood model, and rules of thumb, and the OSHA benzene standard, the respirator cartridge changeout schedule for this Site under these conditions is 8 hours, or one work shift. If conditions change significantly the changeout schedule must be reevaluated. For example, relative humidities above 85% will reduce the service life by 50%, i.e., down to 4 hours.

4. The basis for reliance on data is that MSA and 3M are world renowned manufacturers of respiratory equipment, the Wood model is accepted by OSHA and has been published in a peer reviewed journal, and the Rule of Thumb information is published in a text from the leading association of industrial hygienists.

APPENDIX C

HEALTH AND SAFETY FORMS

KEY ENVIRONMENTAL INCORPORATED

TRAINING SESSION DOCUMENTATION RECORD

Project Name:	**Date:**
Project Number:	**Time:** to
Instructor:	**Sheet: 1 of**
Material Covered:	

NAME (print)	SIGNATURE	COMPANY

I certify that the personnel above have been trained in the subject(s) listed in "Material Covered" as stated.

Instructor Signature

Key Environmental, Inc.
Instructor's Company Affiliation

KEY ENVIRONMENTAL INCORPORATED

SUBCONTRACTOR AFFIDAVIT

I have reviewed the Site Health and Safety Plan for the _____ Site and understand the potential health and safety hazards at this operation and the emergency response procedures. I agree to conduct all on-site work in conformity with the requirements of the Health and Safety Plan.

Project Number:	**Date:**

NAME (print)	SIGNATURE	COMPANY

Site Supervisor _____

KEY ENVIRONMENTAL INCORPORATED

REAL-TIME MONITORING INSTRUMENT CALIBRATION LOG

Project Name:		Project Number:
Location:		
Instrument (s):		
Model Number(s):		Serial Number(s):
Calibration Gas(es):	Concentration	

DATE	TIME	READING	CALIBRATED BY	COMMENTS

KEY ENVIRONMENTAL INCORPORATED

REAL-TIME MONITORING LOG

Date:	Person performing sampling:
Project Name:	Signature:
Project No.:	

Time	Monitoring Location (be specific)	READINGS						COMMENTS (Where was sample taken? e.g., breathing zone or other)	DURATION of monitoring time (minutes)
		O_2 %	LEL %	VOC ppm	Dust mg/m^3	Noise dB	Detector Tube (specify tube)		

Real Time Instrument Calibration Log should accompany this form.

KEY ENVIRONMENTAL INCORPORATED

Case # _____

INCIDENT AND INJURY REPORT

This form must be completed and forwarded to Corporate Health and Safety within 24 hours of any incident/injury.
For serious injuries, also complete page 2 and forward the entire form to Corporate Health and Safety by the end of the day.

Employer Name:	
Employer Address:	
Employer Phone #	Employers FAX #

EMPLOYEE		
Name:	Soc. Sec. #	
Home Address:		
County:	Zip Code:	
Home Telephone:	Date of Birth:	Age:
Occupation: (Job Title):	Sex: Male ☐ Female ☐	
Department:	Married: Yes ☐ No ☐	
How long employed: Years Mo.	No. Children under 18 yrs.	

ACCIDENT/INJURY	
Project Name:	Project Number:
Address of Accident:	
County:	Zip Code:
Was accident on company property: Yes ☐ No ☐	
Date and Time of Injury:	Date Reported:
What was Employee doing when injured? (Be specific – include tools, equipment, materials, or objects involved):	
How did the injury occur? (Describe the event that resulted in injury):	
Body Part injured and nature of injury (Be specific):	
Name of object or substance that directly injured the employee:	

MEDICAL	
First aid given by:	
Date of medical assistance:	Was accident fatal?
Name of medical provider:	
Address of medical provider:	
Diagnosis:	
If hospitalized, name and address of hospital:	

EMPLOYEE'S SIGNATURE:	**Date:**
PREPARER'S SIGNATURE:	**Date:**
SUPERVISOR'S SIGNATURE:	**Date:**
HEALTH & SAFETY SIGNATURE:	**Date:**

KEY ENVIRONMENTAL INCORPORATED

Case # _____

INCIDENT AND INJURY REPORT

ACCIDENT INVESTIGATION AND FOLLOW-UP	
Provide additional information on what the employee was doing and how the injury occurred:	
Witness names (also addresses and phone numbers if not company personnel):	
What did the employee do or fail to do that caused or contributed to the accident?	
What caused or influenced the unsafe act?	
What condition of tools, equipment or the jobsite caused or contributed to the accident?	
What caused or influenced the unsafe condition?	
What action has been taken or is planned to prevent recurrence?	
Person(s) responsible for completion of the action:	
Target date:	Actual completion date:
Completed by:	

OFFICE USE ONLY	
Case Type: First Aid ☐ Medical ☐ Restricted ☐ Days Away from Work ☐	
OSHA Recordable: Yes ☐ No ☐	
Worker's Comp Claim Filed: Yes ☐ No ☐	Date Filed:
Project Manager:	
Date lost work time began:	
Total days away from work:	
Date of restricted activity:	
Total restricted workdays:	
Date returned to full duty:	

APPENDIX D

EMERGENCY CONTACTS AND HOSPITAL ROUTE MAP

EMERGENCY NUMBERS
South Cavalcade Superfund Site
Houston, Texas

Fire	911
Police	911
Ambulance	911
Hospital – Christus St. Joseph Hospital	(713) 757-1000
National Response Center	(800) 424-8802

DIRECTIONS TO EMERGENCY ROOM

Christus St. Joseph Hospital – (713) 757-1000
1401 St. Joseph Parkway, Houston, TX 77002

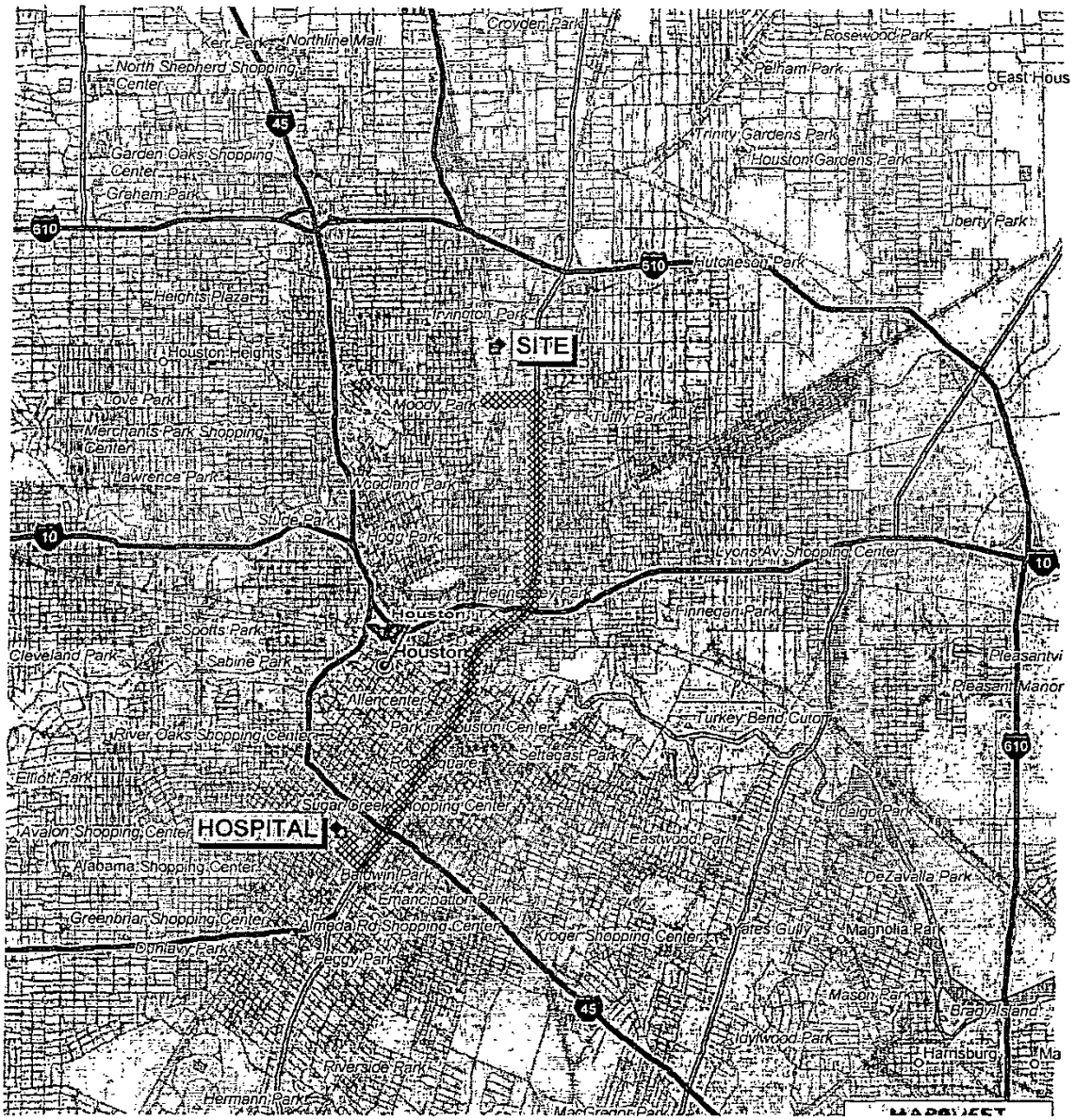
Turn left (East) out of Site on Collingsworth St. about ½ mile to Eastex Freeway;
Turn right (South) onto Eastex Freeway and merge onto US-59 (ramp in on the left);
Travel south on the freeway for about 3.8 miles;
Take the McGowen Ave./Taum Ave. exit then stay straight onto Hamilton St.;
Turn right onto McGowen St. and go about 4 blocks; then,
Turn right onto Crawford St. and then left into the hospital.

Total estimated distance is about 5.5 miles. Total estimated time is about 10 minutes.

UTILITY NUMBERS

Houston One-Call Center	(800) 669-8344

HOSPITAL ROUTE MAP



Christus St. Joseph Hospital – (713) 757-1000 1401 St. Joseph Parkway, Houston, TX 77002

Turn left (East) out of Site on Collingsworth St. about ½ mile to Eastex Freeway;
Turn right (South) onto Eastex Freeway and merge onto US-59 (ramp in on the left);
Travel south on the freeway for about 3.8 miles;
Take the McGowen Ave./Taum Ave. exit then stay straight onto Hamilton St.;
Turn right onto McGowen St. and go about 4 blocks; then,
Turn right onto Crawford St. and then left into the hospital.
Total estimated distance is about 5.5 miles. Total estimated time is about 10 minutes.

ATTACHMENT B

FIELD INFORMATION FORMS

KEY ENVIRONMENTAL INCORPORATED

LOG OF BORING: _____

Page __ of __

Client Name:	Drilling/Boring Method:	Total Boring Depth (ft):
Project Number:	Sampling Method:	Ground Surface Elev. (ft-msl):
Location:	Subcontractor/Drillers:	Measuring Point Elev. (ft-msl):
Date/Time Started:	Monitoring Equipment:	Geologist/Engineer:
Date/Time Completed:	Coordinates:	Consultant: **KEY Environmental, Inc.**

ft-bgs	Sample No.	PID (ppm)	Blows/6-In.	Recovery	SOIL DESCRIPTION (color, texture, moisture, etc.)	Lithology	USCS Classification	Well Construction	ft-bgs
0									0
1									1
2									2
3									3
4									4
5									5
6									6
7									7
8									8
9									9
10									10
11									11
12									12
13									13
14									14

Silt — Gravel

Clay — Bedrock

Sand

NOTES

in - indicates inches

ft - indicates depth in feet

ft-bgs - indicates feet below ground surface

ft-msl - indicates feet above mean sea level

N/A - indicates not applicable to this boring

ppm - indicates parts per million

Signature of Field Supervisor _____

Date _____

drnw-e\drillkey.xls
Form #6

Revised 8/15/2005

LOG OF BORING: _____ *(con't)*

Page __ of __

ft-bgs	Sample No.	PID (ppm)	Blows/6-in.	Recovery	SOIL DESCRIPTION (color, texture, moisture, etc.)	Lithology	USCS Classification	Well Construction	ft-bgs
14									14
15									15
16									16
17									17
18									18
19									19
20									20
21									21
22									22
23									23
24									24
25									25
26									26
27									27
28									28
29									29
30									30

Silt — Gravel

Clay — Bedrock

Sand

NOTES

in - indicates inches

ft - indicates depth in feet

ft-bgs - indicates feet below ground surface

ft-msl - indicates feet above mean sea level

N/A - indicates not applicable to this boring

ppm - indicates parts per million

KEY ENVIRONMENTAL INCORPORATED

dmw-e\drillkey.xls
Form #6

Revised 8/15/2005

005727

LOG OF BORING: _____ *(con't)*

Pa(Page __ of __

ft-bgs	Sample No.	PID (ppm)	Blows/6-in.	Recovery	SOIL DESCRIPTION (color, texture, moisture, etc.)	Lithology	USCS Classification	Well Construction	ft-bgs
30									30
31									31
32									32
33									33
34									34
35									35
36									36
37									37
38									38
39									39
40									40
41									41
42									42
43									43
44									44
45									45
46									46

Silt — Gravel

Clay — Bedrock

Sand

NOTES

in - indicates inches

ft - indicates depth in feet

ft-bgs - indicates feet below ground surface

ft-msl - indicates feet above mean sea level

N/A - indicates not applicable to this boring

ppm - indicates parts per million

KEY ENVIRONMENTAL INCORPORATED

dmw-e\drillkey.xls
Form #6

Revised 8/15/2005

005728

LOG OF BORING: _____ *(con't)*

Pa(Page __ of __

ft-bgs	Sample No.	Hnu (ppm)	Blows/6-in.	Recovery	SOIL DESCRIPTION (color, texture, moisture, etc.)	Lithology	USCS Classification	Well Construction	ft-bgs
46									46
47									47
48									48
49									49
50									50
51									51
52									52
53									53
54									54
55									55
56									56
57									57
58									58
59									59
60									60
61									61
62									62

Silt — Gravel

Clay — Bedrock

Sand

NOTES

in - indicates inches

ft - indicates depth in feet

ft-bgs - indicates feet below ground surface

ft-msl - indicates feet above mean sea level

N/A - indicates not applicable to this boring

ppm - indicates parts per million

KEY ENVIRONMENTAL INCORPORATED

KEY ENVIRONMENTAL INCORPORATED

GROUNDWATER SAMPLE COLLECTION RECORD

WELL NO.:

PERMIT NO.:

Project No.: _____ Client: _____

Project Name: _____ Project Location: _____

Weather Conditions: _____ Sampling Date: _____

1. WATER LEVEL DATA (measured from top of inner well casing)

a. Depth to LNAPL: _____ (ft) b. Depth to Water: _____ (ft)

c. Depth to DNAPL: _____ (ft) d. Total Well Depth: _____ (ft)

e. LNAPL Thickness: (a-b) _____ (ft) f. DNAPL Thickness: (c-d) _____ (ft)

g. Length of Water Column: _____ (ft) (a-d)

h. Well Volume: _____ (gal)

2. WELL PURGE DATA

a. Purge Method: _____

b. Field Testing Equipment: _____

c. Required Total Purge Volume (1f x 2c) (gals.): _____

d. Total Volume and Number of Well Volumes Removed: _____

e. Begin Purge Time: End Purge Time:

Conversion Factors (a x cf = h)	
Well I.D.	Conv. Fact. (cf)
1	0.041
2	0.163
4	0.653
6	1.470

Read No.	Lapse Time (min.)	Purge Rate	Temp (deg. C) (±10%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (ft)
PREPURGE VALUES											
PURGING VALUES											

3. SAMPLE COLLECTION DATA Sampling Personnel: _____

Sampling Method(s) & Equip: _____

Sample I.D. (Name, Date, Time): _____

Sample Analytical Parameters/Method: _____

Sample Start Time: End SampleTime:

PID/FID READING(s) : PID/FID Model & Ionization Potential

ODOR/SHEEN:

COMMENTS:

BORING Field Investigation (6/05) Spreadsheet - South Cavalcade, Houston, Texas

Boring Location	Drilling Complete Date	Total Depth	Sand/Silt - Intervals	Clay Intervals	*Core* Depth to Saturation	Temp./Monitor Well?- Screen Interv.	Development Complete Date	NAPL Product/Sheen/Odor - and Interval	Plugged Yes/No	Sample- Yes/No - Date&Type	Field Analytical/Lab?- Sample Results	COMMENTS* Field Observations

ATTACHMENT C

LOW FLOW PURGING AND SAMPLING –
STANDARD OPERATING PROCEDURE

ATTACHMENT C
STANDARD OPERATING PROCEDURE – LOW-FLOW PURGING/SAMPLING

1.0 PURPOSE

This standard operating procedure (SOP) provides guidelines for the collection of representative groundwater samples from monitoring wells. Groundwater samples are typically collected from monitoring wells for laboratory analysis to support the characterization of representative groundwater quality. Low-flow purging has the advantages of minimizing the turbidity and mixing between the overlying stagnant casing water and water within the screened interval. Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. Typically, flow rates on the order of 0.1-0.5 liter/minute are used, however, these flow rates may be varied dependent upon site-specific hydrogeology.

2.0 REQUIRED MATERIALS

The following list identifies the types of equipment which may be used during groundwater sampling tasks. Project-specific equipment should be selected based upon project objectives, the depth of groundwater, purge volumes, analytical parameters, and well construction. The types of groundwater sampling equipment are as follows:

Purging/Sample Collection Equipment

- Low-flow (e.g., 0.1-0.5 liter/minute) pumps such as peristaltic pumps; bladder pumps, electrical submersible pumps, and gas-driven pumps;
- Pumps are to be constructed of stainless steel or Teflon™;

(Note that bailers are inappropriate devices for low-flow sampling.)

