

**INTERIM MEASURES WORKPLAN
WCC FILE NO. 92B007C
TASK 1001**

**VICKSBURG CHEMICAL DIVISION
CEDAR CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI**

for:

**Cedar Chemical Corporation
Memphis, Tennessee**

May 1992

Woodward-Clyde 

Woodward-Clyde Consultants
2822 O'Neal Lane (70816)
P.O. Box 66317 (70896)
Baton Rouge, Louisiana

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This Workplan defines and describes the Interim Measures to be executed by Cedar Chemical Corporation (Cedar) at its facility in Vicksburg, Mississippi. The purpose of Interim Measures is to expeditiously mitigate the threat to human health and the environment that might be caused by a potential release of hazardous constituents into the environment from the Cedar facility.

The entire Interim Measures program consists of four tasks:

- Interim Measures Workplan
- Interim Measures Design Program
- Interim Measures Construction Quality Assurance Plan
- Final Interim Measures Report

The Interim Measures are intended to be executed concurrently with a RCRA Facility Investigation Corrective Measures Study (RFI/CMS). Interim measures must be consistent with and integrated into any long term solution at the facility.

The Interim Measures Workplan is due within 30 days of the effective date hereof. The workplan includes the following elements:

- interim measures objectives
- technical approach including interim measures design program
- project schedule
- project management plan
- health and safety plan
- community relations plan

INTERIM MEASURES OBJECTIVES

Interim Measure Objectives are the goals to be met in order to meet the purpose of the Interim Measures as set forth in Section 1.0, Introduction of the Interim Measures Workplan. Objectives are stated for various Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) within Cedar. Each objective is preceded by a discussion of background information. The SWMUs and AOCs have been identified in the RCRA Facility Assessment (RFA) and the Consent Decree. Each of these units is labeled on Figure 1, a site identification map.

2.1 MANAGEMENT OF SURFACE IMPOUNDMENT

The construction of the Surface Impoundment (SWMU 3) is complete. The objective is to maintain the unit and minimize potential for leaks.

2.1.1 Background on Surface Impoundment

The Surface Impoundment (SWMU 3) exists primarily for the purpose of collection of surface water runoff from the South Plant. The water contains low concentrations of pesticides from accumulation of diminimis losses onto surface soil during many years of operation. The Surface Impoundment (SWMU 3) also occasionally receives non-hazardous waste water from the North Plant. The water is treated by pumping through Activated Carbon Treatment Unit (SWMU 4) prior to discharge to the Mississippi River via pipeline.

2.1.2 Objectives for Surface Impoundment

In order to mitigate potential threat to the environment, Cedar has removed contaminated sediments in the impoundments and secured them in a landfill constructed adjacent to the Surface Impoundment (SWMU 3). The landfill was designed in accordance with RCRA guidelines. Additionally, the ponds have been retrofitted with a double synthetic liner consistent with RCRA guidelines. The Surface Impoundment

(SWMU 3) will have potential value during long term corrective actions taken at the facility. The pond could serve as receptor for:

- surface water,
- groundwater from the Former Production Areas (SWMUS 7, 11, 14, 15, and 16)
- groundwater and leachate from landfills prior to treatment of such water.

Cedar will deliver to the EPA and MSDEQ a copy of the as-built plan and engineering design for the Surface Impoundment (SWMU 3). In order to demonstrate the use of the impoundment, Cedar shall additionally prepare a topographic site plan by Autocad showing the inlet to the Surface Impoundment (SWMU 3) and the source of the water flow into the inlet during rain events and during dry periods and showing areas of direct run on.

2.2 MANAGEMENT OF THE INACTIVE LANDFILL

The Inactive Landfill (SWMU 2) will be maintained as an interim measure during the conduct of the RFI. The RFI/CMS/CMI will establish a more permanent remedy.

2.2.1 Background of the Inactive Landfill

The Inactive Landfill (SWMU 2) exists on a natural hill approximately 30 feet in elevation above the levees of the adjacent Surface Impoundment (SWMU 3). The Inactive Landfill (SWMU 2) was initially closed by regrading and establishing a vegetative cover in 1979. Additional improvements occurred in 1983 with grading and construction of an engineered cap in accordance with plans approved by the MSDEQ.

2.2.2 Objectives for the Inactive Landfill

The Inactive Landfill (SWMU 2) will be maintained so as to prevent potential escape of hazardous constituents and erosion of the existing cap and vegetation shall be maintained pending more adequate remedies. Steps shall be taken by Cedar to maintain

the cap by adding soil on top of areas where visible contamination has resurfaced. In addition to maintaining cap, enough soil will be placed on the landfill to create a crown. The landfill will be investigated under the RFI/CMS program with emphasis on decreasing the permeability of the cap, increasing the area that is capped, and addition of groundwater and/or leachate collection devices such as recovery wells and/or trench drains.

It is the objective of the Interim Measures Workplan to provide a detailed inspection and maintenance program. The inspection program will consist of walking the surface of the landfill in a prescribed path at a frequency of not less than once per month and after each rain event of 1.5 inches during an eight hour time period. The inspection will look for discolored soil and erosion gullies of more than six inches in depth. If either discolored soil or erosion gullies are found, maintenance, consisting of covering with soil shall begin within seven days unless access is not possible due to weather events, in which case Cedar's efforts to perform said maintenance shall be documented.

2.3 MANAGEMENT OF AREAS WITH CONTAMINATED SOILS AND SURFACE WATER RUNOFF

In order to mitigate potential contaminant movement offsite from active and inactive production areas sediments will be restricted from being carried offsite.

2.3.1 Background of Areas with Contaminated Soils and Surface Water Runoff

The soils and sediment within inactive production areas in the South Plant are lightly contaminated with pesticides which have accumulated through years of de minimis losses. The surface drainage from the South Plant is intended to flow to the Surface Impoundment where contaminated sediment will settle within the Surface Impoundment (SWMU 3) and contaminated rainwater will be adsorbed by the carbon in the Activated Carbon Treatment Units (SWMU 4). WCC has identified three surface water runoff and sediment deposition areas requiring management of contaminated sediment (Figure 7):

2.3.1.1 Area A. Area A is the surface water runoff area and associated locations for sediment deposition to the north, east, and west of Inactive Landfill (SWMU 2) generally described by the following location descriptions:

- Area between the Surface Impoundment (SWMU 3) at the South Plant and the main railroad spur.
- Eroded area east of the Inactive Landfill (SWMU 2) and small valley (mud flat) at the west corner of the Inactive Landfill (SWMU 2)

2.3.1.2 Area B. Area B is the surface water runoff area and associated locations for sediment deposition to the west of Former Dinoseb Production Area (SWMU 7) as generally described by the following location descriptions:

- Plant railroad Spur Area north and west of the Former Dinoseb Production Area (SWMU 7).
- Area between the Former Dinoseb Production Area (SWMU 7) and the main railroad spur.

Most of the rainwater impacting these areas flows to the Surface Impoundment (SWMU 3) via the South Plant Drainage System (SWMU 5) either through a sump and drainage system in the railroad spur area or by flowing to the south where most of the water enters a sump and is pumped to the Surface Impoundment (SWMU 3).

2.3.1.3 Area C. Area C is the surface water runoff area where water flows into the ditch on the west side of the South Plant, in particular, that which comes from the following locations:

- Area adjacent to the Container (Drum) Storage Area (SWMU 1)
- Junkyard (SWMU 34) located north of the South Plant

The area adjacent to the Container (Drum) Storage Area (SWMU 1) is included within a closure plan for that area submitted to the MSDEQ by Cedar.

2.3.2 Objectives for Areas with Contaminated Soils and Surface Water Runoff

The interim measure objectives for the site are specified below. The fact that the interim measures are limited in scope will not preclude Cedar from continuing the demolition and cleanup of the former production facility, including excavation of surrounding soil. Such activities have preceded interim measures and may continue throughout the IM/RFI/CMS process.

The following are the objectives for the three areas noted above:

2.3.2.1 Area A. The objective is to minimize potential for sediments to be transported to Stouts Bayou or Hennesseys Bayou. The interim measures program described in Section 2.2 will mitigate the potential for additional contamination transport from the source until a permanent remedy is found under the RFI/CMS/CMI program.

2.3.2.2 Area B. The objective is to minimize the rainwater flow that bypasses the South Sump (SWMU 5). The surface water running in ditches along the railroad tract south of the Former Atrazine Production Area (SWMU 16) will be forced, to the extent practically possible, to flow into the South Sump (SWMU 5). It is a further objective to minimize the potential for sediment transport in that rainwater that does bypass the South Sump (SWMU 5).

2.3.2.3 Area C. The objective is to minimize potential for sediments to be transported to the Major Drainage Ditch (SWMU 13) and to close the Container (Drum) Storage Area (SWMU 1), including adjacent soil, under an approved RCRA closure plan.

2.4 MANAGEMENT OF SUMPS

Sumps need to be kept clean of accumulations of hazardous constituents.

2.4.1 Background of Sumps

Sumps unrelated to control of storm water exist within the inactive production areas of the South Plant. At one time the sumps drained or were pumped to the Surface

Impoundment (SWMU 3); however, all of the sumps were blocked in order to preclude the possibility of pesticide spills from entering the Surface Impoundment (SWMU 3) by gravity flow. The sumps were blocked when manufacture and storage of pesticides was occurring at the site.

2.4.2 Objectives for Sumps

Removal of the contents of the sumps, so identified, shall begin within seven (7) days of the effective date. After each sump is cleaned it will be covered or closed by filling with soils compacted clay and/or concrete. After the initial cleaning, if additional material accumulates within the sump prior to covering or closing, that material will be removed within four (4) days.

2.5 MANAGEMENT OF GROUNDWATER

A monitoring system of 15 wells and 2 piezometers exist to monitor groundwater around the Surface Impoundment (SWMU 3) and the Inactive Landfill (SWMU 2).

2.5.1 Background of Groundwater Monitoring

In 1981, Cedar's predecessor firm commissioned the first hydrogeologic investigation. The report of that investigation provides descriptions of the geology and hydrology of the site and states that underlying the facility is a layer of Glendon limestone of the Vicksburg Formation and, under the limestone, is the Jackson Formation. The top of the Glendon limestone is expected to be 80 to 100 feet beneath the plant site and has a general thickness of 25 to 65 feet, while the dense non-permeable Jackson Formation is from 40 to 150 feet thick.

Above the bedrock is a layer of 50 to 70 feet of various silts and clays thought to be comprised of marine-clay and sand-marrow, montmorillonitic and bentonitic clays, lignites and massive silts. The permeability is expected to be within 10^{-5} to 10^{-9} centimeters per second and decreases significantly with depth. The report also states that water wells are not often successful in the local area because of the low permeability of the upper silty clay layer and the limestone.

The report also describes surface water and groundwater hydrology. The plant site is at an elevation varying from 100 to 200 feet above mean sea level. The surface drainage pattern at the plant is to the east and south, and the water flows to Stouts Bayou and Hatcher Bayou.

Later studies, based on the data determined from the monitoring wells, indicate that groundwater flows basically to the southeast and south in the area of the effluent ponds, the inactive disposal area, and the South Plant. Groundwater flows directly toward Stouts Bayou in the southeasterly direction from the North Plant area. Based on sampling of the monitoring wells, very shallow groundwater is present at an average depth of four feet, with a range of one to nine feet under the site.

Cedar has endeavored to maintain a groundwater monitoring program equivalent to the RCRA program. Results of groundwater monitoring indicated that groundwater assessment is required; therefore, a Groundwater Assessment Report was prepared in 1985.

Additionally, Cedar provided corrective action activities; for example, by replacing the broken underground inlet line to the Surface Impoundment (SWMU 3). The line is suspected as a potential source of contaminants found in Monitor Well 1A. Another example is the recent construction of a blanket drain adjacent to the double synthetic liner on the east wall of Pond A in the Surface Impoundment (SWMU 3) to intercept groundwater.

2.5.2 Objectives for Management of Groundwater

There is insufficient geologic and hydrogeologic information on the former production areas of the South Plant; therefore, during the Interim Measures activities, *nine* (9) temporary piezometers will be installed as shown in Figure 4. Prior to installing the piezometers, three borings will be drilled down to the marl (50-60 below ground level).

Information from this system of piezometers will help determine the flow patterns of the groundwater in the upper most aquifer beneath the South Plant. To date, only a small portion of the South Plant has been monitored with piezometers for groundwater flow

pattern determination. Once the groundwater flow patterns have been established, the intent, as specified in the Groundwater Assessment Workplan, (due, per the Consent Decree, within 60 days of approval of the RFI Preliminary Report; i.e., at the same time as the RFI Workplan) is to plug these temporary piezometers and replace at least two (2) of them with permanent wells screened in the appropriate zone of the upper aquifer.

Figure 6 illustrates a correlated cross-section of monitor wells 16, 13, 14 and piezometer PZ3 obtained from the boring logs of these wells and other monitor wells installed at the facility. Information obtained from previous hydrogeologic studies does not clearly indicate if the silty clay and the clayey silt are hydraulically related (Figure 6). The borings and piezometers will provide additional information on the hydraulic communication between the various layers of loess underlying the facility.

Since an interim measures objective is to modify the existing groundwater monitoring program such that it is consistent with or equivalent to a RCRA program, a Sampling and Analysis Plan (SAP) for the existing groundwater monitoring system was prepared and is attached as Appendix A. The SAP also includes a Quality Assurance plan. The SAP is to be modified for the Groundwater Assessment when it is anticipated that the list of analytical parameters will be expanded.

The results of the interim measures activities will impact the direction of the groundwater assessment workplan. Three workplans (Interim Measures Workplan, RFI Workplan, and Groundwater Assessment Workplan) will be operating simultaneously at the same facility; however, the plans will be integrated.

During the Interim Measure piezometer installation a leaking municipal water line will be investigated if repairs by the City of Vicksburg have not occurred prior to that time. A 16-inch potable water line runs parallel to the Mid South Rail System and may be leaking and creating constant groundwater recharge in the vicinity of the surface impoundments.

Cedar will prepare and submit to the EPA and MSDEQ, a Groundwater Assessment Report on March 1, 1993 containing information on the following:

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- Whether hazardous waste or hazardous waste constituents have entered the groundwater;
- The rate and extent of migration of hazardous waste or hazardous waste constituents in the groundwater; and
- The concentrations of hazardous waste or hazardous waste constituents in the groundwater.

Cedar will update the report yearly to include all existing wells and piezometers and include existing data on:

- The number, location, depth of wells, and the rationale for the well placement;
- Construction logs for each monitoring well;
- A list of the monitoring parameters; this list shall include indicator parameters as well as the pertinent hazardous constituents in 40 CFR 261, Appendix VIII or alternatively the TCL/TAL list;
- Geologic cross-sections;
- Sampling and analytical methods for those hazardous wastes or hazardous constituents at the facility;
- Evaluation procedures;
- Groundwater surface elevations measured on a quarterly basis;
- Annual determination of the groundwater flow rate and direction in the uppermost aquifer;
- Concentrations or values of the indicator parameters obtained from quarterly analysis at each groundwater monitoring well;
- Evaluation of the indicator parameters;
- Results of the analysis from each groundwater monitoring well;
- Calculated hydraulic conductivity and effective porosity; and
- Summary of results.

TECHNICAL APPROACH INCLUDING ENGINEERING DESIGN PROGRAM

The technical approach for each of the interim measures is intended to be direct, practical, and simple to implement and maintain. The interim measures and the engineering design are likewise simple.

3.1 SURFACE IMPOUNDMENT RETROFIT PROGRESS

The Surface Impoundments (SWMU 3) plan and engineering design has been prepared and reviewed by the MSDEQ and EPA and implemented by Cedar. A copy of the design document is attached in a separate volume as Appendix E. The Surface Impoundment (SWMU 3) retrofit project has been completed; however, certain maintenance and repair activities are taking place.

Figure 2 of this Interim Measure Workplan is a topographic site plan. The topographic site plan shows the general contouring of the entire facility. Figure 8 is a rain event surface runoff map showing the inlet to the Surface Impoundment (SWMU 3) and sources of water flow into the inlet during rain events and areas of direct run-on.

Dry Periods

During dry periods, water is transferred to the Surface Impoundment (SWMU 3) via a series of drainage pipes from areas such as:

- cooling tower blowdown
- water-cooled air conditioning
- freeze checks for fire fighting system

The volume flowing to the Surface Impoundment during dry conditions is estimated by Cedar personnel at 100-150 gallons/minute.

Wet Periods

During rain events, direct run-on to the Surface Impoundment (SWMU 3) comes from the Inactive Landfill (SWMU 2) and from surface run-off through the gravity drainage system and the south sump. Approximately $0.450 (10^6) \text{ ft}^2$ of surface area is draining directly to the Surface Impoundment (SWMU 3), while $1.82 (10^6) \text{ ft}^2$ is draining through the gravity drainage system or to the south sump. The 100-year 1 hour rainfall event is 3.8" (Hershfield, 1961) which is equivalent to 0.32 feet/hour of rain. Using a run-off factor of $C = 0.8$, the Rational Method ($Q = C \cdot \text{rainfall intensity} \cdot \text{run-off area}$) predicts:

$$Q_{\text{direct run-on}} = 14,400 \text{ gallons/minute}$$

$$Q_{\text{run-on via gravity drainage and south sump}} = 58,000 \text{ gallons/minute}$$

These run-off values are the maximum predicted values for the 1 hour 100-year rainfall event. Calibration with actual rainfall events and flow to the pond may be used to refine the run-off factor, C, for the south plant area.