Peristaltic pumps may be the least desirable choice, and for some projects, may not be an option at all. Some regions have specific requirements regarding what type of pumps should be used for sampling of particular analytical parameters. For example, USEPA Region II does not allow the use of peristaltic pumps for collecting samples for analysis of organic parameters. For this reason, region-specific requirements regarding pump selection shall be specified in the project-specific work plan. Another consideration is the soft silicon tubing required for use with the peristaltic pump mechanism. There is potential that this tubing may react with more complex organic compounds.

Related sampling and field measurement equipment will include some or all of the following:

- A multi-parameter measurement unit with in-line sampling capability such as a Horiba® U-22;
- A photoionization detector (PID) to monitor for volatile organic constituents upon opening the monitoring well cap (the need for this instrument will be specified in the project specific work plan)
- An in-line filtration apparatus, 0.45 μm or 0.1 μm, if dissolved metals are a constituent of interest at the site;
- A water level meter; and,
- An interface probe, if light non-aqueous phase liquid (NAPL) or dense NAPL are potentially present on site (the need for this instrument will be specified in the project-specific work plan).

General equipment includes:

- Safety Glasses or equivalent eye protection;
- Distilled water and dispenser bottle;
- Decontamination solutions (such as Alconox and solvents);
- Field data sheets and log book;
- Sample preservation solutions;
- Sample containers;
- Buckets and intermediate containers;
- Coolers;
- Shipping labels;
- Permanent markers/pens;
- Packing tape;
- First aid kit;
- Key(s) for well locks; and,
- Stopwatch.

Disposable materials include:

- Plastic sheeting/bags;
- Pump tubing;
- Gloves;
- Filters;
- Chemical-free paper towels; and,
- Protective coveralls (*e.g.*, Tyvek), if necessary.

3.0 METHODOLOGIES

3.1 Pre-Sampling Considerations

Water samples should not be collected immediately following well development. Sufficient time should be allowed for the groundwater flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and method of installation. USEPA protocols recommend an evaluation of site conditions with a typical minimum time lag of one week. (Note: Project personnel shall review applicable regulatory guidelines regarding the required lag time on a project-specific basis.)

Several preparatory activities need to be completed prior to actual sampling of each well. These preparatory activities can be summarized as follows:

- Log in sample bottles received from laboratory, prepare any deionized water or preservatives needed for the sampling;
- If necessary, prepare pumps with standard decontamination procedures;
- Don the necessary personnel protective equipment (PPE) stipulated in the Site health and safety plan (HASP);
- Measure static water level prior to well purging. Water levels may be measured to the nearest hundredth of a foot with an electronic probe from the established measuring point of the well casing. If water levels will be used to determine groundwater flow direction and/or hydraulic gradients, all measurements should be collected over as short a time period as possible.
- Unless specified otherwise in the project-specific Field Sampling Plan (FSP), well depth should be obtained from the well logs, rather than from measuring total depth, as this activity may disturb material that has settled to the bottom of the well and increase turbidity in samples. If it is necessary to measure total depth, or to measure dense non-aqueous phase liquid (DNAPL), perform these measurements after the sample has been collected, a minimum of 24 hours prior to sampling, or on a separate occasion where sampling is not being performed.

3.2 Equipment Calibration

Prior to purging and sampling, all sampling devices and monitoring equipment should be calibrated according to manufacturer's recommendations. Dissolved oxygen calibration must be

corrected for local barometric pressure readings and elevation. Calibration should be performed each day prior to sampling.

3.3 Well Purging

For low-flow, minimal drawdown sampling protocols, an in-line water quality measurement device such as a flow-through cell is used to establish the stabilization time on a well-specific basis for several indicator parameters, as follows:

- pH;
- specific conductance;
- dissolved oxygen;
- turbidity; and,
- Oxidation-Reduction Potential (ORP) (as required on a project-specific basis).

This differs from the general guideline used in conventional purging and sampling protocols that requires removal of a minimum of three casing volumes prior to sampling. Following are recommendations to be considered before, during, and after purging and sampling:

- establish a flow rate that maintains minimal drawdown in the well during both purging and sampling, typically between 100mL/min and 500mL/min;
- maximize tubing wall thickness and minimize tubing length;
- place the sampling device intake at the middle or slightly above the middle of the screened interval, unless specified otherwise in the project-specific work plan
- For wells completed as open boreholes in bedrock, placement of the sampling device will be specified in the project-specific work plan;
- minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion;
- make proper adjustments to stabilize the flow rate as soon as possible;
- monitor water quality indicators during purging.

<u>Pump Selection</u>

There are no unusual requirements for groundwater sampling devices when using low-flow, minimal drawdown techniques. The primary requirement is that the device give consistent results and minimal disturbance of the sample across a range of low flow rates (i.e., <0.5 liter/minute). Note that pumping rates that cause minimal to no drawdown in one well could easily cause significant drawdown in another well that has been installed in a less transmissive formation. Consistency in operation is critical to meet accuracy and precision goals.

There are several pumps which are used frequently for purging or sampling. These types include the peristaltic, bladder, and submersible pumps. It is desirable that the pump be easily adjustable

and operate reliably at these lower flow rates. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid. Bailers and other grab-type samplers are not suited for low-flow sampling and shall not be used.

Bladder Pumps

The bladder pump is a compressed air or gas-operated, positive displacement submersible well pump that uses inert compressed gas, *e.g.*, nitrogen, to inflate an internal bladder which pumps water up the discharge line. These pumps are used when large volumes of water must be purged from monitoring wells or when water depths exceed the limits of a peristaltic pump. Usually these pumps are used on wells with diameters of 2 inches or greater and wells with depths up to 150 feet. When economically feasible the bladder pumps will be dedicated to each well. The line assembly is dedicated for use on one well only. After use, the tubing is wrapped, marked, and stored for future use in the well to which it is dedicated.

The following procedures should be followed for using the bladder pump:

- Connect the line assembly to the pump by first attaching the cable and then connecting the sample and gas lines.
- Lower the pump down the well by unrolling the line off the spool until the pump is located at the desired position inside the well.
- Secure the cable to hold the pump at the desired depth.
- Connect the gas line to the control box. The discharge line should be connected to the water quality meter or flow-through cell, with cell discharge line placed into a container (*e.g.*, 5-gallon bucket or 55-gallon drum) to collect the purged water.
- Connect the gas supply to the control box and adjust the pressure according to the manufacturer's manual.
- As noted, the tubing is used on one well only; after each sampling event it is packed, sealed, and stored for future use on that well.

Submersible Pumps

When wells are encountered which require excessive lift (depth to water is greater than 20 feet) or have diameters greater than 2 inches, positive displacement submersible pumps may also be used to purge the required amount of water. When economically feasible, the submersible pumps will be dedicated to each well. However, in some cases, this is not economically feasible, and the same pump must be used in several wells. When this must be done, the pumps will be appropriately decontaminated between wells. Also, a pump will be used on wells known to

contain similar constituent levels, or used first in wells with lower constituent levels before use in wells suspected to contain higher constituent concentrations.

1. The submersible pump should be lowered to the desired depth using a safety line that is secured to the well casing.

2. Connect the power cord to the power source (generator) and turn on the pump.

3. Connect the discharge line to the water quality meter or flow-through cell, with cell discharge line placed into a container (*e.g.*, 5-gallon bucket or 55-gallon drum) to collect the purged water.

4. Continue to monitor the pumping rate and water level in the well, slowing the rate if drawdown occurs.

Peristaltic Pumps

Peristaltic pumps must be operated above ground next to the well and are limited to water level depths of 20 to 30 feet below ground surface. The following procedure describes the use of peristaltic pumps for purging and sample collection.

1. New Nalgene or low density polyethylene (LDPE) suction line is used on each well being purged. New silicone pump head tubing will also be used if the pump is also used for sampling.

2. The type of tubing used to collect the sample will be contingent on the parameters of interest.

   - If conventional parameters (i.e., biological oxygen demand [BOD], total suspended solids [TSS], fecal coliform, pH, and oil and grease) are being analyzed, then standard Nalgene tubing is sufficient to collect the sample.

   - If volatile, semi-volatile, or metals parameters are the constituents of interest, Teflon™ tubing is used to collect the sample.

3. Unless authorized otherwise, all purged groundwater is collected, containerized, and when possible, managed in an onsite treatment system. All tubing is discarded after each use or dedicated to future use within the same well.

Unless authorized otherwise, all purged groundwater is collected, containerized, and when possible, managed in an onsite treatment system.

3.4 Monitoring or Water Level and Water Quality Indicator Parameters

Performance criteria for determining stabilization should be based on water-level drawdown, pumping rate, and equipment specifications for measuring indicator parameters. Check the water level periodically during purging and sampling to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 meter) during purging. This goal may not be possible to achieve under some circumstances and may require adjustment based on site-specific conditions and personal experience.

In-line water quality indicator parameters should be continuously monitored during purging, as follows:

- temperature;
- pH;
- ORP;
- conductivity,
- dissolved oxygen; and,
- turbidity.

Measurements should be taken every three to five minutes. Stabilization is achieved after all parameters have stabilized for three successive readings. The three successive reading should be within the following guidelines to indicate stabilization:

- ± 10% for temperature;
- ± 0.1 s.u. for pH;
- ± 3% for conductivity;
- ± 10 mv for ORP;
- ± 10% for turbidity, when Turbidity is >10 NTU; and,
- ± 0.3mg/L for dissolved oxygen.

Note that these are guidelines only; for example, in those instances where the field parameters measure at very low quantities, even minor fluctuations can exceed the guidelines, even though stabilization has been achieved. In these instances, the field technician must use professional judgment to determine that parameter stabilization has been achieved.

Parameters will typically stabilize in the following order: pH, temperature, and specific conductance, followed by ORP, dissolved oxygen, and turbidity. If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that ORP, DO and turbidity are very conservative parameters in terms of stabilization and it may be difficult to achieve the stabilization guidelines for these parameters regardless of purge time. Professional judgment may be used in the event that pH, temperature and conductivity have stabilized but ORP, turbidity and D.O. continue to fluctuate. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well.

3.5 Groundwater Sampling

Sample collection should occur as soon as possible once one of the following have been met:

- At least three consecutive readings have been achieved within stabilization parameters, with a minimum of six readings;
- Three well volumes have been removed; or
- Purging has commenced for four hours.

Disconnect or bypass the in-line monitoring device that was used to measure field parameters prior to sample collection. The sampling flow rate should remain at the established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates <0.5 liters/minute are appropriate. The same device used for purging should be used for sampling. Samples will be collected in decreasing order of their volatility. This order is generally as follows:

- Volatile organic chemicals (VOCs);
- Total organic halogens (TOX);
- Gas sensitive parameters (e.g., Fe^{2+}, CH_4, H_2S/HS^-, alkalinity);
- Total organic carbon (TOC);
- Semivolatile organics chemicals (SVOCs);
- Inorganic parameters; and,
- If filtered samples are to be collected, these should be collected last.

Samples collected for volatile organics should be carefully placed into 40 milliliter glass vials with Teflon septum lids. No air bubbles should be present in the vial after sealing

the septum lid; if air bubbles are present, fill the vial more completely. Other common laboratory-provided sample bottles include polyethylene or clear glass for metals and amber glass for phenols and SVOCs.

If the workplan specifies dissolved metals analysis, field filtration of each sample will be necessary. Filtering is performed using an in-line filtration device, hand vacuum pumps with transfer vessels, or peristaltic pumps with disposable funnels/filters. If using the vacuum pump method, a laboratory cleaned transfer vessel is used. If using a peristaltic pump, new silicone tubing is used in the pump head for each sample filtered and new Teflon tubing is used from the pump head to the filter. Samples are filtered through 0.45 micron filter unless specified otherwise in the workplan. After filtering, samples requiring preservatives are preserved and all containers are securely placed in coolers and chilled to an appropriate temperature (usually < 4°C). Each cooler containing samples will contain a completed chain-of-custody form.

Sampling technicians should wear a clean pair of disposable gloves for each well.

4.0 QA/QC PROCEDURES

Quality control requirements depend upon project-specific circumstances and objectives and should be addressed in the workplan.

5.0 DATA RECORDING AND MANAGEMENT

A written record of each monitoring event must be maintained. The record provides a summary of the sample collection procedures and conditions, shipment method, the analyses requested and the custody history. This record consists of the following:

- Field notebook;
- Groundwater Sample Collection Form;
- Chain of custody form; and,
- Shipping receipts.

Sample labels shall be completed at the time each sample is collected and will include the information listed below.

- Project name;
- Sample number;
- Time and date;
- Preservative (if applicable);
- Analyses to be performed; and,
- Sampler's name.

6.0 REFERENCES

U.S. EPA, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, by Robert W. Puls and Michael J. Barcelona, EPA/540/S-95/504, April 1996.

U.S. EPA, Region II, *Ground Water Sampling Procedure - Low Flow Pump Purging and Sampling.*

U.S. EPA, Region IV, *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers.*

EPA 542-S-02-001 May 2002, *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers.*

ATTACHMENT D

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

Prepared for:

Beazer East, Inc.

Prepared by:

Key Environmental, Inc.
1200 Arch Street, Suite 200
Carnegie, Pennsylvania 15106

August 2005

QUALITY ASSURANCE PROJECT PLAN

SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

Prepared for:

Beazer East, Inc.

Prepared by:

Key Environmental, Inc.
1200 Arch Street, Suite 200
Carnegie, Pennsylvania 15106

August 2005

Mr. James Zubrow, P.G.
Project Manager
KEY Environmental, Inc.

Ms. Jane Kilzer
QA Officer
KEY Environmental, Inc.

Mr. Mike Bollinger
Environmental Manager
Beazer East, Inc.

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LIST OF ABBREVIATIONS/ACRONYMS

%R	Percent Recovery
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
Beazer	Beazer East, Inc.
Bechtel	Bechtel Environmental, Inc.
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
C	Completeness
CLP	Contract Laboratory Program
COI	Constituent of Interest
Contractor	Key Environmental, Inc.
DNAPL	Dense Non-Aqueous Phase Liquid
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
GC	Gas Chromatograph
GDMVS	Graphical Data Management and Visualization System
GESPMP	Groundwater Extraction System Performance Monitoring Plan
GFTER	Groundwater Fate and Transport Evaluation Report
GIS	Geographic Information System
gpm	gallon per minute
GRAA	Groundwater Remedial Action Area
IDW	Investigation Derived Wastes
KEY	Key Environmental, Inc.
Koppers	Koppers Company, Inc.
LQM	Laboratory Quality Manual
MNA	Monitored Natural Attenuation
NPL	National Priorities List
PAH	Polynuclear Aromatic Hydrocarbon
PID	Photo-ionization Detector
QA/QC	Quality Assurance/Quality Control
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAWP	Remedial Action Work Plan
RD/RA	Remedial Design and Remedial Action
RDWP	Remedial Design Work Plan
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPD	Relative Percent Difference
SAS	Special Analytical Services
Site	South Cavalcade Superfund Site

SOP	Standard Operating Procedure
SOW	Statement of Work
STL	Severn Trent Laboratories, Inc., Savannah, GA
TCEQ	Texas Commission on Environmental Quality
TDWR	Texas Department of Water Resources
TOC	Total Organic Carbon
U.S. EPA	United States Environmental Protection Agency
VGFTER	Verification of Groundwater Fate and Transport Evaluation Report
VOC	Volatile Organic Compound
Workplan	Supplemental Groundwater Characterization Workplan

1.0 PROJECT MANAGEMENT

This Quality Assurance Project Plan (QAPP) has been prepared by Key Environmental, Inc. (KEY) on behalf of Beazer East, Inc. (Beazer) to support the Supplemental Groundwater Characterization Workplan (Workplan) for the South Cavalcade Superfund Site (Site) located in Houston Texas (Figure 1). This QAPP is intended to serve as an integral part of the Workplan. Please refer to the Workplan for a detailed description of the project objectives, scope of work and schedule. This QAPP provides details regarding the analytical methods, data analysis processes, and other procedures to be followed to ensure confidence in the analytical results and to document the validity of the results of the sampling and analysis activities described in the Workplan. Although this QAPP was prepared to support the Workplan, it is the intention of Beazer to update this document as necessary to support any future monitoring activities.

This QAPP satisfies United States Environmental Protection Agency (U.S EPA) requirements for a QAPP, in accordance with the following guidelines:

1. U.S. EPA, "Guidance for the Data Quality Objectives Process," EPA QA/G-4, August 2000;

2. U.S. EPA "EPA Requirements for Quality Assurance Project Plans," EPA QA/R-5, March 2001; and,

3. U.S. EPA "EPA Guidance for Quality Assurance Project Plans," EPA QA/G-5, December 2002.

1.1 PROJECT ORGANIZATION

Beazer will oversee and coordinate the project. KEY, as the Contractor, will be responsible for ensuring that project-specific sampling activities related to the supplemental groundwater characterization investigation are implemented in conformance with the requirements of the Workplan. Those tasks not performed by the Contractor will be completed by a subcontractor under the direct supervision of the Contractor. The Contractor will also perform Quality Assurance/Quality Control (QA/QC) functions for field activities and deliverables. Deliverables will be issued to Beazer by the Contractor for submittal to the U.S.EPA and the Texas Commission on Environmental Quality (TCEQ), as appropriate. The project organizational chart is presented in Figure 2. Severn Trent Laboratories, Inc. (STL) – Savannah, located at 5102 LaRoche Avenue, Savannah, GA will be the subcontracted laboratory. STL Savannah has previously provided to Beazer analytical services for the South Cavalcade Site.