3.2 LANDFILL INSPECTION AND MAINTENANCE

The Inactive Landfill (SWMU 2) inspector will be provided with a topography of the landfill with a prescribed path designed to enable the inspector to see potential areas of concern. Potential areas of concern will be identified on the map as areas where erosion has historically been a problem, soil discoloration has been noted, or rainwater has ponded. The inspector will mark on the map any areas of ponded rainwater, soil discoloration or erosion gullies of more than six inches in depth. He will date and sign the map as documentation of the inspection and will be provided a new map for each inspection. A sample inspection map and checklist will be provided in the Interim Measures Design package.

If maintenance is required, the Vicksburg Facility Environmental Director or his representative shall deliver the map with notations to the Vicksburg Facility Maintenance Manager or his representative who shall authorize and direct appropriate

maintenance to occur within seven days unless access is not possible due to weather events. Maintenance will generally consist of:

- covering areas where rainwater ponds with soil such that it is crowned to shed water,
- covering soil that is discolored with clean soil, and
- filling erosion gullies with clean soil,

When maintenance has occurred, a notation shall be made on the map noting the correction. The map will be kept on file as documentation.

Such events as described above shall occur at a frequency of not less than one per month and after each rain event of one and one-half inches during an eight hour time period. A rain gage shall be maintained by the Vicksburg Facility laboratory personnel at the direction of the Environmental Director.

3.3 CONTAMINATED SOILS AND SURFACE WATER RUNOFF

Refer to Figure 7, for the locations of the areas discussed below.

3.3.1 Area A. As noted in Section 2.3 Area A is:

- Area between the Surface Impoundment (SWMU 3) at the South Plant and the Mid South Rail System
- Eroded area east of the Inactive Landfill (SWMU 2)
- Small valley (mud flat) at the west corner of the Inactive Landfill (SWMU 2)

The technical approach for Area A is to carry out the inspection and maintenance program for the Inactive Landfill (SWMU 2) described in Section 3.2 and to trap sediment particles on the deposition areas noted above.

The engineering design will consist of choosing permeable impediments to flow such as:

- Filtration fence
- Hay bales

The location of the filtration fence or hay bales will be shown on a site topographic map such as Figure 2. The landfill inspection procedure explained in Section 3.2 will be expanded to include examination of the filtration fence or hay bales and replacement as an item of maintenance as needed.

3.3.2 Area B. As noted in Section 2.3, Area B is the following:

- Railroad Spur Area north of the Former Dinoseb Production Area (SWMU 7)
- Area between the Former Dinoseb Production Area (SWMU 7) and the Mid South Rail System

The technical approach for Area B will be to design the grade such that rain water run off will drain to the South Sump and be captured and pumped to the Surface Impoundment (SWMU 3). A portion of the grade at the South sump will be raised to the top of the impoundment walls and the surrounding soil stabilized or paved to inhibit erosion into the sump. More importantly, holes in the sump wall will be busted at grade level.

Estimates of flow to the sump versus rainfall amount will be made so that the rainfall event beyond which the South Sump will no longer capture the total flow can be predicted. In order to trap sediments beyond the South Sump, either hay bales or filtration fences will be used.

3.3.3 Area C. As noted in Section 2.3, Area C is the following:

- Area adjacent to the Container (Drum) Storage Area (SWMU 1)
- Junkyard (SWMU 34) located north of the South Plant

The technical approach for Area C is to choose permeable impediments to flow such as:

- Filtration Fence
- Hay Bales

The location of the filtration fences or hay bales will be shown on a site topographic map such as Figure 2.

3.4 SUMPS

The technical approach with sumps in the South Plant is to clean them and fill them with compacted clay or concrete or a combination thereof. Another alternative is to put a cover on roof over the sump. The cap when constructed to be provided is to be rounded so as to shed water and conform to the following:

- 8 inches of concrete, if on a roadway,
- 2 inches of concrete, if in a building or in a semi-permanent location, and
- compacted clay, if structure is to be removed within two years

The following is a complete list of the sumps to be closed, covered or roofed under Interim Measures, if such activity has not already occurred.

- DNBP drumming room and DNBP warehouse floor drain
- Sump at southeast corner of the Container (Drum) Storage Area (SWMU 1)
- Sump at northeast corner of Atrazine warehouse
- The old Rail-Carwash basin
- The sump associated with the former Toxaphene Production Area (SWMU 14)
- Sumps within the former storage tank containment areas located to the west and south of the Former Dinoseb Production Area (SWMU 7).
- Sumps within the Former MSMA Tank Farm Area (SWMU 11).

The Former MSMA Production Area (SWMU 11) floor drain sump is needed because of the IRFNA process. The area is covered with a roof.

The Sumps and floor drainage system associated with the Former Dinoseb Production Area (SWMU 7) have been dismantled and properly disposed off-site.

The sump at the southwest corner of the Container (Drum) Storage Area (SWMU 1) will be closed pursuant to closure plans for that area to be submitted to the EPA and MSDEQ as a 60 day deliverable.

The two circular sumps eight feet in diameter located west of the Surface Impoundment (SWMU 3) and the railroad tracks that were apparently intended to store water for water treatment but were not put into service have been filled with clean soil, capped and rounded. No further action is intended.

The sump at the southwest corner of the former dinoseb Drum Loading/unloading Area (SWMU 8) has been cleaned, inspected for cracks and temporarily converted to a wheel wash decontamination pad. Cedar will build a new decontamination pad and then clean close the sump noted.

3.5 GROUNDWATER

During the Interim Measures activities, nine (9) temporary piezometers will be installed as shown in Figure 4. Prior to installing the piezometers, three borings will be made down to the marl (50-60 feet below ground level).

Information obtained from this system of piezometers will help determine the exact flow patterns of the groundwater in the upper most aquifer beneath the South Plant. To date, only a small portion of the South Plant has been monitored with piezometers for groundwater flow pattern determination. Once the ground water flow patterns have been established, the intent, as specified in the Groundwater Assessment Workplan, is to plug these temporary piezometers and replace at least two (2) of them with permanent wells screened in the appropriate zone of the upper aquifer.

Since an interim measures objective is to modify the existing groundwater monitoring program such that it is consistent with or equivalent to a RCRA program, a Sampling and Analysis Plan (SAP) for the existing groundwater monitoring system was prepared and is attached as Appendix A. The SAP also includes a Quality Assurance Plan. The SAP is also used for the Groundwater Assessment.

The results of the interim measures activities will impact the direction of the groundwater assessment workplan. Three workplans (Interim Measures Workplan, RFI Workplan, and Groundwater Assessment Workplan) will be operating simultaneously at the same facility; however, the plans will be integrated.

PROJECT SCHEDULE AND SUBMITTAL SUMMARY

4.1 INTERIM MEASURES PROJECT SCHEDULE

A proposed Interim Measures project schedule is shown as Figure 5. This schedule shows milestones mandated by the Consent Decree as well as additional details for the planned remedial activities on site. The schedule may be revised after completion of the Final Design Documents for the Interim Measures Design Program to reflect refinements in the project as a result of the design program.

4.2 REPORTING REQUIREMENTS

Several reports are mandated by the Consent Decree. These reports include the following: Progress Reports, the Interim Measures Workplan, Final Design Documents, Construction Quality Assurance Plan, and the Interim Measures Report. Due dates for these reports are also mandated in the Consent Decree. The schedule presented in Figure 5 incorporates these required reports.

4.2.1 Progress Reports

Monthly progress reports dated the 10th of the month will be provided to EPA and MSDEQ containing:

- Description and estimate of the percentage of the interim measures completed
- Summaries of all findings
- Summaries of all changes made in the interim measures during the reporting period
- Summaries of all contacts with representatives of the local community, *public interest groups*, or State government during the reporting period
- Actions being taken to rectify problems
- Changes in personnel during the reporting period
- Projected work for the next reporting period

- Copies of daily reports, inspection reports, laboratory/monitoring data, etc.

4.2.2 Final Design Documents

The Final Design Documents will consist of the Final Design Plans and Specifications (100% complete), the Operations and Maintenance Plan, and Project Schedule. The final documents will contain reproducible drawings and specifications. The Final Design Documents will be submitted to EPA and MSDEQ within thirty calendar days of approval of the Interim Measures Workplan.

Final design documents will be prepared for use in contractor selection and as contract documents for implementation of the interim measures. In the event that Cedar implements any of the interim measures internally, Cedar will follow contract documents as if they were a contractor.

The plans and specifications will expand on the plan of action presented in this work plan for each of the specific interim measures objectives.