The management, technical, and QA/QC responsibilities of the key project personnel for implementation of the future sampling activities are summarized as follows:

- <u>Beazer Project Manager</u>

- Coordinate project technical activities
- Conduct project planning activities
- Attend review and planning meetings between Beazer, U.S EPA, and TCEQ, as necessary
- Review all project deliverables
- Oversee the project budget, schedule, and staffing

• Contractor Project Manager

- Coordinate project technical activities
- Assist the Beazer Project Coordinator in project planning
- Attend review and planning meetings between Beazer, U.S EPA, and TCEQ, as necessary
- Provide technical guidance to field personnel
- Establish project files
- Review all project deliverables
- Manage the project budget, schedule, and staffing

• Contractor Investigation Task Leader

- Organize and schedule field and laboratory subcontractor activities
- Ensure that appropriate field documentation is incorporated into the project files
- Supervise field investigation activities and ensure that the Workplan and QAPP are followed
- Provide Health and Safety field support
- Participate in project meetings with Beazer, U.S EPA, and TCEQ, as necessary
- Prepare project technical reports

• Contractor QA/QC Officer

- Review laboratory data corrective action, as necessary for quality assurance (QA) compliance
- Perform or coordinate analytical data validation and review
- Review laboratory QA/QC
- Review data validation and review documentation
- Initiate corrective action, as necessary, for QA compliance

• Laboratory Manager(s):

- Ensure resources are available on an as-required basis
- Coordinate analyses and chain of custody
- Oversee review of data
- Direct implementation of corrective actions required as a result of data review, internal audits, or external audits (if required)
- Oversee preparation of analytical reports

- Approve final analytical reports and case narratives prior to submission to the Contractor

- Analytical Laboratory QA/QC Officer:

  - Review laboratory QA and quality control (QC)
  - Review QA/QC documentation
  - Investigate project-related nonconformance's
  - Verify resolution of such nonconformance's

Primary responsibility for data quality rests with the Contractor's QA/QC Officer. Ultimate responsibility for project data quality lies with the Contractor's Project Manager. Third level quality assurance will be provided by the analytical laboratory's Project Manager and QA/QC Officer prior to release of data and/or reports to the Contractor.

1.2 PROJECT BACKGROUND/ DEFINITION

Site background information is presented in this subsection; the Site description is discussed in Section 1.2.1 and the Site groundwater remedial history is presented in Section 1.2.2. The project definition is discussed in Section 1.2.3.

1.2.1 Site Description

The following site description is taken verbatim from the Verification of Groundwater Fate and Transport Evaluation Report (VGFTER) (KEY, 2000), except where noted at the end of this Subsection. The South Cavalcade Site occupies approximately 66 acres of urban land approximately three miles north of downtown Houston, Texas. The Site is rectangular in shape with a length of approximately 3,400 feet (in the north-south direction) and a width of approximately 900 feet (in the east-west direction). A Site plan is provided as Figure 3.

The Site was operated as a wood treating plant from 1910 until 1962. Creosote and various metal salts were used in the wood treating processes. The wood treating process area was located in the southern portion of the Site along Collingsworth Street. Koppers Company, Inc. (Koppers) operated the wood treating facility from 1940 until closure in 1962. A coal tar distillation plant was operated by Koppers on the southeastern portion of the Site from about 1944 until 1962. Since the discontinuation of these operations, several trucking firms have occupied the property.

The Site is currently occupied by three trucking firms; thus, much of the ground surface, especially in the southern and northern portions of the Site, is covered by concrete or asphalt pavement, or buildings, as shown on Figure 3. Additionally, Beazer completed the construction of a concrete cap in areas where soil concentrations exceed the remedial goal specified in the U.S. EPA Record of Decision (ROD) (U.S. EPA, 1998) for the Site. The central portion of the Site is currently undeveloped. A groundwater treatment facility is located along the eastern Site boundary in the central portion of the Site. Future use of the Site properties for non-residential purposes is to be expected, because deed restrictions for on-Site properties are in place and the

consent agreements between U.S. EPA and the respective property owners prohibit property use for residential purposes. The consent agreements between EPA and the respective property owners also prohibit on-Site groundwater use.

Land use in the vicinity of the Site is a mixture of commercial, industrial and residential. Industrial and commercial properties are located to the east and across Collingsworth Street to the south of the Site. The North Cavalcade Superfund Site, which is also the location of a former wood treating facility, is located directly across Cavalcade Street to the north of the Site. Active rail lines immediately border the Site boundaries to the east and the west. The nearest residences are located several hundred feet to the west of the Site. Note that the Harris County Toll Road Authority (HCTTRA) is constructing an extension of the Hardy Toll Road which will border the western Site boundary. As a result, the toll road has or is in the process of acquiring the railroad right-of-way and certain residential properties to the west of the Site.

1.2.2 Site Groundwater Remedial History

The following description of the Site groundwater remedial history is taken verbatim from the VGFTER except where noted at the end of this subsection. In 1983, the Houston Metropolitan Transit Authority investigated the Site for potential use in the municipal mass transit system. Results of this investigation indicated localized areas of potential impact and the Site was subsequently referred to the Texas Department of Water Resources (TDWR). In April 1984, TDWR recommended to U.S. EPA that the Site be placed on the National Priorities List (NPL). In October 1984, U.S. EPA proposed that the Site be added to the NPL. The Site was formally included on the NPL in June 1986.

In March 1985, Koppers entered into an Administrative Order on Consent (AOC) to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the Site. The RI/FS was completed by Koppers in August 1988, Remedial Investigation (Keystone Environmental Resources, July 1988) and Feasibility Study Reports (Keystone Environmental Resources, August 1988) were submitted to U.S. EPA.

A ROD was subsequently issued by U.S. EPA in September 1988 which presented the selected remedial alternatives for Site soil and groundwater. The selected remedial alternative for groundwater included extraction and treatment of groundwater containing constituent concentrations greater than the remedial goals specified in the ROD. The ROD stipulated that "groundwater collection will continue until constituents have been recovered to the maximum extent possible", as "determined during the Remedial Action, based upon experience in operating the groundwater collection and treatment system." The ROD specified that once U.S. EPA had determined that groundwater constituents have been recovered to the maximum extent possible, groundwater collection would cease and any remaining constituents would be allowed to naturally attenuate to background levels. The ROD also indicated that the groundwater could be remediated via in situ biological treatment if equal performance was demonstrated.

A Detailed Statement of Work for the South Cavalcade Site (SOW) was completed by Bechtel Environmental, Inc. (Bechtel) on behalf of Beazer in May 1990. The SOW described the remedial design and remedial action (RD/RA) activities to be performed by Beazer including

pilot study tasks to support the design of the selected remedies. In March 1991, Beazer entered into a Consent Decree with U.S. EPA for implementation of the RD/RA activities specified in the SOW. The SOW was subsequently incorporated into the U.S. EPA-approved Remedial Design Work Plan (RDWP) prepared by Bechtel on behalf of Beazer, dated March 1992.

Tasks conducted to support the groundwater remedial design included groundwater collection well, groundwater recovery trench, and groundwater treatment system pilot studies. Pilot study tasks were completed in October 1993. A 100% Design Groundwater Collection and Reinjection System and Dense Non-Aqueous Phase Liquid (DNAPL) Recovery System Report was prepared by McLaren/Hart Environmental Engineering Corporation on behalf of Beazer. The design report was submitted to U.S. EPA in December 1994, and was subsequently approved.

Implementation of the groundwater remedial action was initiated in June 1995 in accordance with a U.S. EPA-approved Remedial Action Work Plan (RAWP) dated May 1995 and associated support documents. One DNAPL recovery well (RWN-4) and four groundwater collection wells (RWN-1, RWN-2, RWN-3 and RWN-5) were installed within Groundwater Remedial Action Area (GRAA) 1 located in the north section of the Site. One DNAPL recovery well (RWS-5) and three groundwater collection wells (RWS-3, RWS-4, and RWS-6) were installed within GRAA 2, which includes the area formerly occupied by the coal tar distillation plant. Two combined groundwater collection/DNAPL recovery wells (RWS-1 and RWS-2) were installed within GRAA 3, which includes the area formerly occupied by the wood treating process area.

Start-up of the groundwater collection and DNAPL recovery components of the groundwater remedy was conducted in September 1995, following completion of the groundwater treatment plant modifications. In an U.S. EPA letter dated October 6, 1995, U.S. EPA indicated that "there is some question as to whether U.S. EPA will continue to apply the current remedial action goals [i.e., the remedial goals specified in the ROD issued in 1988] to groundwater cleanup." This direction was taken in response to a July 31, 1995 U.S. EPA memorandum directing a policy favoring applicable and relevant and appropriate requirement (ARAR) waivers at sites where it is technically impracticable to remediate groundwater to Federal or State standards. As provided by the October 6, 1995 U.S. EPA letter and in accordance with an agreement between U.S. EPA and Beazer, groundwater collection and treatment has been delayed pending determination of the potential inapplicability of the groundwater remedial goals specified in the ROD. Operation of the DNAPL recovery component of the groundwater remedy is currently ongoing.

DNAPL recovery operations were conducted in conjunction with groundwater pumping during November and December 1995 as start-up of the groundwater treatment system was completed. In January 1996, operation of the DNAPL recovery system in the passive mode of operation (i.e. collection of DNAPL without groundwater pumping to increase hydraulic gradients) was initiated in accordance with the U.S. EPA-approved 100% Remedial Design. Evaluation of the DNAPL recovery data collected through June 1996 in accordance with the statistical protocol (i.e., zero-slope analysis) specified in the Groundwater Extraction System Performance Monitoring Plan (GESPMP) indicated that DNAPL had been recovered to the "maximum extent possible" under the passive mode of operation.

As a result and in accordance with the U.S. EPA-approved 100% Remedial Design, DNAPL recovery, with groundwater extraction to enhance hydraulic gradients, was initiated in one GRAA (GRAA 3) to evaluate the effectiveness and practicability of this enhancement prior to its use in the other GRAAs. Evaluation of the DNAPL recovery data collected in GRAA 3 from July through September 1996 indicated that groundwater extraction (at a pumping rate of 0.3 gallons per minute [gpm] from individual recovery wells) appeared to enhance DNAPL recovery in Wells RWS-1 and RWS-2. Based on this observation, DNAPL recovery with groundwater extraction to enhance hydraulic gradients was initiated in GRAAs 1 and 2 in October 1996. Beazer continues operation of the DNAPL Recovery System in the gradient enhanced mode, in accordance with the U.S. EPA-approved RAWP and applicable U.S. EPA Guidance, such as the Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration.

In addition to the ongoing DNAPL recovery operation, Beazer has been conducting annual groundwater monitoring since March 1993 in two deeper monitoring wells located in the vicinity of the Site, as stipulated in the ROD. This activity is independent of the natural attenuation assessment for shallow groundwater and is subject only to the applicable provisions of the ROD and U.S. EPA approved RDWP. The results of this monitoring show that the deeper groundwater beneath the Site has not been impacted.

On August 5, 1997, Beazer submitted a revised Groundwater Fate and Transport Evaluation Report (GFTER) to the U.S. EPA for review and approval. The GFTER presented the results of analytical groundwater fate and transport modeling conducted using existing data, where possible, and information from published technical literature as protective default values where Site-specific data were not available. The fate and transport modeling presented in the GFTER was completed by Beazer as a preliminary evaluation of whether natural attenuation processes are sufficient to meet the remedial objectives for shallow groundwater at the South Cavalcade Site. The results of the GFTER supported a preliminary hypothesis that effective natural attenuation of dissolved organic constituents of interest (COI) may be occurring in the shallow groundwater zone at the Site. The GFTER was approved by the U.S. EPA on August 14, 1997.

On July 31, 2000, Beazer submitted a VGFTER to the U.S. EPA. The VGFTER was conducted pursuant to the Work Plan for Verification of the Groundwater Fate and Transport Evaluation which was reviewed and approved by the U.S. EPA. The VGFTER also describes and incorporates supplemental data collection activities that were conducted in response to the results from implementing the approved VGFTER Work Plan. The scope of the supplemental activities was communicated to U.S. EPA by letter dated March 21, 2000. The results of the VGFTER supported the conclusion that a Monitored Natural Attenuation (MNA) remedy is feasible for dissolved phase COIs in shallow groundwater at the South Cavalcade Site.

Since the completion of EPA's review of the VGFTER, EPA and Beazer have conducted detailed reviews of all Site geologic and constituent concentration data to determine whether potential preferential pathways for groundwater exist. As a result of these evaluations, a scope of work for the supplemental groundwater characterization was developed.

1.2.3 Project Definition

The Workplan, which this QAPP supports, presents the scope of work for supplemental groundwater characterization in the shallow and intermediate groundwater-bearing units at the Site. The purpose of the investigation is to provide additional data: to support re-evaluation of the groundwater remedy to include monitored natural attenuation; to develop a monitoring network for both aquifers; and to complete delineation of the groundwater contaminants in the southwest portion of the Site. This QAPP is intended to serve as an integral part of the Workplan. Please refer to the Workplan for a detailed description of the project objectives, scope of work and schedule.

The scope of the investigation was developed through a series of meetings and communications among representatives of Beazer, U.S. EPA, and TCEQ. The scope of the investigation was discussed with the U.S. EPA and TCEQ during a meeting in Houston on April 5, 2005 and concurrence regarding the scope of work was achieved.

1.3 PROJECT DESCRIPTION

The Workplan describes the investigation procedures necessary to provide additional data to investigate preferential groundwater migration pathways and to support the re-evaluation of the groundwater remedy to include monitored natural attenuation. Section 2.0 of the Workplan describes the scope of the supplemental groundwater characterization investigation, the methodologies to be used for its implementation, and the chemical parameters that will be evaluated, in detail. Table 1 of this QAPP summarizes the sampling methods and parameters to be analyzed during each investigative task outlined in Section 2.0 of the Workplan. Table 2 of this QAPP presents the matrix sample summary, QC sample summary, and analytical requirements summary for each investigative task.

1.4 DATA QUALITY OBJECTIVE PROCESS

The Data Quality Objective (DQO) process specifies the appropriate amount and type of data required, and establishes tolerable levels of uncertainty for the environmental decisions to be made. U.S. EPA has developed a systematic process for developing DQOs that includes consideration of several critical elements. The process requires definition of the problem and statement of the decisions that will be made based on study results. The users of the data and key personnel and their roles in the program are identified, as are any regulatory criteria or agencies that will be involved. Information needed to support these decisions can then be determined, including what the COI are and physical boundaries of the study area, the quantity of data that will be needed, the means to collect these data and the level of uncertainty that will be acceptable. Program design can then be optimized to collect defensible data in the most efficient manner.

For the investigation described in the Workplan, the decisions to be made are as follows:

- Do preferential groundwater migration pathways to offsite locations exist;

- Is the existing monitoring network sufficient to assess plume attenuation or potential constituent migration;

- Where should additional monitoring points (if any) be placed; and,

- To support the decision making process, potential preferential groundwater migration pathways (i.e. more permeable zones within the alluvial sediments) will be investigated and monitoring wells that are spatially representative of the Site will be sampled/analyzed. An iterative process may be used to accomplish project objectives.

1.4.1 Project Quality Objectives

This QAPP serves as a controlling mechanism during the supplemental groundwater characterization investigation to provide procedures which, when followed properly, will assure that all decisions based on laboratory and field data generated during this investigation are technically sound and properly documented. Specific procedures for sampling, laboratory analyses, data reporting, and data validation, are presented in other sections of this QAPP.

1.4.2 Measurement Performance Criteria

As a result of the varying nature of the data required, there are several applicable levels of data quality for the Workplan. A primary component of data quality is selection of the appropriate analytical level for the intended data use. Analytical levels, as described in "Data Quality Objectives for Remedial Response Activities" (U.S. EPA, March 1987), are as follows:

- Level I - Field screening or analysis using portable instruments. Results are often not compound-specific and not quantitative, but are available in real-time. Level I data are appropriate for initial field screening and for health and safety monitoring. They are frequently used to determine sample collection locations for laboratory analyses.

- Level II - Field analysis using more sophisticated portable analytical instruments; in some cases, the instruments may be set up in a mobile laboratory on location. There is a wide range in the quality of data that can be generated that is dependent on the use of suitable calibration standards, reference materials and sample preparation equipment. Results are available in real-time or within several hours.

- Level III - All analyses are performed in an off-site analytical laboratory. Level III provides quantitative data. Documented sampling and analysis procedures must be used. Level III analyses may or may not use Contract Laboratory Program (CLP) procedures, but at a minimum, abbreviated CLP-type deliverables are required. Level III requires QA/QC procedures conducted in accordance with U.S. EPA guidelines. The laboratory may or may not be a CLP laboratory.

- Level IV – CLP-equivalent routine analytical services. All analyses are performed in an off-site analytical laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols and documentation with full validation of all data.

- Level V - Analysis by nonstandard methods. All analyses are performed in an off-site laboratory that may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits. CLP Special Analytical Services (SAS) are Level V.

Level I will be used for the screening activities required for in the Workplan, specifically this includes screening data for volatile organic compounds (VOCs) measured with a photo-ionization detector (PID) and field water quality parameters (e.g., pH conductivity, dissolved oxygen, temperature). It is anticipated that all laboratory analytical services for the scope of work presented in the Workplan will be Level III.

Each of these levels is characterized by statistically based criteria expressed in terms of:

- Precision;
- Accuracy;
- Representativeness;
- Completeness;
- Comparability; and,
- Sensitivity.

These parameters are discussed in the following six subsections.

1.4.2.1 Precision

Precision is defined as the degree of agreement between repeated measurements of the same parameter under prescribed, similar conditions. Field and laboratory precision will be monitored using results from duplicate sample analyses. Precision can then be expressed as the relative percent difference (RPD) of one result with another. The RPD is calculated as follows:

$$RPD = \frac{D1 - D2}{\frac{(D1+D2)}{2}} x\,100$$

Where: RPD = relative percent difference
D1 = first duplicate value
D2 = second duplicate value.

The overall DQO for precision of analytical measurements is expressed as a percent of the duplicates having RPDs within established control limits. For the purposes of this project, a RPD of 30% will be used as a benchmark. However, it should be recognized that significant variability in duplicate sample concentrations can occur, particularly for soil samples. Note, soil samples for this project will be analyzed for TOC only. Groundwater samples that have the potential for significant interferences or high suspended solids content (e.g., those from temporary wells without sandpacks) may also have significant variability in duplicate sample

results. When evaluating the RPD results for field duplicate samples, the nature of the samples must be considered and professional judgment must be employed.