An Operation and Maintenance Plan which describes the procedures to be followed to maintain the effectiveness of the interim measures throughout the period of the RFI until the final corrective measures are implemented will be included. The general concept for maintenance and inspection is included in the Technical Approach section of this workplan for each specific interim measure.

4.2.3 Interim Measures Workplan

Cedar Chemical Corporation herewith submits to EPA and MSDEQ this Interim Measures Workplan. The Interim Measures Workplan contains a Health and Safety Plan and a Community Relations Plan. This workplan is submitted within thirty calendar days of the effective date of the Consent Decree.

4.2.4 Construction Quality Assurance Plan

The CQA Plan is to be an outline of inspection activities that will be used to monitor the construction and/or installation of the components of the Interim Measures. The CQA Plan will also provide for documentation of activities and provisions for storage of all records. The CQA Plan will be filed with MSDEQ and EPA within thirty calendar days of the approval of the Interim Measures Workplan.

4.2.5 Groundwater Monitoring Reports

The Interim Measures activities will supplement the existing groundwater monitoring program with a Sampling and Analysis Plan (Appendix A) to ensure sufficient monitoring is in place to immediately detect release from the SWMUs and AOCs and to define any contamination plume present in the upper aquifer. Cedar will begin submission of annual Groundwater Monitoring Reports to EPA and MSDEQ on or before March 1 of each calendar year. This monitoring report will include the following information:

- the calculated rate of migration of hazardous waste or hazardous waste constituents in the groundwater
- the calculated rate of migration of the groundwater
- a summary of groundwater data previously generated

4.2.6 Draft and Final Interim Measures Report

At the completion of project construction (except for long term operation, maintenance, and monitoring), an Interim Measures Implementation Report will be submitted to EPA and MSDEQ as required by the Consent Decree. The report will document that the project is consistent with the design specifications, and that the interim measures are performing adequately. The report will include, when necessary, the following elements:

- Synopsis of the interim measures and certification of the design and construction
- Explanation of any modifications to the plans and why these were

necessary for the project

- Listing of the criteria, established before the interim measures were initiated, for judging the functioning of the interim measures and also explaining any modification to these criteria
- Results of facility monitoring, indicating that the interim measures will meet or exceed the performance criteria
- Explanation of the operation and maintenance to be undertaken at the facility
- Inspection summary reports
- Inspection data sheets
- Problem identification and corrective measure reports
- Reporting data sheets
- As-built drawings.

The final Interim Measures Report submitted to the EPA Region IV and MSDEQ will incorporate comments received on draft submissions of the report to these regulatory agencies. The report will incorporate information from the Interim Measures Workplan and the Interim Measures Implementation Report.

PROJECT MANAGEMENT PLAN

The Project Management Plan consists of the following elements:

- project task definition
- specific personnel positions within the project organizational structure

5.1 PROJECT TASK DEFINITION

The Surface Impoundment (SWMU 3) has been retrofitted. Management and maintenance is currently in progress. The as built drawings of the synthetic liners in the existing impoundments is presented in Appendix E.

For the remaining items of the interim measures, Cedar has retained the services of Woodward-Clyde Consultants (WCC) as an independent engineering firm to develop the interim measures work plan and associated documents. Following approval of these documents by EPA and MSDEQ, WCC will assist Cedar in selecting a remedial contractor for the interim measures or assist Cedar in the internal implementation. Any contractor selected will be contracted directly with Cedar, however, WCC will provide construction oversight and inspection to implement the Interim Measures Work Plan and associated Construction Quality Assurance Plan.

5.2 PROJECT PERSONNEL

Figure 3 is an organization chart depicting the administration of the interim measures, preliminary report, and the RFI Work Plan. Duties of key personnel are described below.

5.2.1 EPA and MSDEQ Project Coordinator. The EPA and MSDEQ project coordinators or designated agents will observe interim measures activities to any extent deemed necessary to confirm that the requirements of the Consent Decree, and the

Interim Measures Workplan are met.

5.2.2 Project Director. The Project Director is an employee of and is the official representative for Cedar Chemical. He is in charge of administration of the work and the completion of the project.

5.2.3 Woodward-Clyde Consultants (WCC) Project Manager. The WCC Project Manager will develop the plans required by the Consent Decree and oversee remediation work implementing the interim measures on behalf of Cedar Chemical, and will be the primary contact with the Cedar Chemical. The WCC Project Manager is Richard D. Karkkainen. Mr. Karkkainen is an experienced remedial manager, WCC Vice President and Managing Principal of the Baton Rouge Operating Unit consisting of 150 personnel and offices in Baton Rouge and Lake Charles, Louisiana and Little Rock, Arkansas.

5.2.4 WCC Interim Measures Task Manager. The WCC Interim Measures Task Manager will handle day to day interim measures activities of WCC and coordinate them with RFI activities. He will coordinate both efforts and oversee their implementation. The site coordinator will also oversee any verification testing, verify the accuracy of hazardous waste disposal manifests on behalf of Cedar Chemical, and will maintain the on-site files.

5.2.5 Contractor's Project Manager. The Contractor's Project Manager will oversee daily operations of the interim measures activities and maintain budgets and schedules. The Contractor's Project Manager will interface with WCC Site Coordinator to transmit any test results or other information relating to the interim measures. The Contractor Project Manager for Interim Measures may be a Cedar employee.

5.2.6 Remediation Contractor's Health and Safety Officer. A Health and Safety (H&S) officer will be responsible for the administration and implementation of site Health and Safety for interim measures activities by the remediation Contractor and its subcontractors as described in the Health and Safety Plan. However, the H&S officer will have the overall responsibility for safety and health and will:

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- Ensure that an employee medical surveillance program which meets the requirements of 29 CFR 1910.120 is instituted and maintained.
- Be responsible for the initial pre-construction indoctrination of all on-site personnel with regard to the H&S Plan and other safety requirements to be observed during the construction, including but not limited to:
 - a) potential hazards,
 - b) personal hygiene principles,
 - c) personnel protective equipment,
 - d) respiratory protection equipment usage and fit testing, and
 - e) emergency response including site evacuation, dealing with fire and medical situations.
- Be responsible for the maintenance of separate exclusion, contamination reduction, and support zones as described in the Contractor's H&S Plan and on the drawings.
- Ensure that personnel exposure air monitoring is properly conducted and recorded.
- Maintain a record keeping system which will include daily records of all site activity, waste quantities produced, waste transportation activity information, laboratory results, and other information as required.

HEALTH AND SAFETY PLAN

This Health and Safety Plan establishes guidelines and requirements for the safety of field personnel during the conduct of the field activities associated with the referenced project. The activities addressed by this plan are those described in Section 3.0. All employees of Woodward-Clyde Consultants (WCC) involved in this project are required to abide by the provisions of this plan. They are required to read this plan and sign the attached Compliance Agreement. The Health and Safety Plan is attached as Appendix B.