The precision of Level I data will be confirmed through repetitive and/or consecutive measurements. The precision of Level III data can be measured through the analysis of field duplicates, laboratory duplicates, and matrix spike duplicates. The frequency of field duplicate collection is specified in Section 2.5.1.1. The frequencies of laboratory duplicate analyses (required for inorganic analyses) and matrix spike/matrix spike duplicate set analyses (required for organic analyses), will be at a minimum of 1 per 20 field samples.

Reproducibility is expressed as a relative percent difference, which is the absolute value of the range between the duplicate results divided by the mean. Acceptable RPDs for each analyte from laboratory and matrix spike duplicates are specified in descriptions of their respective methods. Field duplicate precision criteria for soils and waters are included in data validation guidelines.

1.4.2.2 Accuracy

Accuracy is the measure of the degree of agreement between an analyzed value and the true or accepted value where it is known. Field and laboratory accuracy will be monitored using known concentrations of analytes and surrogates spiked into blanks and selected samples. Accuracy can then be expressed as a percent recovery (%R), which is calculated as follows:

$$\%R = \frac{Qd}{Qa} x\,100$$

Where: %R = percent recovery
Qd = spiked sample result minus the sample result
Qa = spiked amount.

The overall DQO for accuracy is thus the percent of samples that have %R within prescribed control limits.

Accuracy of Level III data can be measured by the analysis of equipment blanks, trip blanks, method blanks, matrix spikes, and surrogate standards. Blanks provide a way of detecting biases introduced in the sampling, sample handling, and analysis. Matrix spikes are samples to which known amounts of target constituents are added.

The frequency of equipment blank and trip blank collection and analysis is specified in Section 2.5.1.1. The frequencies of analyses of method blanks, laboratory control spikes, and matrix spikes, and surrogate standards are specified in the respective methods. The methods also present the acceptable percent recovery limits for each analyte.

1.4.2.3 Representativeness

Representativeness expresses the extent to which the analytical data reflect the actual media at the site and are representative of site conditions and characteristics. Representativeness is a function of the sampling program design and execution and the analytical program. Representativeness from field activities is addressed by collecting an adequate number of samples from optimal locations using standard procedures. The number and location of samples and methodologies of sampling are specified in the Workplan. Representativeness as a function of analytical-method issues may be compromised by method deviations, the presence of potential laboratory or field artifacts, indications of sample non-homogeneity, and recovery anomalies from surrogates or spikes into field samples.

1.4.2.4 Completeness

Completeness (C) is a measure of the amount of valid data obtained from an analytical measurement system. It is expressed as a percent of the overall data that were generated and is calculated as follows:

$$\%C = \frac{V}{T} x\, 100$$

Where: %C = percent completeness
V = number of measurements judged valid
T = total number of measurements.

An acceptable percentage of data determined to be valid should be established as target goals for each particular objective. Anything below these goals would require re-sampling and re-analysis or a modification to the goal with justification. As a general rule, the sampling programs will be designed so that program needs will be met if 90% completeness is achieved.

1.4.2.5 Comparability

Comparability is an expression of the confidence with which one data set can be compared against another. Comparability is a qualitative function of the sampling and analysis methods. To assure that one data set can be compared to another, the sampling and analysis methods will follow well-documented standard procedures. The procedures to be used are described in the Workplan.

1.4.2.6 Sensitivity

Sensitivity is the ability of the method to detect the contaminant of concern at the concentration of interest (regulatory clean up standard). Method detection limits and reporting limits for the analytes of interest are specified in Section 2.4 and are adequately sensitive for the measurement of the constituents at the levels required for this project. QC measures which aid in evaluating sensitivity are field rinsate blanks, trip blanks, and laboratory method blanks. These QC samples are used to ensure that field or laboratory practices do not introduce contaminants, which may

positively bias laboratory results. Method reporting limits are set at a level equal to that of the low level standard of the instrument calibration curve.

1.5 DOCUMENTATION AND RECORDS

The data acquired during the implementation of this project may be utilized in the preparation of the following documents to be prepared on behalf of Beazer:

- Supplemental Groundwater Characterization Report
- Natural Attenuation Monitoring Plan

The above-listed documents may, at Beazer's discretion, be separately prepared and titled as listed, or the content of such separate documents may be combined into one or more reports and/or titled differently.

All records generated during this project will be kept on file by Contractor on behalf of Beazer. These records may include: field log books, field sampling forms, chain of custody forms, laboratory data deliverables, photographs, and other relevant records. These records will be kept in accordance with applicable record retention requirements specified in the Consent Decree.

Revisions and updates to this QAPP will be prepared as Beazer and/or the Contractor deem necessary. A full revision to the QAPP will be prepared if work has not been completed within five years. This will ensure that laboratory changes or method improvements are addressed and that changes to program objectives or scope that may be made as a result of the information gathered in the initial stages are incorporated into the overall program QA/QC. Changes to the QAPP will be documented and signed by Beazer and the Contractor. Document control will be maintained through changing the Revision Numbers and Date in the header of this document.

2.0 MEASUREMENT DATA ACQUISITION

2.1 SAMPLING PROCESS DESIGN

Sampling methods/frequency, laboratory analytical methods/parameters, and QA/QC procedures/frequency are presented in this QAPP. Sampling locations, sampling methods, and sampling frequency are discussed in detail in Section 2.0 of the Workplan. Laboratory analytical parameters for the anticipated sampling and analysis programs may include analysis for one or more of the following parameters:

- Total Organic Carbon (TOC)
- Benzene and Naphthalene

The specific list of parameters associated with each of the respective tasks is identified on Table 1. Routine analyses will be preformed in accordance with the following guidance documents:

- EPA, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, as updated and revised;
- American Society of Agronomy, Inc., Methods of Soil Analysis, Number 9, Part 2, page 570, (Walkley-Black Procedure); and/or,
- Laboratory SOPs.

QA/QC samples will be collected and submitted to the laboratory for analysis in accordance with the frequencies discussed in Section 2.5.1.1 of this QAPP.

2.2 SAMPLING METHODS

Sections 2.0 and 3.0 of the Workplan provide detailed information regarding sampling methods, decontamination procedures, and management of investigation derived waste (IDW). Attachment B of the Workplan contains the Standard Operating Procedure (SOP) for low flow purging and sampling.

2.3 SAMPLING HANDLING AND CUSTODY

Included in Appendix A of this QAPP are KEY (SOPs) 103, 105, 106, and 114 which present the sample handling and custody procedures. Section 2.0 of the Workplan also discusses sample handling and custody information.

2.4 ANALYTICAL METHODS AND DETECTION LIMITS

The analytical procedures to be used for this program are presented in Table 2. Detailed information and quality control requirements are provided in the subcontract laboratory's

Laboratory Quality Manual (LQM). The subcontract laboratory selected for this QAPP is STL-Savannah. The Texas lab certification number for STL-Savannah is TX216-2005A. A copy of STL-Savannah's LQM is provided in Appendix B. The STL-Savannah laboratory is capable of achieving organic analysis detection limits that are suitable for the purpose of the project. A summary of STL-Savannah's most recent method detection and reporting limits for U.S. EPA Method SW-846 8260B is as follows:

COI	MDL (ug/L)	RL (ug/L)
Benzene	0.36	1.0
Naphthalene	0.44	5.0

MDL – Method Detection Limit per most recent STL-Savannah study.
RL – Reporting Limit

2.5 QUALITY CONTROL

This section discusses field and laboratory quality control requirements. Laboratory quality control requirements are dictated, in large part, by the analytical methods. Additional aspects of laboratory quality control are discussed in the selected laboratory's LQM.

2.5.1 Field Quality Control Requirements

Quality control in the field will be maintained through equipment calibration (discussed in Section 2.7.1 of this QAPP), measurement reproducibility, and the collection of QC samples.

2.5.1.1 Field Quality Control Samples

Quality control for field sampling efforts will primarily be measured via the collection of field QC samples, which consist of the following:

- Field duplicates;
- Equipment blanks;
- Trip blanks.

The data application and sample requirements for each are discussed in the following paragraphs.

Field Duplicates

Field duplicates are used to evaluate the laboratory analytical program for reproducibility of data. One field duplicate for each analysis will be analyzed at a rate of one per every 20 samples.

Field duplicates are collected simultaneously by splitting a sample evenly between the matrix and QC sample bottles. For instance, a groundwater sample bailer would be emptied, in relatively equal volumes, into two sample bottles (one matrix and one QC).

Field duplicates of soil samples for all analyses except volatile organics will be taken by homogenizing the material in a suitable container, i.e., stainless steel bowl, and then placing replicate portions into the sample containers. Field duplicates for volatile analyses will be collected as separate samples from the same location or boring depth. Preservation and filtration will be performed as necessary for the appropriate analysis.

Equipment Blanks

Equipment blank data are used to evaluate field decontamination procedures. Equipment blanks will be collected by pouring analyte-free water, supplied by the analytical laboratory, through a decontaminated sample bailer or over decontaminated soil sampling utensils, and then into the sample bottles. Preservation and filtration will be performed as necessary for the appropriate analyses. If disposable equipment is used, the field blank will be taken from a rinse of the equipment prior to sampling use. One field blank per matrix will be sufficient for this project.

Trip Blanks

Trip blank data will be used to evaluate exposure to volatile organic constituents (VOCs) during sampling, shipping and storage at the laboratory. The prepared trip blanks are to be transported with the VOC vials to the field. One set of trip blanks will be included in each cooler containing VOC sample vials and will be analyzed only for the required VOCs.

2.5.2 Laboratory Quality Control Requirements

Quality control data are necessary to determine precision and accuracy of the analyses, and to demonstrate the absence of interferences and contamination of glassware and reagents. Laboratory-generated QC will consist of blanks, replicates, standards, matrix spikes, surrogate spikes and blanks. These will be prepared and analyzed at the method-required frequencies. Method-recommended matrix spiking solutions will be used to determine matrix effects. Surrogates will be added to all samples requiring gas chromatograph (GC) analyses (or as specified in the method). At a minimum, one method blank will be processed for every batch (up to 20 samples) analyzed. Blank samples will be analyzed in order to assess possible contamination and determine which corrective measures may be taken, if necessary.

Laboratory Duplicates

Replicate samples are aliquots of a single sample that are split upon arrival at the laboratory or prior to analysis. Laboratory duplicates are required by methods for inorganic analyses. Since it is anticipated that the concentrations of most organic parameters will be below the laboratory detection limits, precision data on replicate analyses will largely be derived from matrix spike duplicate data. Significant differences between two replicates that are split in a controlled laboratory environment will result in flagging of the affected analytical results.

Surrogate Analysis

Surrogate spike analysis is used to determine the recovery efficiency of analytes in the sample preparation and analysis. Calculated percentage recovery of the spike is used as a measure of the accuracy of the total analytical method. A surrogate spike is prepared by adding to a sample (before extraction) a known amount of pure compound similar to that for which the sample is being analyzed. Surrogate compounds will be added to all samples that are to be analyzed for volatiles including method blanks, duplicate samples, and matrix spikes using the compounds recommended in the respective methods. If a recovery does not fall within these limits, the corrective actions described in the method will be implemented.

Matrix Spike/Matrix Spike Duplicate Analysis

This technique is used to determine the effect of matrix interference on analytical results. Aliquots of the same sample are prepared in the laboratory and each aliquot receives consistent treatment throughout the analytical method. Spikes are added at concentrations specified in the methods. Spike duplicates are prepared for organic analyses. The percent difference between the values of the spike duplicates is taken as a measure of the precision of the analytical method.

Method Blanks

Method blanks will be run for all appropriate analyses to verify that the procedures used do not introduce contaminants that affect the analytical results. The method blank will be prepared by addition of all reagents to a substance of similar matrix as the sample. This blank will then undergo all of the procedures required for sample preparation. The resultant solution will be analyzed with the field samples prepared under identical conditions.

Deviations from the established QC criteria will be noted and reanalysis or other corrective action will be instituted as appropriate for the situation.

2.6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Field check summary sheets will be used to identify the most recent maintenance, battery charge, and equipment condition. Routine maintenance procedures will be noted in the field notebooks and may include:

- Removal of surface dirt and debris from exposed surfaces of the field measurement systems;
- Cleansing of the ionization chamber, lamp window, and any filters in a PID; and,
- Daily inspections of sampling equipment and measurement systems for possible problems (i.e., cracked or clogged lines or tubing or weak batteries).

Spare and replacement parts stored in the field to minimize downtime may include:

- Appropriately sized batteries;

- Locks;
- Decontamination supplies;
- Extra sample containers;
- Bailers;
- Bailer line;
- Stainless steel bowls and spatulas/spoons;
- Calibration kit(s), battery charger, and support equipment;
- Health and safety supplies; and,
- Tool kit.

If damaged equipment is identified, it will be replaced by the same or equivalent model as soon as practicable. Field QA activities will be reported to the Contractor Project Manager and QA Officer. Problems encountered during the program affecting quality will be reported. The Project Manager/QA Officer will be responsible for initiating the corrective actions and for ensuring that the actions are taken in a timely manner and that the desired results are produced.

During the course of the corrective actions, the field personnel will be responsible for seeing that field instruments are functioning properly and that work progresses satisfactorily. Additionally, field personnel are responsible for the performance of routine preventive maintenance and QC procedures.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

This section discusses instrument calibration procedures and frequency of calibration. Field instrument calibration is discussed in Section 2.7.1. Laboratory instrument calibration is discussed in Section 2.7.2.

2.7.1 Field Instrument Calibration

Precision and accuracy of field measurements will be maintained in two ways:

- Through daily calibration of each instrument in accordance with the manufacturer's procedures; and,

- By checking the reproducibility of the measurement by obtaining and recording multiple readings.

2.7.1.1 Equipment Requirements

The following field equipment is anticipated for use during the Workplan, for various screening, monitoring, and measurement tasks:

- Electronic groundwater and non-aqueous phase liquid (NAPL) depth measuring devices ;
- PID;
- In Situ groundwater collection method (i.e. Geoprobe® Screen Point Sampler);

- Groundwater sampling pumps such as peristaltic pumps, bladder pumps, electrical submersible pumps, and gas driven pumps; and,
- Field meters for measuring pH, turbidity, temperature, dissolved oxygen, specific conductance (i.e. Horiba™).

2.7.1.2 Calibration Requirements

All equipment will be calibrated daily for each day of use, or more frequently if necessary. Calibration information is to be recorded on the equipment calibration forms or in the field notebook. If calibration difficulties are experienced for a given piece of equipment, the Contractor or subcontractor responsible for equipment upkeep will replace the equipment with a similar, or equivalent model, as soon as is practicable.

2.7.2 Laboratory Instrument Calibration

Calibration of laboratory equipment will be accomplished according to published procedures associated with specific methods of analysis and U.S. EPA guidance. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities. These records will be filed at the location where the work is performed and will be potentially subject to QA audit. For all instruments, the laboratory will maintain a factory-trained repair staff with in-house spare parts, or maintain service contracts with vendors.

2.8 DATA ACQUISITION

Data will be transferred electronically or by computer diskette directly from the laboratory to the Contractor. Once received by the Contractor, data will be reduced and formatted in easily interpreted tables in Excel format. From this format, data will also be electronically transferred into the Contractor's Graphical Data Management and Visualization System (GDMVS). The data format required by the Contractor is presented in KEY SOP 155 (Appendix A).

2.9 DATA MANAGEMENT

The analytical, survey and geological electronic and hardcopy data will be managed and maintained by the Contractor. Any requests for these data by third parties must be first approved by Beazer. Data management for the project has the following objectives:

- Establish a controlled, functional, and efficiently operated data management system and accompanying procedures to manage, analyze, document, and transfer the environmental data that are collected and generated.

- Maintain a usable and accurate database throughout the life of the project.

- Process specific data requests from project and Beazer personnel.

- Transfer specific data components to other parties, as appropriate.
- Archive the database and related documentation upon closure of the project.

2.9.1 Data Transmittal, Transformation, and Analysis

Upon receipt of data from the analytical laboratory, Contractor personnel will ensure that all data packages are complete. If data packages are determined to be incomplete, the laboratory will be contacted and will be required to promptly provide the missing information. Contractor personnel will be responsible for transcribing all data, including electronically transferred data (i.e., electronic data deliverables [EDDs]), into tables suitable for data review. After review and validation, field and laboratory data will be entered into the database with appropriate qualifiers.

Contractor personnel will review Level III data to ascertain that the laboratory has provided the following information:

- Results for all samples submitted;
- Correct reporting units;
- Documentation of acceptable matrix spike duplicate and surrogate recoveries;
- Acceptable standard and preparation blank results; and,
- Appropriate qualifiers of data for which results are reported below the detection limit or for analytes that are also detected in method or preparation blanks.

Tables containing analytical data will be generated through queries from the database and compared against the applicable criteria. Geographic Information System (GIS) data may be used to generate boring logs, groundwater flow maps, and isoconcentration plots.

Geologic data obtained form boring logs, well construction information, and survey coordinates and elevations will also be entered. The data will be reviewed for accuracy and completeness.

Any difficulties originating from the EDD format shall be resolved with the laboratory before the data are imported. Upon importing analytical data, a random sampling will be verified against the associated hard copy data and a copy of the reviewed electronic data printout will be annotated, signed, and retained in the project file.

2.9.2 Data Storage and Retrieval

All electronic data will reside in the Contractor database to be accessed and managed by the Contractor. All records will be maintained by the Contractor until project completion and closeout.

Upon completion of all data review and/or validation, Contractor personnel will prepare data summary tables, as applicable. The Contractor Project Manager is responsible for ensuring that no errors are introduced in data transcription. Both the Contractor Investigation Task Leader and the QA Officer will review and/or check all data tables.