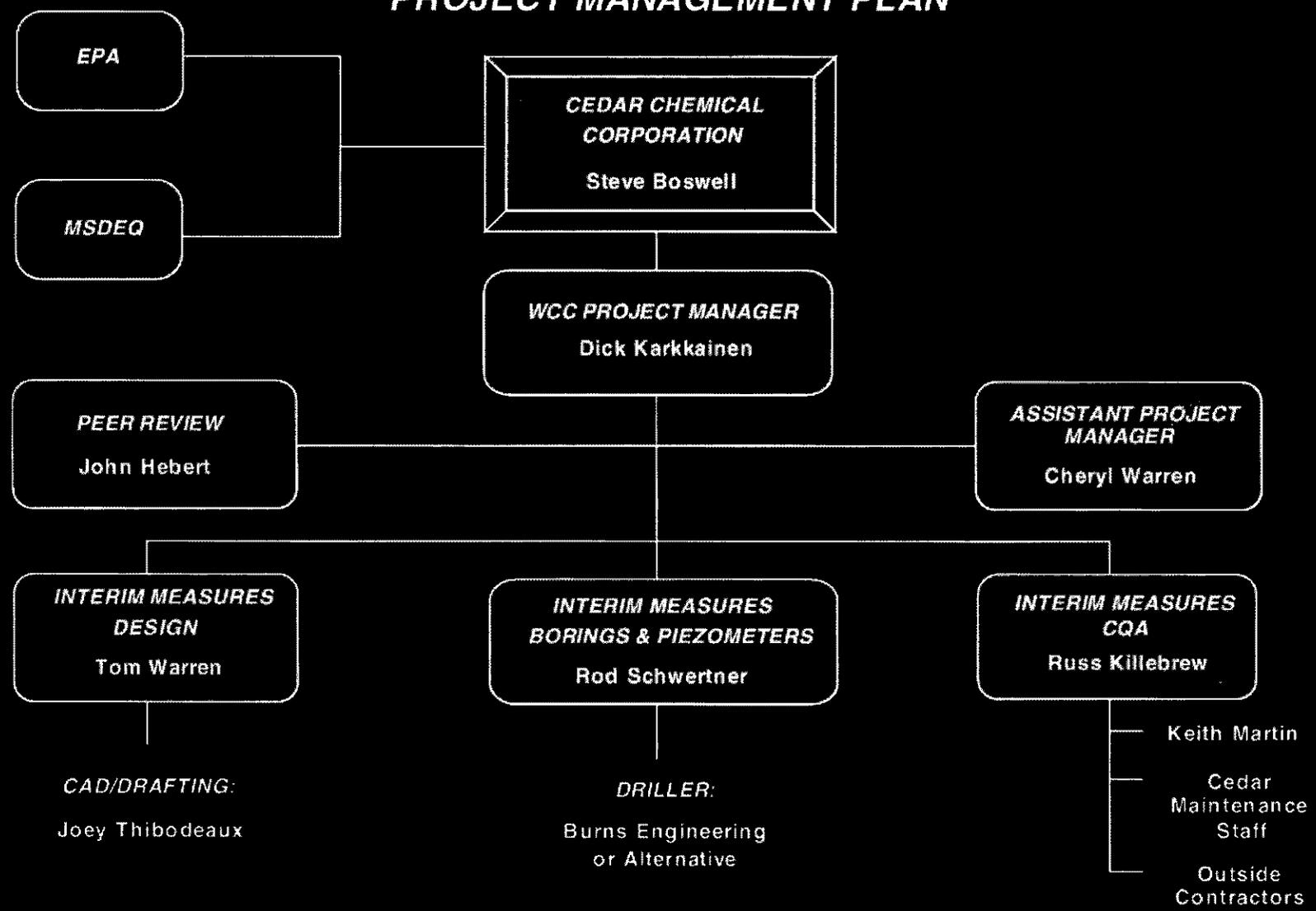
The health and safety guidelines and requirements presented are based on a review of available information and an evaluation of potential hazards. This plan outlines the health and safety procedures and equipment required for activities at this site to minimize the potential for exposures of field personnel. This plan may be modified by the project manager, the corporate health and safety officer, and the Baton Rouge health and safety officer in response to additional information obtained regarding the potential hazards to field investigative personnel. The plan has been prepared for the exclusive use of WCC Personnel and WCC subcontractors. WCC liability is extended to WCC Personnel and WCC Subcontractors only.

Cedar will be remedial contractor for many interim measure activities. The Cedar Health and Safety Plan is attached as Appendix D.

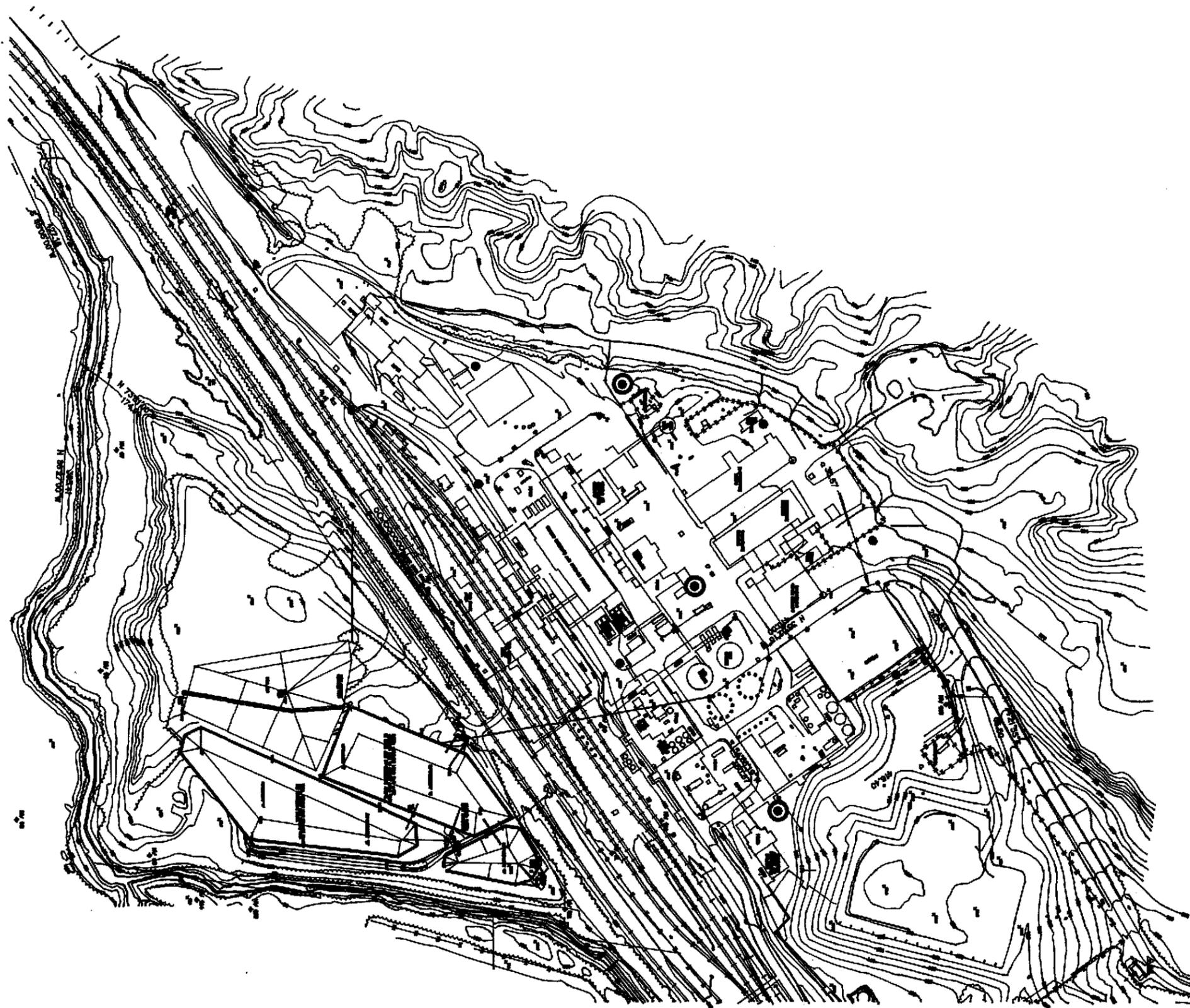
COMMUNITY RELATIONS PLAN

Cedar Chemical Corporation has developed a Community Relations Plan as outlined in the Consent Decree. The purpose of the Community Relations Plan is to provide guidelines for the dissemination of information to the public concerning the Interim Measures activities and results. The Community Relation Plan is attached as Appendix C of this document. The plan consists of the preparation of news releases and presentation of the releases to the local newspaper. The releases will discuss the facts and will note that appointments for further discussion can be made with the Plant Manager of the Vicksburg facility. In the event that public meetings are scheduled, Cedar Chemical Corporation or its representative will prepare fact sheets and be present for participation in the public meetings.