Data not suited to entry into the GDMVS will be included or summarized in reports to management, and data reports will be made part of the permanent project file. The Contractor's Project Manager will be responsible for ensuring that all data are included in the permanent project file.

3.0 ASSESSMENT/OVERSIGHT

3.1 ASSESSMENT AND RESPONSE ACTIONS

The assessment and oversight of the project activities may include a process of review and evaluation through systems audits, performance audits, internal peer review, and laboratory oversight. This process will ensure that the QAPP is adhered to, the quality of the data is adequate, and corrective actions, when needed, are implemented effectively and in a timely manner.

3.1.1 Technical Systems Audits

Systems audits performed by the QA/QC Officer or designee may encompass evaluation of QA components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits will be conducted if Beazer requests an unscheduled audit or conditions that may compromise quality are identified. The Systems Audit (if required) will consist of an inspection of the following procedures:

- Sampling
- Sample custody
- Sample storage and preservation
- Sample preparation
- Analytical methodology
- Data management
- Preventive maintenance
- Recordkeeping

3.1.2 Technical Performance Audits

Performance audits may be conducted to determine conformance to the QAPP. As in system audits, unplanned audits may be implemented if requested. Performance audits will be performed after sampling activities commence and the project begins to generate data. These audits document that sampling, custody, and record-keeping in the field are in compliance with applicable requirements of the QAPP.

3.1.2.1 Field Performance Audits

A field performance audit may be conducted at the discretion of the Project Manager to ensure that field personnel are in compliance with the Workplan and applicable SOPs. Each audit shall cover the items necessary to verify proper control of the activities within the defined scope of work. Concerns such as equipment inspections and calibration, personnel training, decontamination, field screening, sample collection, sample shipping and chain-of-custody procedures, and document control are included in a field audit.

The mobilization stage may be audited before work begins to assure that all procedures, training, and materials are in place to support the QAPP. Field activities may be audited during the initial stage to assure compliance with the QAPP. Additional audits may be required depending on the results of these audits. All audits and corrective actions will be reported in writing to the Project Manager.

3.1.2.2 Laboratory Audits

Texas certified laboratories will be used for this program. If conditions are noted that indicate potential quality issues with analytical results, an audit may be conducted at the recommendation of the QA/QC Officer. This audit shall consist of a general audit and a specific procedure audit. A general audit will be an overview of the whole laboratory from sample receipt to sample disposal. A specific technical audit will be a detailed in depth review of an actual method or procedure.

The findings from any audit conducted will be documented on a laboratory audit record form. Any issues, observations, and findings shall be discussed with the Laboratory Manager. The results of the audit shall be kept on file along with any corrective action taken. If, as a result of the audit, there is uncertainty as to the validity or correctness of a test result, immediate corrective action should be taken and the client notified in writing.

3.2 CORRECTIVE ACTION PROTOCOLS

Project management and staff, including field investigation teams, quality assurance auditors, document, sample control personnel, and laboratory groups, will monitor ongoing work performance in the normal course of daily responsibilities. When a significant condition adverse to quality is noted at the project location or laboratory, the cause of the condition will be determined and corrective action taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned and taken will be documented and reported to the Project Manager. Implementation of correction action will be verified by documented follow-up action. All project personnel have the responsibility, as part of their normal work duties, to promptly identify and report conditions adverse to quality, and solicit correction. Corrective actions may be initiated under the following (for example):

- When predetermined acceptance standards are not attained (objectives for precision, accuracy, and completeness);
- When procedures or data compiled are determined to be incorrect or incomplete;
- When equipment or instrumentation is found to be malfunctioning;
- When samples and test results cannot be traced with certainty;
- When quality assurance requirements have been violated;

- When designated approvals have been circumvented;
- As a result of system and performance audits; or,
- As a result of a management assessment.

Corrective actions shall be documented using appropriate field and laboratory forms. All corrective action forms shall be entered into the project files.

3.3 REPORTS TO MANAGEMENT

As needed, progress reports will be prepared by the Contractor, or designate, and submitted to Beazer. Quality assurance reports to management will consist of reports on audits, reports on correction of deficiencies found in audits, a final QA report on field sampling activities, and a final analytical laboratory QA/QC report.

4.0 DATA VALIDATION AND USABILITY

4.1 DATA REVIEW, VALIDATION, AND VERIFICATION

This section discusses data review, validation, and verification. Field data are discussed in Section 4.1.1. Laboratory data are discussed in Section 4.1.2.

4.1.1 Field Data

Field data will be reviewed using four different procedures:

- Routine checks will be made during the processing of data, i.e., looking for errors in identification codes;
- Internal consistency of a data set will be evaluated. This step will involve plotting the data and testing for outliers;
- Checks for consistency of the data set over time will be performed. This can be accomplished by visually comparing data sets against gross upper limits obtained from historical data sets, or by testing for historical consistency. Anomalous data will be identified; and,
- Checks will be made for consistency with parallel data sets; i.e., data sets obtained from the same population (for example, from the same region of the aquifer).

The purpose of these validation checks and tests is to identify outliers; i.e., an observation that does not conform to the pattern established by other observations. Outliers may be the result of transcription errors or instrumentation breakdowns. Outliers may also be manifestations of a greater degree of spatial or temporal variability than expected.

After an outlier has been identified, a decision concerning its factual basis must be made. Obvious mistakes in data will be corrected when possible, and the correct values inserted. If the correct values cannot be obtained, the data may be excluded. An attempt will be made to explain the existence of the outlier. If no plausible explanation can be found for the outlier, it may be excluded, but a note to that effect will be included in the report. Also, an attempt will be made to determine the effect of the outlier with both inclusion and exclusion from the data set.

4.1.2 Laboratory Data

Prior to submitting analytical data to the Contractor, the laboratory must verify compliance to the method requirements. The laboratory will follow their QA/QC manual, SOPs, and this QAPP for all sample analyses. The laboratory will also be responsible for the oversight of the data quality for all analyses. Any sample integrity issues, discrepancies with the chain of custody, or concerns with the analysis will be addressed and resolved through the Laboratory QA/QC Officer.

All analytical data and calculations shall be reviewed by the laboratory and shall include a minimum of three levels of documented review, including analyst review, peer review and supervisory review. For each level, the review process shall be documented, signed and dated by the reviewer. Each step of this review process shall include the evaluation of data quality based on both the results of the QC data and the professional judgment of those conducting the review. All electronic deliverables must be checked against the hard-copy reports to ensure that the two versions match. Laboratory data will be reported to include the following information:

- Summary and QA/QC narrative;
- Original Chain of Custody form;
- Sample receipt form documenting sample condition;
- Sample results with method reference, dates of sample receipt, preparation, and analysis noted on report form;
- Dilution/concentration factors;
- Sample-specific reporting limits;
- Surrogate recoveries;
- Method blank results linked to field samples;
- Matrix spike results, matrix spike duplicate results, recovery, and precision values;
- Laboratory control sample results;
- Duplicate sample results; and,
- Summaries of initial and continuing calibration analyses.

4.2 VALIDATION AND VERIFICATION METHODS

To ensure the utility of the sample results, a data usability assessment of the analytical data will be completed. This review will be completed by the Contractor's QA/QC Officer. The analytical results generated via SW-846 Method 8260B will be reviewed in accordance with specific critical components of relevant U.S. EPA guidance for data validation. Specifically, analytical results will be reviewed considering the following general rubrics:

- Sample holding time compliance
- Acceptable surrogate spike recoveries
- Laboratory method blank artifacts
- MS/MSD RPDs and recoveries

The analytical results will be reviewed to ensure that samples were analyzed within an acceptable time frame (based on the date of sample collection). Surrogate recoveries will be reviewed to determine if the Gas Chromatography/Mass Spectrometry instrumentation was performing adequately. Method blank results will be reviewed to identify the possibility of laboratory contamination of the samples. The MS/MSD results will provide an indication of the precision of the analytical method given the potential for matrix interference effects.

The data usability assessment will be completed in accordance with applicable sections of with the following guidance document: U.S. EPA's Contract Laboratory Program, National Functional Guidelines for Organic Data Review. As required, this guidance document will be

used in conjunction with the laboratory SOPs for the respective analytical methods. Professional judgment will be exercised throughout the data assessment effort, particularly for situations that are not addressed or clearly specified in the SOPs or in the guidance documents.

4.3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

Results from review/validation of field activities and analytical data will be integrated to allow a final reconciliation of achieved data quality with the stated DQOs.

Accuracy, precision, and completeness will be calculated in accordance with the formulas provided in this document. Representativeness will be evaluated based on the implementation of the field sampling program and analytical program with attention paid to evidence of non-homogeneity of samples. Reporting limits will be compared to applicable criteria to evaluate whether adequate sensitivity was achieved. Sampling and analysis methods and results will be reviewed against historical data or data from other related locations to determine comparability.

4.3.1 Data Quality Assessment

The Supplemental Groundwater Characterization Report will identify any areas of concern where objectives were not met and evaluate the impact of these upon the intended uses of the data. Specific samples or analytes for which the uncertainty exceeds program or project-specific objectives will be identified so that Beazer may make informed decisions on the potential impact to the overall program.

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U.S. EPA, December 2002, EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5.

U.S. EPA, Contract Laboratory Program, National Functional Guidelines for Organic Data Review.

TABLES

TABLE 1

SAMPLE COLLECTION SUMMARY
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

Task	Sample Method	Sample Analysis	Analytical Method
Potential Preferential Pathway Investigation – Soil Sampling	Geoprobe/Soil Core	TOC	Walkley-Black
Potential Preferential Pathway Investigation – Groundwater Sampling	Point Sampler/Installation of a Temporary Well Low Flow Purge and Sampling (See Text of Work Plan)	Benzene and Naphthalene Field Parameters	SW846 8260B See Notes
Existing Monitoring Well and Piezometer Sampling	Low Flow Purge and Sampling (See Text of Work Plan)	Benzene and Naphthalene Field Parameters	SW846 8260B See Notes

Notes:

SW846 refers to "U.S. EPA, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW846, third ed., as revised and updated.
TOC refers to Total Organic Carbon
"Field Parameters" include pH, specific conductance, temperature, dissolved oxygen, oxidation/reduction potential (ORP), and turbidity, as measured by a field instrument, e.g. Horiba™

TABLE 2

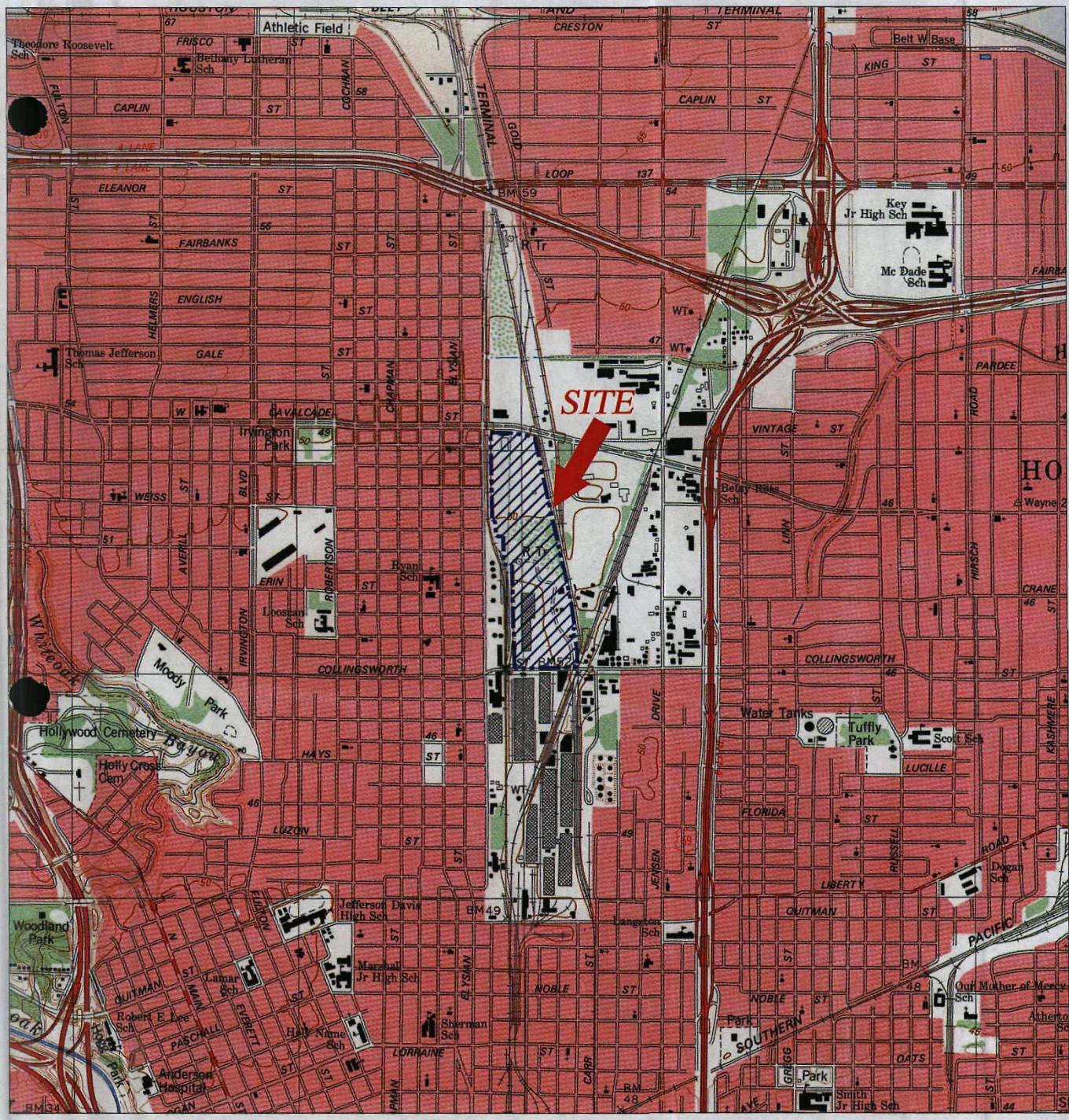
ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

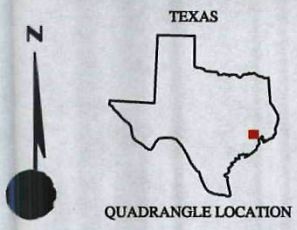
Matrix Sample Summary			QC Sample Summary				Analytical Requirements Summary				
Analytical Parameter	**Matrix**	**Approximate No. of Samples**	**Field Duplicates**	**Equipment Blanks**	**MS/MSDs**	**Trip Blanks**	**Method Reference**	**Container Type**	**Required Sample Volume**	**Preservation**	**Holding Time**
TOC - Potential Preferential Pathway Investigation	Soil	10	1	1	1	---	Walkley-Black	4 oz Glass Jar	50 grams	4°C	28 Days
Benzene and Naphthalene – Potential Preferential Pathway Investigation	Water	16	1	1	1	1/trip	SW846 8260B	Glass Vials	3 40-ml vials with Teflon-lined septum	4°C + HCl	14 Days
Benzene and Naphthalene – Existing Monitoring Well and Piezometer Sampling	Water	26	2	1	2	1/trip	SW846 8260B	Glass Vials	3 40-ml vials with Teflon-lined septum	4°C + HCl	14 Days

Notes:

SW846 refers to "U.S. EPA, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW846, third ed., as revised and updated.
TOC refers to Total Organic Carbon
Approximate number of samples. Step-out locations: in the event that obvious evidence of groundwater impact is observed during the potential preferential pathway investigation, additional borings with groundwater sampling will be added.

FIGURES





QUADRANGLE LOCATION

BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA

DRAWN: BKC	DATE: 5-19-05	KEY ENVIRONMENTAL INCORPORATED
CHKD: JRH	DATE: 5-19-05	
APPD: JSZ	DATE: 5-19-05	
SCALE: 1" = 2000'		

QUALITY ASSURANCE PROJECT PLAN
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE OF SETTEGAST, TEXAS – 1982

KEY ENVIRONMENTAL, INC.

ISSUE DATE:

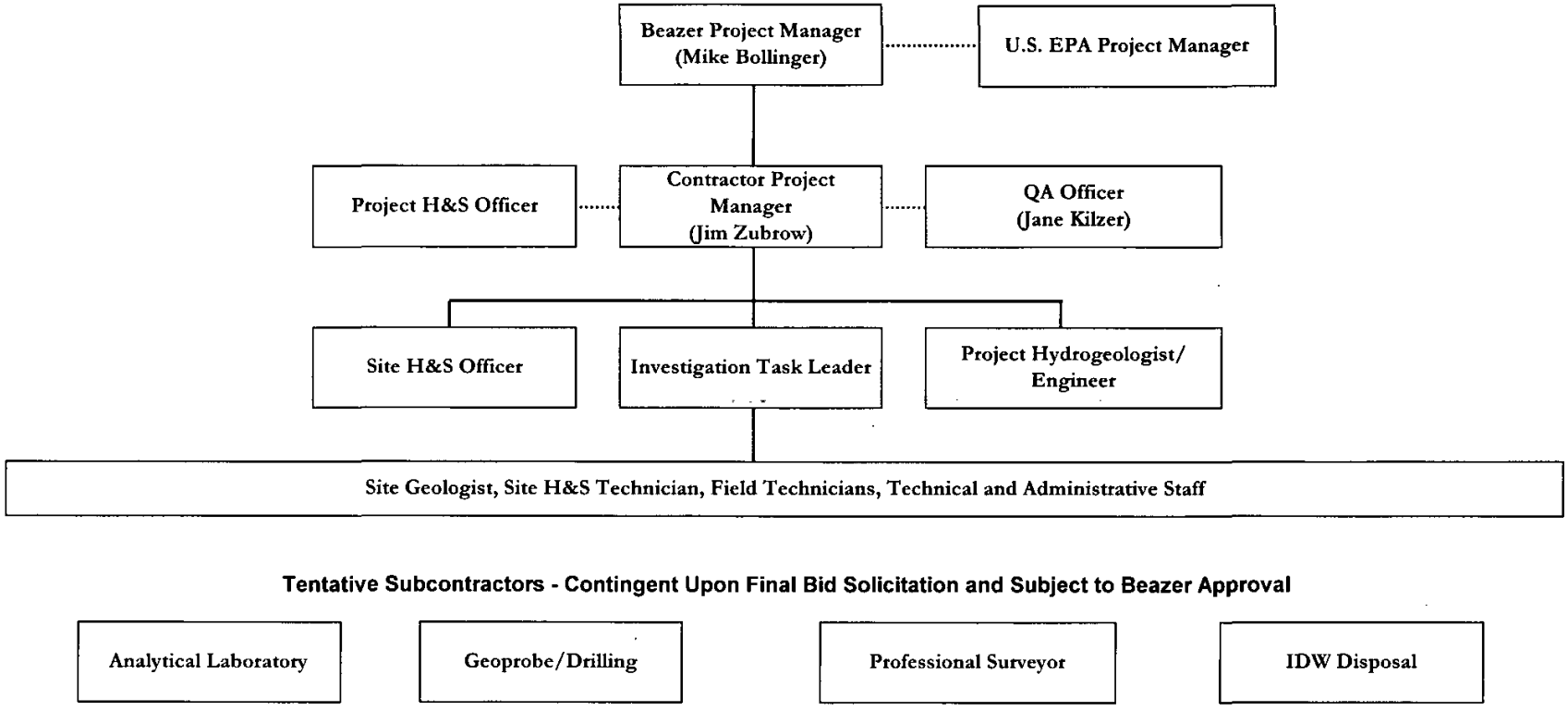
ROSSLYN FARMS INDUSTRIAL PARK
1200 ARCH ST., SUITE 200
CARNEGIE, PA 15106

SITE LOCATION MAP

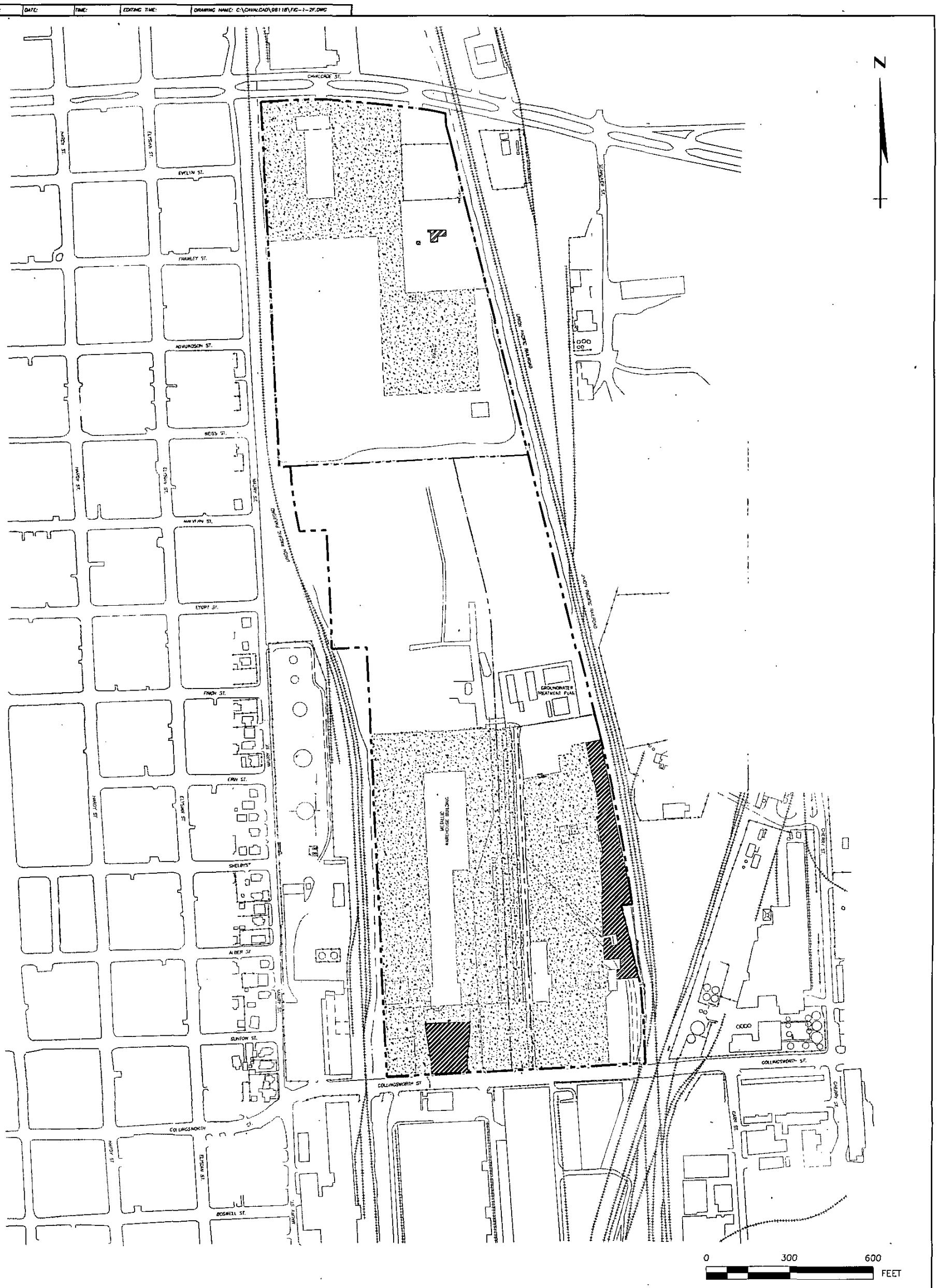
DRAWING NUMBER
05-070
FIGURE 1

FILE: Y:\SOUTH CAVALCADE\98-587\FIG-01.DWG

FIGURE 2
PROJECT ORGANIZATIONAL CHART
QUALITY ASSURANCE PROJECT PLAN
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS



EDITED BY:	DATE:	TIME:	EDITING TIME:	DRAWING NAME: C:\CAVALCAD\98118\FIG-1-2F.DWG



LEGEND:

SOUTH CAVALCADE SITE BOUNDARY

PROPERTY BOUNDARIES

AREAS COVERED WITH ASPHALT OR CONCRETE

CONCRETE CAP CONSTRUCTED BY BEAZER

BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA

DRAWN: BKC	DATE: 5-19-05	KEY ENVIRONMENTAL INCORPORATED	
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APPD: JSZ	DATE: 5-19-05		
SCALE: AS SHOWN			

QUALITY ASSURANCE PROJECT PLAN
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

REV #	DATE	DESCRIPTION	APPD
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KEY ENVIRONMENTAL, INC.

ISSUE DATE:

ROSSLYN FARMS INDUSTRIAL PARK
1200 ARCH ST., SUITE 200
CARNEGIE, PA 15106

SITE PLAN

DRAWING NUMBER
05-070
FIGURE 3

APPENDIX A

KEY STANDARD OPERATING PROCEDURES

#103 - ENVIRONMENTAL SAMPLE PREPARATION

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents procedures for selecting appropriate sample containers and preservatives when collecting environmental samples for analysis at a selected laboratory. Procedures for packaging and shipping environmental samples are presented in Key SOP #114.

Environmental samples are those that are anticipated to be relatively low in analyte concentration. These samples consist of materials that may have been impacted by source area materials, but do not consist of source area materials such as sludge, material from drums, material from bulk storage tanks, *etc.* Examples of environmental samples include: soil samples collected adjacent to or underlying a source area, stream and sediment samples, and groundwater samples (which do not contain non-aqueous phase liquid).

2.0 REQUIRED MATERIALS

Required materials for sample containers and preservation may include:

- various sized glass containers (with Teflon®-lined lids or caps, clear or amber colored);
- various sized polyethylene containers (with Teflon®-lined lids or caps);
- nitric acid;
- sulfuric acid;
- hydrochloric acid;
- sodium hydroxide; and,
- sodium thiosulfate.

Project-specific, appropriate sample container size, sample volume, holding times, and preservatives should be presented in the Quality Assurance Project Plan (QAPjP).

3.0 METHODOLOGIES

Sample Containers

To limit potential chemical or physical changes in a sample during collection and transport, the sample container selection should be based on the following:

- Sample containers should be new and certified clean prior to sampling activities;
- Sample containers should be constructed of non-reactive materials; and,
- Sample containers should not chemically or physically alter the sample.

The most widely used containers for aqueous samples are composed of glass or polyethylene.

Aqueous Samples

Glass Containers

Glass containers will be used when organic compounds are the analytes of interest. Sample volume will be sufficient to fill each sample container to allow the laboratory to attain the method-specific detection limits. Specific to volatile organic analysis, sample volume will be sufficient to fill each sample container so that no air bubbles are present. Once the sample container is full (and preserved if appropriate), it will be sealed with a Teflon®-lined screw cap. Specific container sizes for each analytical category are presented in the project-specific QAPjP.

Polyethylene Containers

Polyethylene containers will be used for aqueous samples when metals and/or inorganic analytes are the parameters of interest. One-liter polyethylene bottles with solid polyethylene or polyethylene-lined caps will generally be used to collect groundwater samples for metals and inorganic analysis. Once the sample container is full (and preserved if appropriate), it will be sealed with the polyethylene screw cap. Specific container sizes for each analytical category are presented in the project-specific QAPjP.

Solid Samples

Sample containers for the soil matrix are typically clear glass with a volume of 8 ounces. Larger sample containers may be necessary depending upon the number and type of analyses.

Sample Preservation

Sample preservation is important to retard physical and chemical alterations of unstable analytes within the sample matrix. Sample preservation methods are limited and are generally intended to:

Retard biological action;

- Retard hydrolysis of chemical compounds and complexes;
- Limit photolysis;
- Reduce volatility of constituents; and,
- Reduce sorption effects.

Preservation is usually limited to acidification, treatment with an alkaline chemical, reducing light exposure, filtration, and refrigeration.

Prior to any form of preservation, the following parameters, at a minimum, will be measured in the field on water samples and recorded in the field notebook:

- pH;
- Specific conductance; and,
- Temperature.

These field measurements record baseline information on the water sample prior to external influences such as temperature, dissolved carbon dioxide, or oxygen affecting the sample.

Acidification

Acidification of samples is generally performed for two purposes. Acidifying a (water) sample serves to limit metal adsorption to the sample container and will maintain the metal in a dissolved state. Secondly, acidification will act to inhibit bacterial growth. Samples to be acidified for either purpose will require a minimum volume of 100 ml and will be acidified to a pH < 2. Acidification is performed immediately after taking field measurements or following sample filtration.

Alkaline Treatment

Samples are preserved with an alkaline chemical (*e.g.* NaOH) to form salts with volatile compounds such as cyanide. Samples undergoing this preservation require a minimum volume of 100 ml and will be treated to a pH >12.

Preservation of the sample will be performed by the addition of NaOH until the desired pH is achieved (pH > 12). Preservation of a water sample is performed immediately after the field measurements are collected and recorded.

Filtration

Filtration of samples will be used only for specific analytical parameters. It will be used when the dissolved metal content of water is of concern. Filtration will not be performed for samples to be analyzed for volatile organics, semi-volatile organics, or total recoverable metals.

When sample filtration is required, the sample will be drawn through a 0.45 micron filter. The filter material will either be paper or fiberglass dependent on the nature of the sampled water. Filtration is performed immediately following the field measurements and prior to any other preservation methods. If the sample contains a significant level of suspended solids, a paper prefilter will be used prior to the 0.45 micron filter.

Temperature Control

All field samples that are to be analyzed by the laboratory will be sealed and then refrigerated during transfer to and storage at the laboratory. Refrigeration of samples is a bacterial inhibitor and slows the chemical and biological changes of a sample exposed to an oxidizing atmosphere.

Transfer and storage of samples will be between 0°C and 10°C, with a target temperature of 4°C. Solid samples are typically limited to this preservation method.

Laboratory Selection and Coordination

Choosing a qualified analytical laboratory is an integral part of sampling activities. Regulatory program requirements and certifications must be considered in selecting the laboratory to ensure that the laboratory is capable of meeting project-specific requirements. Also, the provisions of any Consent Orders or Unilateral Orders applicable to the project must be reviewed and communicated to the laboratory to ensure project-specific requirements are met.

Laboratory Selection

- An analytical laboratory will be chosen based on the following criteria:
- Capabilities of the laboratory including performance history, certifications, and regulatory program experience;
- The qualifications and experience of the laboratory staff;
- Availability of a designated technical client representative who serves as a single point of contact for all Key projects;
- Quality and completeness of standard deliverables, including electronic data transfer availability;
- The specified analyses and turnaround time; and,
- The adequacy of the laboratory's quality assurance/quality control program.

Coordination

After selecting a laboratory, the laboratory will be contacted and the following information requested pertaining to the sampling activities:

- Identification of a responsible party to act as sample custodian at the laboratory who is authorized to accept samples and verify the data entered from the accompanying chain-of-custody forms into the laboratory tracking system.
- Provisions for a laboratory sample custody log consisting of serially numbered, standard laboratory tracking report sheets.
- Specifications of laboratory sample custody procedures for sample handling, storage, and dispersement for analysis.

The laboratory will be notified within 48 hours prior to receipt of samples. The samples will be packaged and shipped *via* express courier or hand delivered within 48 hours of collection to the laboratory. The laboratory will then be contacted to verify receipt of the samples and estimated turnaround time.

Sample Packaging and Shipping

Proper sample packaging and shipping accomplishes the following:

- Allows individual samples to be tracked through transport and analysis;
- Limits the possibility of breaking or losing a sample bottle during transport; and,
- Is part of formal chain-of-custody (COC) procedures (tracking of possession of the samples).

Samples will be packaged and shipped according to the procedures in Key SOP #114, "Sample Handling, Preservation, Packaging, and Shipping."

4.0 DATA RECORDING OR MANAGEMENT

(Reserved)

5.0 REFERENCES

U.S. Environmental Protection Agency, 1986. *RCRA Groundwater Monitoring Technical Enforcement Guidance Document.* OSWER-9950.1. September 1986.

U.S. Environmental Protection Agency, 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846 3rd Edition (with revisions).

U.S. Environmental Protection Agency, 1987. *A Compendium of Superfund Field Operations Methods, Part 1.* EPA/540/P-87/001. December 1987.

U.S. Environmental Protection Agency, 1991. *Compendium of ERT Groundwater Sampling Procedures.* EPA/540/P-91/007. January 1991.

#105 - CHAIN OF CUSTODY

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents procedures for documenting possession/custody of environmental samples from the time of collection through delivery to the receiving analytical laboratory. At this point, internal laboratory records should document sample custody until final disposition. This SOP also discusses sample identification and the use of chain-of-custody (COC) forms.

Possession of the samples must be traceable from the time each is collected until analysis is completed. To document sample possession, chain-of-custody procedures are followed. Chain-of-custody evidence includes all documentation associated with the sample including the chain-of-custody form, sample label, custody seal, courier's receipt (if applicable), and field notebook.

A sample is under custody if one or more of the following criteria are met:

- It is in possession of the custodian or a designated member of the sampling team;
- It is in plain view, after being in possession;
- It was in possession and is secured against tampering; and,
- It is placed in a designated secure area.

2.0 REQUIRED MATERIALS

- Sample container labels;
- Chain-of-custody forms;
- Field notebook;
- Shipping Airbills;
- Locks or Packaging Tape; and,
- Custody seals.

3.0 METHODOLOGIES

The Project Manager (or designee) is responsible for ensuring that sample labeling is completed in accordance with this SOP and that chain-of-custody forms are completed for sample shipments. All individuals relinquishing and receiving samples shall sign, date, and record the time on the chain-of-custody forms.

Sample Identification

Blank sample labels will be supplied by the analytical laboratory and affixed to the sample container. Sample labels will be completed using waterproof permanent markers or ink. The labels will be filled out at the time of sample collection by the field sampling personnel. The following identifying sample information will be included on the label:

- Client/Site;
- Sample identification alpha-numeric code;
- Sample collector's initials;
- Date and time (military) of sample collection;
- Analytical method; and,
- Laboratory analysis to be performed.

Chain-of-Custody Forms

Once the sample containers have been filled with the sampled media and properly labeled, they will be prepared for shipment to the receiving analytical laboratory. Coolers containing samples will be accompanied by a chain-of-custody form (see example COC form in Figure 1).

The field team leader (or designee) shall complete a chain-of-custody form for each lot of packaged samples (*e.g.*, cooler). COC forms shall be completed in ink. Any transcription errors shall be corrected by striking the erroneous information with a single horizontal line. The corrected information shall be added immediately adjacent to the strikeout. The sampler should initial the correction.

The following information will be recorded on the COC form:

- Client/Site;
- Name(s) of sampler(s);
- Sample identification alpha-numeric code;
- Date and time (military) of sample collection;
- Type of sample (*e.g.*, soil, groundwater);
- Number of containers per sample location;
- Requested analyses;
- Type of containers and preservatives used;
- Name and address for the completed laboratory reports;
- Name and address for laboratory invoices; and,
- Specific instructions/notes for the laboratory, as necessary.

Any area of the COC, where sample information is not completed, should have a hatched line drawn through to show that this portion of the COC will not be completed.

Each COC will be placed in a waterproof plastic bag and affixed to the underside of the shipping container lid. Samples will be packaged properly for shipment as described in SOP #114, Sample Handling, Preservation, Packaging, and Shipping, and dispatched to the appropriate laboratory for analysis. Shipping containers will be padlocked or otherwise sealed for shipment to the laboratory.

All shipments should be accompanied by the completed Chain-of-Custody Record. The original record will accompany the shipment to the laboratory, and a copy will be retained by the field

team leader for the project file. Shipping bills and receipts must be retained as part of the chain-of-custody documentation.