**Figure 3
INTERIM MEASURES
PROJECT MANAGEMENT PLAN**



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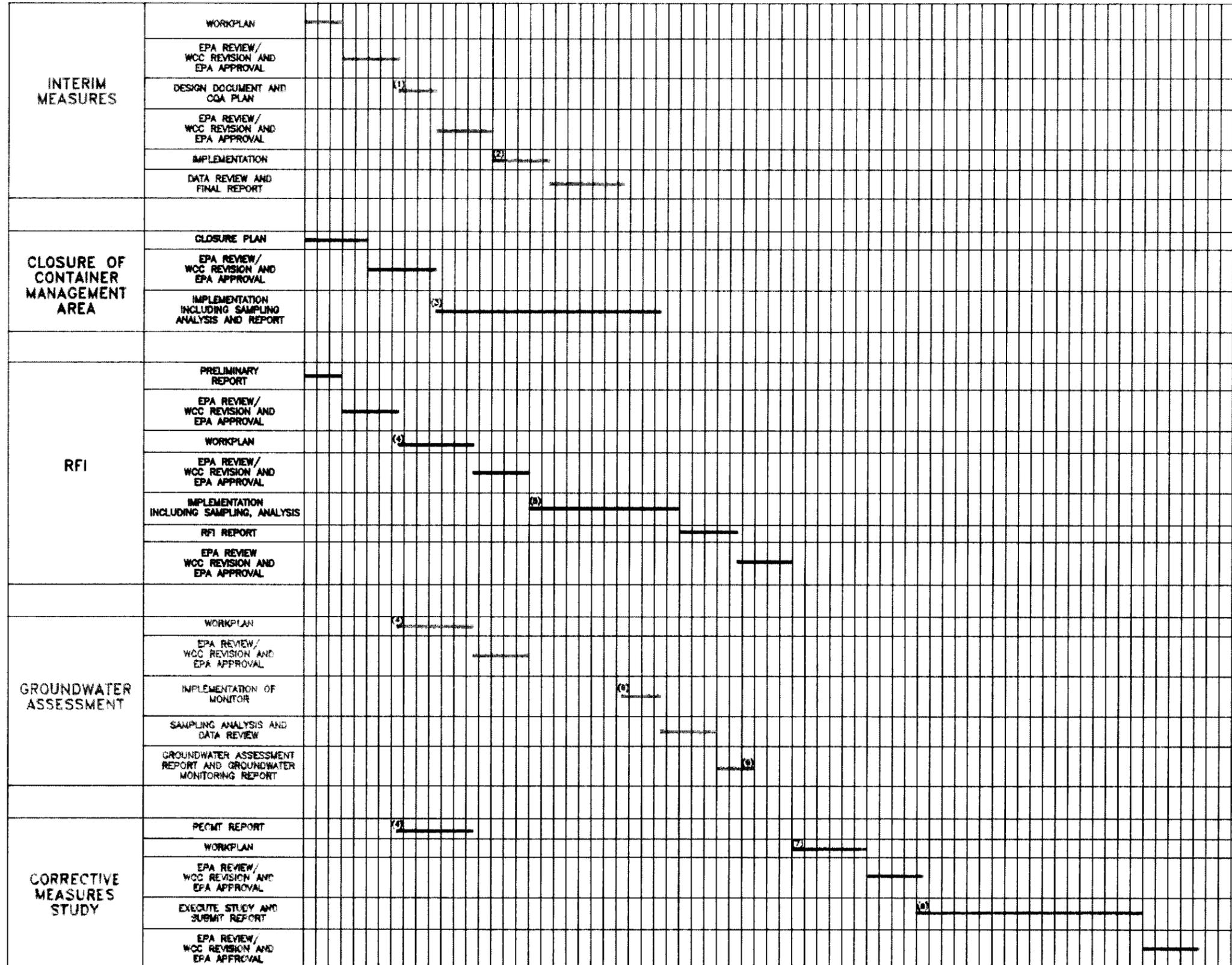
- - PROPOSED PIEZOMETER
- ⊙ - PROPOSED DEEP BORING ADJACENT TO PIEZOMETER



DATE	REVISION	DRWN/CHKD
INTERIM MEASURES WORKPLAN		
Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Baton Rouge, Louisiana		
CEDAR CHEMICAL CORPORATION VICKSBURG CHEMICAL DIVISION VICKSBURG, MISSISSIPPI		
SCALE: AS SHOWN	MADE BY: J. BICKFORD CHECKED BY: <i>[Signature]</i>	DATE: 5/7/92 FILE NO: 92B007C
PROPOSED LOCATION OF BORINGS AND PIEZOMETERS		FIGURE 4

TIME IN DAYS

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750



NOTES:

- (1) START POINT DEPENDENT ON EPA APPROVAL OF INTERIM MEASURES WORKPLAN
- (2) START POINT DEPENDENT OF EPA APPROVAL OF DESIGN DOCUMENT AND CQA PLAN
- (3) START POINT DEPENDENT ON EPA APPROVAL OF CONTAINER MANAGEMENT AREA CLOSURE PLAN
- (4) START POINT DEPENDENT ON EPA APPROVAL OF PRELIMINARY REPORT
- (5) START POINT DEPENDENT ON EPA APPROVAL OF RFI WORKPLAN
- (6) START POINT DEPENDENT ON DATA AND CONCLUSIONS
- (7) START POINT DEPENDENT ON EPA APPROVAL OF RFI REPORT
- (8) START POINT DEPENDENT ON EPA APPROVAL OF CMS WORKPLAN
- (9) DUE MARCH 1, 1993 PURSUANT TO CONSENT DECREE

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DATE	REVISION	DRW/CHKD
PROJECT SCHEDULE		
Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Baton Rouge, Louisiana		
CEDAR CHEMICAL CORPORATION VICKSBURG CHEMICAL DIVISION VICKSBURG, MISSISSIPPI		
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	CHECKED BY: <i>[Signature]</i>	FILE NO: 92B007C
		FIGURE 5

MW13

MW14

MW16

PZ3

CLAY

FILL/SURFACE LAYERS

SAND SEAM

CLAYEY SILT

SILTY CLAY

CLAYEY SILT

SILTY CLAY

SANDY CLAY

MARL

NO.	REVISION	DATE	INITIAL

INTERIM MEASURES WORK PLAN

WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists
and Environmental Scientists
Baton Rouge, Louisiana

CEBAR CHEMICAL CORPORATION
VEGETABLE CHEMICAL DIVISION
MONROE, LOUISIANA

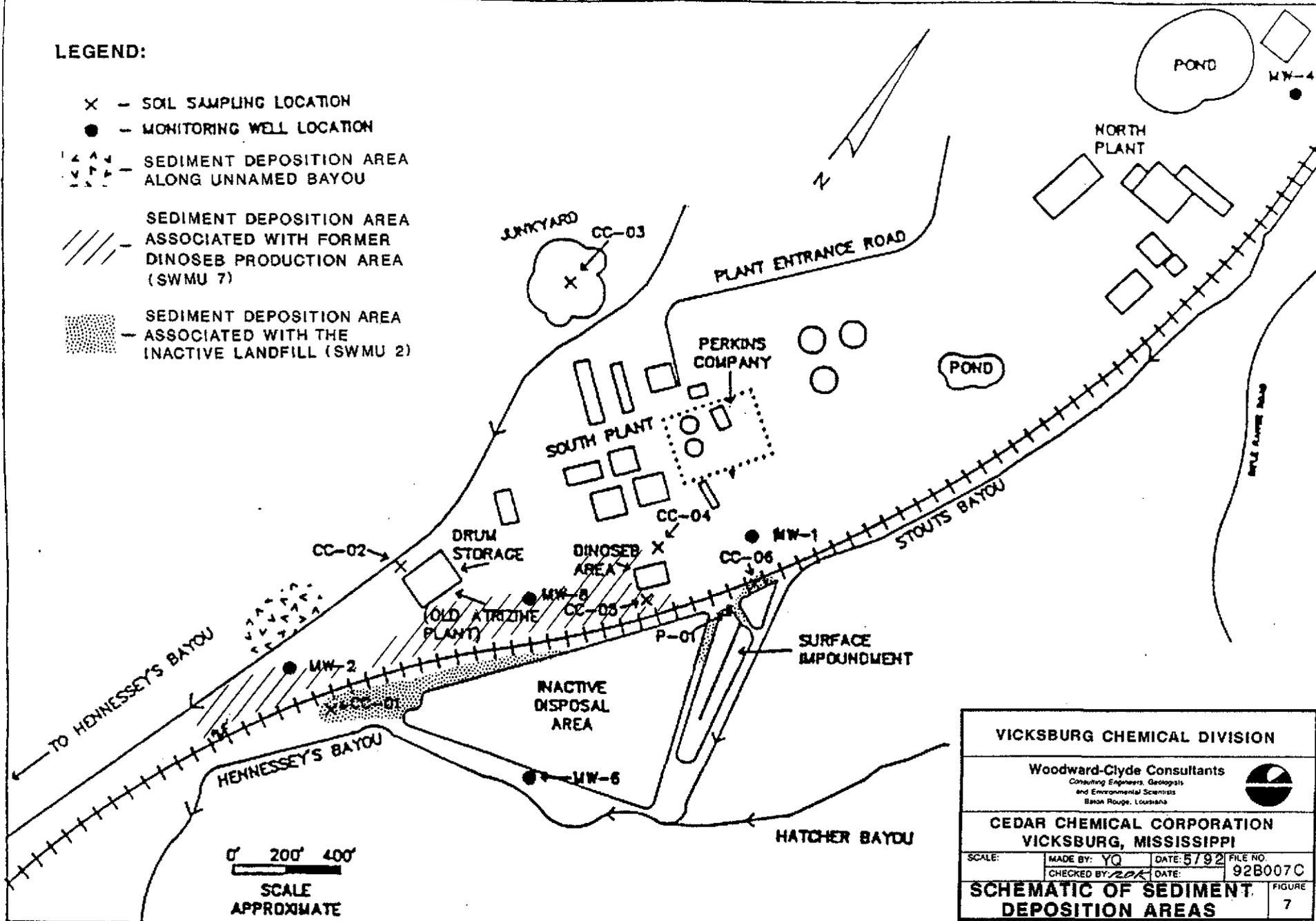
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GEOLOGIC CROSS-SECTION

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LEGEND:

- X - SOIL SAMPLING LOCATION
- - MONITORING WELL LOCATION
- ▲▲▲▲ - SEDIMENT DEPOSITION AREA ALONG UNNAMED BAYOU
- //// - SEDIMENT DEPOSITION AREA ASSOCIATED WITH FORMER DINOSEB PRODUCTION AREA (SWMU 7)
- ▒ - SEDIMENT DEPOSITION AREA ASSOCIATED WITH THE INACTIVE LANDFILL (SWMU 2)



VICKSBURG CHEMICAL DIVISION			
Woodward-Clyde Consultants <small>Consulting Engineers, Geologists and Environmental Scientists Baton Rouge, Louisiana</small>			
CEDAR CHEMICAL CORPORATION VICKSBURG, MISSISSIPPI			
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	CHECKED BY: ROK	DATE:	
SCHEMATIC OF SEDIMENT DEPOSITION AREAS			FIGURE 7

APPENDIX A

**SAMPLING AND ANALYSIS PLAN
FOR GROUND WATER MONITORING WELLS**

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- 3 Chain-of-Custody Record
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The Vicksburg Chemical Division of Cedar Chemical Corporation (Cedar) is located in Vicksburg, Mississippi. The facility is a manufacturer of chemicals. A U.S. Environmental Protection Agency (EPA) Determination of Release was issued for the facility in December, 1989. Negotiations for a Consent Decree began in January, 1990. This Groundwater Sampling and Analysis Plan (SAP) has been developed in partial fulfillment of the work items to be performed under the jurisdiction of the Consent Decree.

1.1 PURPOSE AND SCOPE OF WORK

The objective of the SAP is to specify procedures, techniques and frequency for groundwater sample collection, sample preservation and shipment, analytical procedures and chain of custody control. Additionally, a Quality Assurance Plan (QAP) has been developed to standardize and update analytical procedures, quality assurance requirements, and sampling techniques. The objective of the QAP is to assist in identifying and improving the quality of the data obtained for the Cedar groundwater monitoring program.

The chemical parameters to be analyzed in the groundwater samples in this SAP are enumerated in Table 1 of this appendix. This program is the ongoing quarterly groundwater monitoring program. Sampling events and analyses are to subsequently occur on two occasions:

- during implementation of the Groundwater Assessment
- during implementation of the RFI field program following the installation of monitor wells, if any, during that program.

The list of parameters on Table 1 may expand and will be noted in the Groundwater Assessment Workplan.

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The results of the sampling events are to be included in the Annual Groundwater Monitoring Report first due on March 1, 1993. The Annual Groundwater Monitoring Report will additionally include:

- the calculated rate of migration of hazardous constituents
- the calculated rate of migration of groundwater
- a summary of groundwater data previously generated
- recommendations for modification of the parameters for the ongoing quarterly monitoring program based on the results of the TCL/TAL analyses.

SITE BACKGROUND

The Vicksburg Chemical Division of Cedar Chemical Corporation is located along the Mississippi River in Warren County, Mississippi immediately on the south side within the limits of Vicksburg. Approximately 70 acres border on the Mississippi River. The 650 acre plant site is divided into two separate and distinct operations known as the North Plant and the South Plant. Active operations are or have been conducted on approximately 130 acres.

In operation since 1961, the North Plant produces potassium nitrate and by-product chlorine and liquid nitrogen tetroxide. The raw materials for the North Plant include potassium chloride and nitric acid. The potassium nitrate is sold mainly as a chemical fertilizer. The chlorine is sold for various industrial uses. All nitrogen tetroxide is sold mainly to the government as an oxidizer for rocket fuels.

The South Plant, in operation since 1953, formerly manufactured chlorinated pesticides, arsenical based, organophosphate based, and nitrogen based herbicides. The only active operations at the South Plant are a modern nitric acid unit and an IRFNA unit. Most of the manufactured nitric acid is used as a raw material in the North Plant.

2.1 SITE CONDITIONS

The general site conditions of the Vicksburg facility are presented in subsequent paragraphs. This information was obtained from previous investigations performed at the Cedar Chemical plant.

2.1.1 Subsurface Stratigraphy

Based on various subsurface investigations performed at the site, the subsurface stratigraphy, referenced to natural grade, may be generalized as follows:

<u>From (ft)</u>	<u>To (ft)</u>	<u>Description</u>
0	20	Clayey silt
20	33	Silty clay
33	48	Clayey silt
48	54	Sandy Clay
54		Top of marl

The second (silty clay) layer, the third (clayey silt) layer, and the fourth (sandy clay) layer are sampled by the current groundwater monitoring program at the facility.

2.1.2 Topography

The plant site is located adjacent to the Mississippi River and surrounded by smaller drainage ditches (intermittent bayous). Surface drainage flows easterly down a hill and discharges to Stouts Bayou. This bayou then joins Hennesseys Bayou which flows along the south edge of the plant. Hennesseys Bayou flows west and discharges to the Mississippi River.

2.1.3 Hydrogeology

A shallow ground water aquifer lies beneath the Vicksburg facility. The aquifer is contained in the loess deposits and is, therefore, a stratified mix of clayey silt and silty clay. Some sand and silty sand has also been observed during monitor well installation. Clay layers which extend laterally within the aquifer inhibit the vertical movement of the ground water. Based on recent ground water elevations, the aquifer appears to flow toward Stouts and Hennesseys Bayous. These bayous border the process areas along the (plant) eastern edge of the facility. Previous water level data indicates mounding in the area of the Surface Impoundment. The impoundment has been retrofitted with a geosynthetic liner which is altering the groundwater levels adjacent to the impoundment. Now that the liner is complete, the mounding phenomenon should cease. There is also concern as to the vertical pressure gradient in the various layers of the aquifer. The measured groundwater elevations are all considered to be from a single pressured zone

for determination of groundwater flow patterns. If pressure conduction between zones is retarded, various groundwater flow patterns may exist within the individual aquifer layers. Delineation of specific groundwater flow patterns should be included as part of the Interim Measures Scope of Work.

2.1.4 Waste Characterization and Groundwater Quality

The Surface Impoundment at the South Plant previously received treated process wastewater contaminated with pesticides and herbicides. Currently, stormwater runoff continues to carry de minimis amounts of pesticides and herbicides into the Surface Impoundment. The sediments in the impoundment have been secured in an onsite landfill designed in accordance with RCRA guidelines. An older Inactive Landfill area received solid waste generated as a result of the manufacturing processes (empty drums, pallets, etc). Both of these Solid Waste Management Units (SWMUs) had the potential to cause contamination of the groundwater.

Shallow groundwater monitoring wells have been installed around the perimeter of the Surface Impoundment and Inactive Landfill. Contamination of the groundwater has been detected. Currently, several wells are sampled quarterly and tested for dinitrobutyl phenol, toxaphene, arsenic, and methylene chloride. Numerous years of de minimis losses in the manufacturing areas have contaminated the soils in the process areas and along the railroad tracks. The suspected source of groundwater contamination is stormwater infiltration contaminated from contact with these soils in the processing areas of the South Plant, leakage of the influent line to the Surface Impoundment, and the Surface Impoundment prior to the retrofit with a double synthetic liner. Potentiometric data shows the shallow aquifer to be hydraulically associated with Stouts Bayou. As discussed previously, groundwater appears to discharge to this surface water body.

2.2 SITE BACKGROUND

The Vicksburg Chemical Division facility previously manufactured herbicides and pesticides at the South Plant site. A Determination of Release was issued by the U.S. EPA in December, 1989. Negotiations for the Consent Decree began in January, 1990.

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A summary of previous regulatory and response action is presented in the Preliminary Report to be issued by WCC within thirty days of the effective date of the Consent Decree. Although some site characterization data exists from previous studies and sampling activities at the site, there are still areas requiring further investigation. Existing monitor wells are shown in Figure 1.

**STANDARD OPERATING PROCEDURES
FOR THE GROUNDWATER SAMPLING AND ANALYSIS PLAN**

3.1 WATER LEVEL MEASUREMENT

3.1.1 Water Level Determination

The elevation at the top of the casing (TOC) should be established at each well. This information will be used to determine the water level elevation. To calculate the water level elevation, the distance to the water level from the TOC needs to be measured. This can be achieved by either of the following procedures:

3.1.1.1 Weighted Tape Procedure A weighted tape must be decontaminated prior to use and between wells by procedures detailed in Standard Operating Procedures (SOP) 3.5. The weight should consist of an inert, open-ended object that will create a distinct sound when tapped on the water's surface. The weight should be lowered gently into the well until it is heard to have touched the water. The water level measurement from top of casing to water level should be determined to the ± 0.01 foot and recorded in the logbook as described in SOP 3.4. A measurement of well depth from the top of the casing to the bottom of the well should also be made. This measurement can be used to determine if a significant silt build-up has occurred at the bottom of the well or that the well casing is not blocked. NOTE: When using a weighted tape, be sure that the weight is not secured using an adhesive tape (duct tape, strapping tape, etc.) as the adhesive may contain organic compounds which could contaminate the well.