Upon receipt of the samples by the laboratory, the laboratory person assigned to log-in samples will confirm that the shipping container seals are in good condition and have not been disturbed. The original chain-of-custody form is to be signed and dated by the laboratory person logging in the samples. In addition, the receiving laboratory is to inspect each sample and indicate the condition of the sample on the COC. The receiving laboratory is to retain a copy of each chain-of-custody form along with the shipping bill. Internal laboratory chain-of-custody procedures will be followed once samples are logged in by the receiving laboratory.

4.0 DATA RECORDING/MANAGEMENT

As discussed in Section 3.0, information related to tracking environmental samples will be recorded on the COC forms which will be retained in the project files.

5.0 REFERENCES

U.S. Environmental Protection Agency, 1986. *RCRA Groundwater Monitoring Technical Enforcement*

U.S. Environmental Protection Agency, 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846 3rd Edition (with revisions).

U.S. Environmental Protection Agency, 1987. *A Compendium of Superfund Field Operations Methods, Part 1.* EPA/540/P-87/001. December 1987.

U.S. Environmental Protection Agency, 1991. *Compendium of ERT Groundwater Sampling Procedures.* EPA/540/P-91/007. January 1991.

Figure 1
Example Chain-of-Custody Form

#106 - FIELD LOGBOOK

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents procedures for proper documentation of site activities with respect to the daily field logbook. Field logbooks are the primary source of documentation for site activities, and serve as legal record of all occurrences during those activities.

2.0 REQUIRED MATERIALS

The required materials for maintaining a field log book include a water-resistant, permanently bound notebook and a pen with permanent ink.

3.0 METHODOLOGIES

Pertinent information regarding the site and work procedures must be documented. Information recorded in the notebook should be noted with the date and time of entry. The following items are commonly included as logbook entries:

- Name and location of site;
- Date and time of arrival and departure;
- Name of person keeping log;
- Names and affiliations of project personnel;
- Sampling event description; including methodology, sample numbers and volumes, description of samples, date and time of sample collection, and name of collector;
- Prevailing weather conditions;
- Technical measurements and readings;
- Diagrams and sketches;
- Description of equipment used;
- List and descriptions of photographs; and,
- Equipment calibration information.

Information should be recorded in permanent ink for the legal record. The company name, address, and phone number should be entered at the beginning of the log book. The pages of the logbook should be numbered for ease of reference. Blank spaces should be crossed out and initialed. All notes should be written at the time of observation. Changes or deletions should be crossed out with a single line and initialed by the individual making the change. At the end of each field day, the project scientist/engineer or designee should sign and date each page of the notebook on which entries were made to verify the day's activities.

4.0 QA/QC PROCEDURES

At the end of each day of field activities, the individual or individuals maintaining the field log book should review the notes for accuracy and completeness. Corrections, deletions, or additions should be initialed and the time and date should be noted.

5.0 DATA RECORDING AND MANAGEMENT

It is recommended that a running activity log be maintained, indicating the times of activities and observations; recorded data be written in the form of tables with an appropriate title; and that diagrams be included to illustrate pertinent information. Log books should be labeled with the project name, project number, and a consecutive number for cataloging purposes.

6.0 REFERENCES

Environmental Research Center, University of Nevada - Las Vegas, March 1989, Soil Sampling Quality Assurance User's Guide, EPA/600/8-89/046.

Fetter, C. W., 1994, Applied Hydrogeology, Macmillan College Press Publishing Company, New York, New York, 691 p.

U.S. EPA, September 1986, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, OSWER-9950.1

#114 - SAMPLE HANDLING, PRESERVATION, PACKAGING, AND SHIPPING

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) describes the procedures associated with the handling, preservation, packaging, and shipment of environmental samples for laboratory analysis or testing. Environmental samples may consist of air, groundwater, surface water, sediments, soil, non-aqueous phase liquid (NAPL), and/or sludges. The objective of sample preparation, handling, packaging, and shipping protocols is to develop standard procedures which will preserve the integrity of the samples and minimize the potential for sample tracking errors, sample spillage or leakage, and/or sample container breakage. The field team leader is responsible for the implementation of the sample handling, preservation, packaging, and shipping requirements outlined in the project-specific sampling and analysis plan (SAP).

2.0 REQUIRED MATERIALS

Required materials may include the following:

- Sample containers (preserved, as necessary);
- Sample bottle labels;
- Chain-of-Custody forms;
- Sample cooler;
- Bubble wrap or other suitable packing material;
- "Blue Ice" (*i.e.*, reusable, freezable ice packs) or sealed bagged ice;
- Shipping bills (Federal Express, Airborne, etc.);
- Packaging tape; and,
- Zip lock plastic bags.

3.0 METHODOLOGIES

3.1 Sample Handling

Sample Containers

Sample containers and appropriate preservatives (where necessary) will be supplied by the analytical laboratory. After the respective sample containers have been filled with appropriate sample media and preserved as necessary, samples will be properly identified using sample container labels, and the samples will be stored at an appropriate temperature (usually <4°C) to preserve the integrity of the samples.

Sample Preservation

Preservatives will be supplied by the laboratory. Where possible, preserved containers should be

supplied by the lab. Common preservatives include hydrochloric acid (HCl), sulfuric acid (H_2SO_4), nitric acid (HNO_3), or sodium hydroxide (NaOH). Samples will be preserved in accordance with EPA protocol specified in SW-846 or the project specific protocols outlined in the quality assurance project plan (QAPjP). Use of the preservatives will be noted on the COC for each particular sample and analytical parameter.

Sample Labels

Blank sample labels will be supplied by the analytical laboratory and affixed to the sample container. Sample labels will be completed using waterproof permanent markers or ink. The labels will be filled out at the time of sample collection by the field sampling personnel. The following identifying sample information will be included on the label:

- Client/Site;
- Sample identification alpha-numeric code;
- Sample collector's initials;
- Date and time (military) of sample collection;
- Analytical method; and,
- Laboratory analysis to be performed.

Chain-of-Custody Forms

A chain-of-custody (COC) record will be established and maintained to document sample possession from the time of collection until receipt by the laboratory. Once samples are received by the laboratory, they will be handled under the laboratory internal COC procedures. Field sampling personnel will initiate a COC record by recording the following minimum data as the samples are collected:

- Client/Site;
- Name(s) of sampler(s);
- Sample identification alpha-numeric code;
- Date and time (military) of sample collection;
- Type of sample (e.g., soil, groundwater);
- Number of containers per sample location;
- Requested analyses;
- Type of containers and preservatives used;
- Name and address for the competed laboratory reports;
- Name and address for the laboratory invoices; and,
- Specific instructions/notes for the laboratory, as necessary.

Sample COC forms will be placed in waterproof plastic bags and taped to the underside of the cooler lids. Sample COC forms will generally be supplied by the subcontracting analytical laboratory.

Subsequently, at each change of possession, the COC record will be signed by the person relinquishing the samples and by the person receiving the samples. The date and time of the transfer of possession of the sample will be recorded on the COC form; this occurs when the samples are transferred from the sampling personnel to the courier and when the samples are received at the analytical laboratory. Sample COC forms shall be completed in ink. Any transcription errors shall be corrected by striking the erroneous information with a single horizontal line. The correct information will be added immediately adjacent to the strikeout. The sampler should initial the correction. (Refer to SOP #105 for additional information).

3.2 Sample Packaging and Shipping

All samples will be transported to the analytical laboratory in durable, waterproof, secured metal or plastic coolers. Sample coolers will generally be supplied by the laboratory. All samples will be packaged very carefully to prevent sample breakage. Samples will be shipped *via* overnight carrier (*e.g.,* Federal Express, Airborne, United Parcel Service) or hand delivered to the analytical laboratory, generally within 48 hours of collection. However, project specific protocols will be checked to assure that specified sample holding times are not exceeded in the event that samples are not shipped on the same day that they were collected. Additionally, the sample security and preservation must be maintained if samples are not to be transported immediately to the laboratory. The following procedure should be followed for packaging samples for shipment to the laboratory for testing and/or analysis.

1. Place plastic bubble wrap matting or suitable material over the base and bottom corners of each cooler or shipping container.

2. Obtain a chain-of-custody record (similar to the example shown in Figure 1) and enter all the appropriate information as discussed above. Chain-of-custody records will include complete information for each sample. One or more chain-of-custody records shall be completed for each cooler or shipping container as needed to manifest each sample.

3. Place bubble wrapping or other suitable material around glass bottles and place standing upright on the base of the cooler, taking care to leave room for packing material and ice or equivalent. Rubber bands or tape may be used to secure wrapping completely around each sample bottle.

4. Place additional bubble wrap and/or Styrofoam pellet packing or equivalent material throughout the voids between sample containers within each cooler.

5. Place cold packs or ice in heavy duty "zip-lock" type plastic bags, completely close the bags, and distribute such packages over the top of the samples. Add additional bubble wrap and/or Styrofoam pellets or other packing materials to fill the balance of the cooler or container.

6. If shipping the samples by express, courier, or delivery service, sign the chain-of-custody record thereby relinquishing custody of the samples. The date and time of custody transfer should be recorded on the chain-of-custody form. The custody transfer should be documented when directly transferring custody to a receiving party or when transmitting to a shipping service for subsequent receipt by the analytical laboratory. The shipping service should not be asked to sign chain-of-custody records.

7. Remove the last copy from the chain-of-custody record and retain with the field records. Place the original and remaining copies in a "zip-lock" type plastic bag and tape the bag to the underside of the lid of the cooler or shipping container.

8. Close the top or lid of the cooler or shipping container and with another person gently rotate the container to verify that the contents are packed so that they do not move. Improve the packaging if needed and reclose.

9. Packaging tape should be wrapped entirely around the sample shipping containers. A minimum of two full wraps of packaging tape will be placed in at least two places on the cooler or shipping container. Some project-specific QAPjPs may require custody seals be placed on the sample shipping containers. Sign and date the chain-of-custody tape.

10a. When transporting samples by automobile to the laboratory, and where periodic changes of ice are required, the cooler should only be temporarily closed so that reopening of the cooler can be easily performed. In these cases, chain-of-custody will be maintained by the person transporting the samples and chain-of-custody tape need not be used. If the cooler is to be left unattended, then chain-of-custody procedures should be implemented.

10b. If shipment is required, transport the cooler to an overnight express package terminal or arrange for pickup. Obtain copies of all shipment records as provided by the shipping service.

11. Upon receipt of the samples, the analytical laboratory will open the cooler or shipping container and will sign "received by laboratory" on each chain-of-custody form. The laboratory will verify that the chain-of-custody tape has not been broken previously and that the chain-of-custody tape number corresponds with the number on the chain-of-custody record. The analytical laboratory will then forward the back copy of the chain-of-custody record to the sample collector to indicate that sample transmittal is complete.

4.0 QUALITY CONTROL

Quality control samples such as rinsate blanks and duplicates will be specified by the project QAPjP. A sample jar containing water should be sent as a temperature blank with each sample shipment requiring temperature preservation to ensure proper temperature is maintained. Also, a trip blank, provided by the laboratory will accompany shipments with samples intended for volatile organic chemical (VOC) analysis.

5.0 DATA RECORDING/MANAGEMENT

The documentation for supporting the sample handling, preservation, packaging and shipping will consist of chain-of-custody records, shipping records laboratory reports. In addition, a description of sample packaging procedures will be written in the Field Log Book. All documentation will be retained in the project files.

6.0 REFERENCES

U.S. Environmental Protection Agency, 1986. *RCRA Groundwater Monitoring Technical Enforcement Guidance Document.* OSWER-9950.1. September 1986.

U.S. Environmental Protection Agency, 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846 3rd Edition (with revisions).

U.S. Environmental Protection Agency, 1987. *A Compendium of Superfund Field Operations Methods, Part 1.* EPA/540/P-87/001. December 1987.

U.S. Environmental Protection Agency, 1991. *Compendium of ERT Groundwater Sampling Procedures.* EPA/540/P-91/007. January 1991.

Figure 1
Example Chain-of-Custody Form

KEY ENVIRONMENTAL INCORPORATED

CHAIN OF CUSTODY

1200 Arch Street Suite 200
Carnegie, PA 15106
Phone (412) 279-3363
Fax (412) 279-4332

Project No.:

Project Name:

Samplers:
(signatures)

Sample I.D.	Date	Time	comp	grab	Sample Location Description	Number of Containers											Requested Analyses

Relinquish By: (signature)	Date	Time	Received By: (signature)	Date	Time	Notes:
Relinquish By: (signature)	Date	Time	Received By: (signature)	Date	Time	
Relinquish By: (signature)	Date	Time	Received By: (signature)	Date	Time	

Distribution: Original to Accompany samples; Copy Returned with Report

dmw-c:\administrative\forms\coc.xls
Revised 6/24/2005
Form # 3.

005806

SOP 155 -GIS ELECTRONIC DATA DELIVERABLES

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) specifies the formatting requirements for the submission of electronic laboratory analytical data.

Attached is the file layout structure for the "Labdata. dbf" file as utilized by GIS/Key's™ Winbuild module. The file may be submitted as a dBase (.dbf) or an Excel (.xls) file.

Files should be submitted initially via e-mail, with a diskette of the deliverable mailed to Key Environmental, Inc.'s Pittsburgh office.

If laboratory personnel have any questions regarding this format, they should direct their inquiries to Key Environmental, Inc.'s GIS coordinator. A template of the labdata format is available upon request from Key Environmental, Inc

FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY

Remark	Required	Justify	Field Name (10 Character)	Type	Len	Dec	Notes (Default parameters)
user	X *	L	SITE_ID	C	15		Well or sampling location as labeled on the GIS\Key Map. An entry in SITE_ID is required for all Primary results, duplicates, and splits. Spike results may be associated with samples from another location, and therefore SITE_ID is not required although recommended if appropriate. The import routine requires all sites to be in the project database.
user	X *	L	SP_ID	C	7		Sample Period (EVENT_ID) is used to group QA/QC data to within the data range of the sample period. An entry in the EVENT_ID field is required for Blanks, Control Samples and Spikes. The import routine requires the EVENT_ID to be defined in the project database.
lab	X		SAMP_TYPE	C	1		Sample types are <W>ater, <S>oil, Sediment, Solid. Others sample types can be added, but these are not supported by GIS\Key. The import routine requires < W, S> entry.
lab	X	L	RES_CODE	C	4		Preliminary code used to determine the type of chemical result. See *notes at end of table for details of valid entries.* RES_CODE is used by the GIS/Build routine to derive the GIS\Key RES_TYPE and RES_CLASS fields. Initially assigned by the lab and modified as required by the user to reflect sample status not known by the lab.
GIS	internal		RES_CLASS	C	1		Assigned by GIS/Build from the RES_CODE field, this code refers to the type of result received from the lab. Allowable RES_CLASS entries are <P>rimary/duplicate/split|<C>ontrol sample|<B>lank sample| and <S>pike sample.
GIS	internal	L	RES_TYPE	C	3		Assigned by GIS/Build from the RES_CODE field, this code works in conjunction with RES_CLASS to describe the type of result. It consists of a one character code, a test sequence number, and a result occurrence.
lab			RES_COLUMN	C	1		The column number of a multiple column test. RES_COLUMN should = 0 for the result set of record of a record. This corresponds to a RES_CODE result set occurrence = 0 for the result set of record. For other result sets, the column number of the test should be given. Used primarily for IRPIMS reporting.
lab	X*	L	RES_ORIG	C	3		Points to the originating result of a result set of record in a multiple column or dilution test. A result set of the record may be a combination of one or more column/dilution tests. The RES_ORIG points to the result in the test run from which the result of the record came and should equal the last 3 characters of the RES_CODE for that result. Used primarily for IRPIMS reporting.
lab	X*		SURROG_FLG	L	1		*The field is set to "T" for a surrogate result and "F" for all other result* types.
user	X	L	SAMP_ID	C	15		SAMP_ID is the unique identifier provided to the laboratory on the sample bottle.
user		L	SAMP_ID2	C	15		SAMP_ID2 is used ONLY for Field Spike Duplicates or for Blind Control Sample Duplicates.

FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
user	X *		SAMP_DATE	D	8		Date sample was collected (mm/dd/yy format). Required for all results except blanks, spikes and control samples.
lab/user	X *		SAMP_TIME	C	5		Time sample was collected (##:## 24hr format). Required for all primary, duplicate, split and surrogate results but not required for blank, spike, and control sample results. If not required and not specified, the import routine enters a default of 00:00.
user	X *		SAMP_DEPTH	N	8		Depth below ground surface in meters (metric) or feet (American) at which sample was collected. Required for SAMP_TYPE = <S>, Recommended for SAMP_TYPE = <W>. Depths above ground surface are assigned a negative number. Note that primary key in American version is based on depth measurements to a hundredth of a foot only.
user			S_DEPTH	N	8	3	Depth below ground surface in feet to the top of the sample interval range.
user			E_DEPTH	N	8	3	Depth below ground surface in feet to the bottom of the sample interval range.
user	X *	L	CASE_ID	C	5		Case and blank Ids or case and QA/QC IDs are used to associate primary results with quality control results. CASE_ID is a required entry for quality control data and should be entered for primary results if quality control data is being entered. For small projects, many GIS\Key users use sampling event as CASE_ID. IRPIMS projects should enter the IRPIMS site in the CASE_ID.
lab/user	X*	L	SDG_ID	C	25		SDG or sample delivery group ID. This field (in combination with CASE_ID) is used to associate rinsate blank results with primary results. Required for rinsate blanks.
lab	X*	L	QAQC_ID	C	25		QA/QC Batch ID's are normally assigned only by labs. This field is used to associate laboratory quality control results (i.e. method blanks, lab blanks, matrix spikes, control samples) with primary results. QAQC_ID entries must uniquely identify each batch of samples analyzed by the laboratory and may not be repeated. Required for method blanks.
lab/ user	X*	L	BLANK_ID	C	25		Field Blank identifier. BLANK_ID is used in combination with CASE_ID to associate field blank results with primary results. Required for field blanks.
user	X	L	TCL_ID	C	10		TCL ID, or Template Constituent List is required for all results. A TCL is a data entry template which groups sample results into logical sets. The user defines a TCL to include a lab code (LAB_ID) and optionally a test method (METHOD_ID) and a list of chemicals with reporting limits. GIS/Build can automatically assign a TCL, if METHOD_ID and LAB_ID are provided.
GIS/ user	X		TCL_TYPE	C	1		TCL Type. Used to differentiate lists of chemicals having the same test method and lab. GIS/Build assigns the GIS/Key default value to this field if it is left blank.

FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
lab/user		L	METHOD_ID	C	10		Test Method identification. The import routine will generate error messages if the METHOD_ID is not in the GIS\Key database.
lab	X*	L	EXTRACTION	C	6		Extraction method code. The import routine requires definition of entries in the GIS/Key database.
user		L	LAB_ID	C	5		Lab ID code. The Import routine requires codes to be defined in GIS\Key database. Lab ID codes must be incorporated into the definition of a *TCL_ID*.
GIS	internal	R	SEQ_NUM	C	3		Used to order the compounds in a TCL (SEQ_NUM=1 for the first compound on a TCL). When editing results after data import, the sequence number controls the order in which the results are viewed. GIS/Build assigns a SEQ_NUM based on the SEQ_NUM of the chemicals defined in the TCL. If a TCL definition is not found in the project, the SEQ_NUM assignment is based on the order within the TCL in LABDATA.dbf.
user	X *	L	SPLIT_ID	C	10		SPLIT_ID records the TCL_ID of the first split sample of the primary sample. This field is left blank unless the record is for a primary result and a split sample was analyzed. A split sample result entered as a separate record will be orphaned unless this field is filled in for the primary result record.
user	X *	L	SPLIT_ID2	C	10		SPLIT_ID2 records the TCL_ID of the second split sample of the primary sample. This field is left blank unless the record is for a primary result and a second split sample was analyzed. The second split result, entered as a separate record, will be orphaned unless this field is filled in for the primary result record.
lab	X*	L	LSAMP_ID	C	15		Lab sample ID.
lab		L	LSAMP_ID2	C	15		ab sample ID of duplicates, entered by the lab for known-control sample duplicates and lab spike duplicates.
lab	X *	R	LAB_CAS_ID	C	11		CAS Registry number assigned by the Lab for the constituent. Either a LAB_CAS_ID or a LAB_CHEM must be included with each record. The import routine requires any LAB_CAS_ID to match a CAS_NUM in GIS\Key COMPOUND.DBF.
GIS	internal	R	CAS_NUM	C	11		CAS number from the GIS\Key compound.dbf. This is internally assigned based on a match with LAB_CHEM or LAB_CAS_ID, with preference given to LAB_CAS_ID
lab	X *	L	LAB_CHEM	C	40		Constituent name from lab. Either a LAB_CAS_ID or a LAB_CHEM must be included with each result. If LAB_CHEM is used, then it must match a GIS\Key COMPOUND.DBF alias.
GIS	internal	L	NAME	C	40		Constituent name assigned by comparing LAB_CHEM to COMPOUND.DBF. If LAB_CAS_ID is used without a matching LAB_CHEM, NAME is assigned based on alias 0 in GIS\Key Database.

FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
GIS	internal	R	ALIAS_NUM	C	2		Alias numbers are internally assigned by comparing LAB_CAS_ID and LAB_CHEM to COMPOUND.DBF.
lab	X *	L	CONC	C	11		Utilized to store constituent concentrations for primary results, duplicates, splits & blanks and concentrations added to spikes and control samples. The field is left blank for surrogates. Warning code generated when CONC and LIMIT1 are both left blank for primary results, duplicates, splits and blanks. Stored as a character string to preserve significant figures. May be expressed in scientific notation (e.g. 1.3E03). All entries must be numeric with the exception of "E" (i.e. scientific notation), "+", or a "+/-". A "+" after concentration amount means greater than while a concentration followed by "+/-" and a number expresses an uncertainty factor.
lab	X *	L	LIMIT1	C	10		Detection Limit 1 for a sample result. Stored as a character string to preserve the significant figures. May be expressed in scientific notation (e.g. 1.3E03). Required for primary results, duplicates, splits & blanks if CONC is blank. Left blank for control samples, matrix spikes and surrogates. All entries must be numeric with the exception of "E" (i.e. scientific notation) or "?". A "?" means that the detection limit is unknown. The entered detection limit should reflect dilution. Generally, LIMIT1 refers to the method detection limit. However, GIS\Key places no restrictions on the use of this field.
lab	X *	L	DL_FLAG	C	2		Place a {<} in this field if the result is non-detect, otherwise leave it blank. Required for primary results, duplicates, splits and blanks. The field is left blank for control samples, matrix spikes and surrogates. For IRPIMS files, DL_FLAG corresponds to the PARVQ field. DL_FLAG corresponds to RF_FLAG on the data entry screen.
lab	X *	L	UNITS	C	5		Reported units of concentration. GIS\Key can automatically convert concentrations in mg/l, mg/kg, ug/l, ug/kg, ppm, ppb, and %. Other units are allowed but will generate warning codes.
lab		L	LIMIT2	C	10		Practical quantitation limit for a blank or primary sample result. Format limitations for LIMIT2 are the same as described for LIMIT1. The entered quantitation limit should reflect dilution. GIS\Key places no restrictions on the use of this field.
lab		L	INSTRUMENT	C	20		Identifying number or name of laboratory equipment used to perform the analysis. Used primarily for Air Force reporting.
lab		L	CALIBRATE	C	20		Calibration reference number for the test. Used primarily for Air Force reporting.
GIS	internal		SPIKE_DUP	L	1		Flag indicating a spike control sample duplicate record. Information is combined in the same record as the spike or control sample.
lab/ user		L	TEST_ORIG	C	3		Used for spikes to identify the res_code of the sample that was spiked.
lab			S_CONC	C	11		Spike Concentration

FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
lab	X *		RECOVER	N	3		Constituent Recovery in %. Required for spike, surrogate, and control sample results. The field is left blank for primary samples, duplicates, splits and blanks. Supplied by the Lab for surrogates, lab matrix spikes and known control samples.
lab	X *		D_RECOVER	N	3		Duplicate constituent recovery in %. Required for spike and control sample duplicates results. The field is left blank for primary sample, duplicates, splits, blanks, and surrogates. Supplied by the Lab for lab matrix spikes and known control samples.
lab/user		L	T_CONC	C	11		Target concentration for spikes (i.e. calculated total of concentration in sample plus concentration spiked).
lab		L	R_CONC	C	11		Measured concentration in control samples and spiked samples. Supplied by the Lab for lab matrix spikes, field matrix spikes, blind control samples and known control samples.
lab		L	D_CONC	C	11		Measured concentration in duplicate control samples and spiked samples. Supplied by the Lab for lab matrix spikes, field matrix spikes, blind control samples, and known control samples.
lab			RPD	N	3		Relative Percent Difference (RPD). Supplied by the Lab for matrix spike and control samples that are run in duplicate. When RES_CODEs DL#/DF#/DB#/DK# are used, the RPD is entered with these records.
lab			B_RECOVER	N	3		Lower percent recovery goal for surrogates, spikes, and control samples and spikes reported by the Laboratory.
lab			E_RECOVER	N	3		Upper percent recovery goal for surrogates, spikes, and control samples reported by the Laboratory.
lab			MAX_RPD	N	3		Maximum relative percent difference goal for control samples and spikes reported by the Laboratory.
lab/user	X		PF_CODE	C	1		Preparation Fraction Code: The import routine requires the preparation fraction to be specified and to match a user-defined code in GIS\Key database, standard codes include "T" (total), "D" (dissolved fraction), "A": Acid Rain Extraction, "C" TCLP Extraction, "E" EPTOX Extraction, "S": California Wet Extraction, "W": Deionized Water Extraction.
lab			CR_C	C	1		CLP data concentration "C" column. The import routine requires entry to match a code defined in GIS\Key Database.
lab		L	CR_M	C	2		CLP data method "M" column. The import routine requires entry to match a code defined in GIS\Key Database.
lab		L	CR_Q	C	3		CLP data qualifier "Q" column. The import routine requires entry(s) to match 1 character code(s) defined in the GIS\Key Database.
user		L	ER_Q	C	3		Expert review data qualifier. The import routine requires entry(s) to match 1 character code(s) defined in the GIS\Key Database.
user		L	ER_R1	C	2		Expert review reason 1 "R1" code. The import routine requires entry to match a defined code in GIS\Key Database.
user		L	ER_R2	C	2		Expert review reason 2 "R2" code. The import routine requires entry to match a defined code in GIS\Key Database.

FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
user		L	ER_R3	C	2		Expert review reason 3 "R3" code. The suggested use of this field is to track updates. The import routine requires entry to match a defined code in GIS\Key Database.
user			FILTERED	C	1		Was sample field filtered, <Y>es or <N>o. It is the user's responsibility to ensure that preparation fraction codes reflect field filtering status.
user			PRESERVED	C	1		Sample preservation code, "H" = HCI, "N" = HNO3, "S" = H2S04, "U" = unknown, "" = none, and "O" = other sample preservation code.
user			ICED	C	1		Field preservation Code, "Y" = stored/shipped on ice, "N" = stored/shipped at ambient temperature.
lab	*	L	CUSTODY	C	25		Chain of custody ID. Used to associate travel blanks with primary samples. Required for travel blanks.
lab	*		DILUTION	N	7	2	Dilution factor for sample run ranging from 0.01 to 9999. A required field for all primary results, duplicates, splits and blank results. The field is left blank for all other results.
GIS/user	X*		PROG_TYPE	C	1		Program codes are required for all results. The import routine requires codes to be defined in GIS\Key Database. Program codes must be identical for all chemical results for a particular TCL. GIS/Build assigns the GIS/Key default value to this field if it is left blank.
lab			RECEIVED	D	8		Date sample was received by the Lab (mm/dd/yy format).
lab			REC_TIME	C	5		Time sample was received by the Lab (##:## 24hr format).
lab			PREPARED	D	8		Date sample was prepared or extracted by the Lab (mm/dd/yy format).
lab			PREP_TIME	C	5		Time sample was prepared or extracted by the Lab (##:## 24hr format).
lab			TESTED	D	8		Date sample was analyzed by the Lab (mm/dd/yy format for American Version).
lab			TEST_TIME	C	5		Time sample was analyzed by the Lab (##:## 24hr format).
lab			REPORTED	D	8		Date sample was reported by the Lab (mm/dd/yy format for American Version).
lab			APPROVED	D	8		Date sample was result approved by the Lab (mm/dd/yy format for American Version).
lab/ user		L	LOT_NUMBER	C	4		IRPIMS lot control number (LOTCTLNUM) used to associate primary samples with QC.
lab/ user		L	SA_CODE	C	3		IRPIMS sample type code (SA_CODE) used to identify the type of sample collected.
lab/ user		L	MATRIX	C	2		IRPIMS sampling matrix code.
lab/ user			BASIS	C	1		Used to indicate whether results are reported on a (W)et or (D)ry basis. Required for soil results.
lab/ user			MOISTURE	N	4	1	Percent moisture of a soil sample.
GIS	internal	L	EXC_CODE	C	30		Exception codes are generated by the import routine to alert the user to problems in the LABDATA.DBF file which must be addressed befor the data can be appended to the project database.

FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY

Remark	Required	Justify	Field Name 10 Character	Type	Len	Dec	Notes (Default parameters)
GIS	internal	L	WARN_CODE	C	20		Warning codes are generated by the import routine to alert the user to possible problems in LABDATA.DBF file. Warning codes do not prevent user from appending LABDATA.DBF file to the project database.
GIS	internal		BUILD_FLAG	C	1		Internal flag used during the GIS\Build process.
lab/ user		L	NOTE	C	20		Lab/user notes for samples (i.e. placed in CSAMPLE.DBF). May be expanded to 50 characters.
lab/user		L	TEST_NOTE	C	20		Lab/user notes for tests (i.e. placed in CTEST.DBF). May be expanded to 50 characters.

Notes appear on the following pages.

FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY

Notes:

RES CODES:

PP0<1-9>	Primary Results
PD[1-9]<1-9>	Duplicate
PS[1-2]<1-9>	Split
BF[1-9]<1-9>	Field Blanks
BL[1-9]<1-9>	Lab Blanks
BM[1-9]<1-9>	Method Blanks
BR[1-9]<1-9>	Rinsate Blanks
BT[1-9]<1-9>	Travel Blanks
CB[1-9]<1-9>	Blind Control Sample
CK[1-9]<1-9>	Known Control Sample
SL[1-9]<1-9>	Lab Spike
SF[1-9]<1-9>	Field Spike
DL[1-9]<1-9>	Duplicate Lab Spike
DF[1-9]<1-9>	Duplicate Field Spike
DB[1-9]<1-9>	Duplicate Blind Control Sample
DK[1-9]<1-9>	Duplicate Known Control Sample

Numbers in [] denote test sequence numbers

Numbers in <> denote result set occurrence

* = Conditionally Required

EXCEPTION CODES: (an exc_code indicates bad or missing data)

AN =	No entry in ALIAS_NUM
BI=	No entry in BLANK_ID (for a field blank)
CI=	No entry in CASE_ID
CN=	Cas Number is not found in COMPOUND.DBF
CU=	No entry in CUSTODY (for a trip blank)
DI=	DILUTION < = 0
DP=	Sample depth precision > 2 (not allowed for American or unspecified project)
DR=	Duplicate record
HT=	Holding times out of sequence (SAMP_DATE, RECEIVED, PREPARED, TESTED and REPORTED)
LB=	No entry in LAB_ID
PF=	Invalid in PF_CODE
PS=	No primary sample for duplicate or split
PT =	Invalid in PROG_TYPE
QC =	No entry in QAQC_ID (for a lab blank, method blank, spike or control sample)
RC=	Invalid RES_CODE
SD=	No entry in SAMP_DATE
SG=	No entry in SDG_ID (for a rinsate blank)
SI=	No entry in SITE_ID
SP=	No entry in SP_ID(event) or 3rd character of id is not a '-'
SK=	No spike duplicate match or invalid spike dup fields
ST=	Invalid SAMP_TYPE
TC=	No entry in TCL_ID
TM=	SAMP_TIME format invalid

WARNING CODES:

BA	=	BASIS should be 'W'et or 'D'ry for soil results
CI	=	No entry in case id for a primary sample
DL	=	No detection limit and no conc
DP	=	Sample Depth = 0 or not within range of S_DEPTH & E_DEPTH
PF	=	PF_CODE not defined in project
PS	=	No primary sample for duplicate or split
PT	=	PROG_TYPE not defined in project
SD	=	No entry in sample date for a rinsate or field blank
RE	=	B_RECOVER > E_RECOVER
TM	=	Invalid TEST_TIME for rinsate or lab blank
TT	=	TCL_TYPE not defined in project
U	=	No entry in UNITS

FILE LAYOUT FOR ELECTRONIC DOWN LOAD TO GIS/KEY

Notes (continued):

DUPLICATE RECORD KEY FOR PRIMARIES, DUPLICATES AND SPLITS (RES_CODE = PP0#, PD##, PS##):

SAMP_TYPE + SITE_ID + SAMP_DATE + SAMP_TIME(water) or SAMP_DEPTH(soil) + RES_CODE + TCL_ID + PF_CODE + CAS_NUM

Index file = EXPRI.IDX TO use in FOXPRO enter: USE EXCDATA INDEX EXCPRI

DUPLICATE RECORD KEY FOR BLANKS (RES_CODE = BR##, BM##, BT##, BF##):

SAMP_TYPE + CASE_ID + BLANK_ID + RES_CODE + TCL_ID + PF_CODE + CAS_NUM

Index file = EXCQC.IDX TO use in FOXPRO enter: USE EXCDATA INDEX EXCQC

DUPLICATE RECORD KEY FOR SPIKES AND CONTROL SAMPLES (RES_CODE = SF##, SL##, CB##, CK##):

SAMP_TYPE + CASE_ID + QAQC_ID + RES_CODE + TCL_ID + PF_CODE + CAS_NUM

Index file = EXCQC.IDX

ASSIGNING RES_CODE SEQUENCE NUMBERS [1-9]:

The test sequence number refers to a sample sequence used to differentiate test results that otherwise have the same primary key. For example, a test sequence number of 2 for a duplicate sample would mean that the result set is for the second of 2 duplicate samples originating from the same primary sample. A test sequence number of 2 for a method blank would mean that 2 method blanks were run for the same batch (QAQC_ID). Note that matrix spikes and control samples and their duplicates should always have matching test sequence numbers.

ASSIGNING RES_CODE RESULT SET OCCURRENCES <1-9>:

The result set occurrence is used to differentiate multiple column or dilution runs of the same sample and test method that otherwise have the same primary key. Occurrence = 1 is the set of record and the set used for reporting and graphics.

ASSIGNING RES_ORIG CODES

RES_ORIG codes are equal to the last three characters of RES_CODES for all results except when multiple column/dilution runs are being reported and the result being reported is for the combined "best estimate" result. In this case, the RES_ORIG code equals the last three characters of the RES_CODE of the originating column/dilution run.

ADDITIONAL GUIDANCE FOR FIELD/LAB MATRIX SPIKE DUPLICATES AND BLIND/KNOWN CONTROL SAMPLE DUPLICATES:

Field/lab matrix spike duplicate and blind/known control sample duplicate concentrations are always entered in the D_CONC field, with recoveries in the D_RECOVER field. Spike and control sample duplicates may be entered as individual records using RES_CODEs DL##, DF##, DB##, DK##, or can be combined with the record storing the original spike or control sample when using RES_CODEs SL##, SF##, CB##, CK##.

APPENDIX B

LABORATORY QUALITY MANUAL

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