3.1.1.2 Electronic Water Level Indicator Procedure An electronic water level indicator must also be decontaminated by procedures detailed in SOP 3.5 prior to use and between wells. The indicator probe, connected to a graduated wire is lowered down the well casing. A light turning on or a meter deflection occurs when the electrical circuit is closed indicating that the probe tip has touched the water. The reading should be taken to the nearest ± 0.01 foot by recording the length of graduated wire between the TOC and the water level (probe tip) in the logbook as described in SOP 3.4.

Additionally, a measurement of well depth should be made from TOC to the bottom of the well using the probe.

3.1.2 Cross-contamination Minimization

In areas of known contamination, the sequence of water level measurement should be done, whenever possible, from the well least likely to be contaminated to the well most likely contaminated to reduce the potential for cross-contamination. If this information is not available, an attempt should be made to sample upgradient wells first and then downgradient wells.

3.1.3 Calculation of the Volume of Standing Water

The water level measurement is used to calculate the volume of standing water in the well from the linear feet of standing water and the well diameter. This calculation is then used to determine the volume of water to be purged from the well prior to sampling. To calculate the linear feet of water in the well, subtract the depth to the water from the total depth of the well. From the table below determine the appropriate factor for the specific well inside diameter; multiply the linear feet by the appropriate factor listed on the table below to get the gallons of water present in the well.

<u>Casing Diameter</u>	<u>Casing Volume</u>
2 inches	0.163 gallons/foot
3 inches	0.367 gallons/foot
4 inches	0.653 gallons/foot

For example, if depth to water is 7.5 feet, and the total depth of the 2-inch diameter well is 20 feet, then 12.5 feet of standing water is in the well. Volumetrically, 0.163 x 12.5 (2-inch well), or 2.04 gallons of standing water are in the well.

3.1.4 Free-Phase Immiscible Contamination

If contamination of groundwater by free-phase immiscible chemicals is suspected, procedures for the detection of immiscible, or non-aqueous phase liquids (NAPL) should be employed. The presence of dense NAPL (heavier than water) or light NAPL (less dense than water) can be determined by the use of an electrical interface probe. The probe should be carefully and slowly lowered into the well. A deflection of the needle on the scale of the probe will indicate the air/light NAPL interface, light NAPL/water interface, and water/dense NAPL interface, respectively. The thickness of immiscible contaminants is to be recorded in the logbook as described in SOP 3.4.

3.2 WELL EVACUATION - PURGING THE WELL

In order to obtain a representative sample of groundwater, the standing water in the well casing should be purged or evacuated. Evacuation allows fresh or formation groundwater to enter the well. The optimum method to ensure that formation water is sampled, is to monitor the water being purged by field measurements of pH, temperature and conductivity. For each volume of standing water purged from the well (as calculated earlier) a measurement of these three indicator parameters should be taken. When the subsequent sample are observed to have less than ± 10 percent variation in these parameters, the well is presumed to be adequately flushed. At a minimum, three standing water volumes as determined by the method discussed in SOP 3.1.3 should be removed; however, in wells with very low recoveries this goal may not be practical. When full recovery exceeds two hours, the well should be purged to dryness. If the well is evacuated to dryness, samples of the groundwater should be collected within 24 hours of evacuation.

Evacuation rates should be kept well below 10 gallons per minute and in most cases should be below 5 gallons per minute. At no time should a well be pumped to dryness if recharge rates cause groundwater to vigorously cascade down the sides of the screen which can potentially cause an accelerated loss of volatiles. If at all possible, the water should be drawn down from above the screen in the uppermost part of the water column in high yield formation to ensure that fresh water from the formation will move upward in the screen. In low yield formations, water should be purged so that it is removed

from the bottom of the screen.

Evacuation of a well can be accomplished in several different ways. In any instance it is paramount to ensure that the evacuation procedure does not cause cross-contamination from one well to the next. Therefore, the preferred method employs dedicated equipment whenever possible. The selection of an evacuation method often relies on the depth of the water in the well, as discussed below. The following are potential evacuation methods:

3.2.1 Bailer Purging

Bailers can be used to evacuate shallow wells, and though there are no prohibitive factors preventing their use in deeper wells, the time required and physical strain on the individual purging the well makes hand bailing a less desirable evacuation method for deeper wells. Ideally, if a bailer is used, it is dedicated to one well and often remains hanging from the well cap in the well between use. Regardless of whether the bailer is dedicated or not, it should be decontaminated before use. Decontamination procedures described in SOP 3.5 should be followed.

The preferable materials of bailer construction are teflon, stainless steel, polypropylene, polyethylene, vitron, and polyvinyl chloride (PVC). The bailer should be lowered into the well using a non-porous rope made out of material such as polypropylene or teflon-coated cord. Caution should be used when lowering the bailer into the water so as to avoid aeration of the well water. Retrieve the bailer after it is filled and pour water into a graduated container to measure the amount of water removed from the well. Care should be taken to keep the rope and bailer from touching the ground or other potentially contaminated surfaces. When the first standing water volume has been removed, a groundwater sample should be collected from the bailer for field measurements of pH, temperature, and conductivity. These field measurements should be repeated for each subsequent standing water volume removed.

3.2.2 Mechanical Pump Purging

Suction lift pumps such as centrifugal, diaphragm, or peristaltic pumps can be used to evacuate wells if the static water level is within 25 feet of ground surface. These pumps are utilized at ground surface with the intake line connected to dedicated teflon or high-density polyethylene tubing inserted into the well. The tubing should be equipped with a foot valve to avoid having aerated water from the pump fall back in the well. The outlet tubing should be placed so that the purge water is collected in a graduated container, and can be measured. Deionized water should be used if priming is necessary. Measurements of pH, conductivity, and temperature should be taken for each standing water volume evacuated from the well. If the well is pumped dry and the recharge rate is sufficiently rapid to cause water to cascade into the well, the well should be allowed to recover. Then the pumping rate should be adjusted to a slower rate and the well re-evacuated of two standing water volumes before sampling.

3.2.3 Submersible Pump Purging

Portable submersible pumps are an option for evacuating wells with water levels greater than 25 feet below land surface. One such pump is an electrically powered (110 or 230 V AC) centrifugal pump with an isolated motor. Another is an air displacement pump in which a stainless steel reservoir with check valves at each end alternately fills from the bottom with water from the well, and evacuates when air or compressed gas (nitrogen) is discharged into the reservoir from the top. The decontaminated pump should be carefully lowered into the well, trailing a discharge hose, electrical cables or air lines, and a stainless steel security cable (which should bear most of the weight). If these items are to be bundled, use plastic ties and not electrical tape or duct tape.

If the pump is connected to a portable gasoline generator or air compressor, the generator should be placed some distance away from the well where fumes can not affect sample quality. An inline air filtration system at the discharge line should be used when an air compressor is used in conjunction with an air displacement pump. The submersible pump provides the advantage of high flow rates, however, care should be taken when operating to keep the flow rate within an acceptable limit for the particular well yield (recharge capacity). As with the suction lift pumps, these pumps should be

equipped with a foot valve and fitted with dedicated tubing.

To evacuate, simply turn the pump on, prime with de-ionized water if needed, and measure the outlet water quantities. As with all other evacuation methods, pH, temperature, and conductivity should be measured for each standing water volume removed. These pumps need to be decontaminated prior to sampling and between sampling points. Decontamination procedures are described in SOP 3.5.

3.2.4 Bladder Pump Purging

A bladder pump or gas squeeze pump consists of a housing that encloses a flexible membrane (bladder) that has check valves above and below. The pump is connected to either bottled gas or an air compressor. When in operation, water enters the membrane/bladder through the bottom check valve; compressed gas is injected into cavity between the housing and the bladder, squeezing the bladder and forcing the water through the top check valve and ultimately out of the well. Another type of bladder pump is also available that works on the same principle except that the water enters the chamber between the membrane and the casing, and the gas is injected into bladder. Similar to the submersible pumps, the bladder pump should be carefully lowered into the well by a security cable. In low-yielding wells (i.e., wells incapable of producing three well volumes), the bladder pump should be placed at the bottom of the well screen so that water is removed from the bottom of the well screen.

The outlet tubing from the bladder pump should be placed so that purge water can be collected into a graduated container. Field measurements of temperature, pH, and conductivity should be taken for each standing water volume evacuated from the well.

3.2.5 Inertia Pump Purging

An inertia pump consists of a PTFE footing which is essentially a reservoir with check valves at the bottom inlet and top outlet, and a tube rising to the wellhead. An up-and-down movement of the tube pumps water through inertia derived from the upward movement of water with each stroke. The whole system is dedicated and can be pumped by hand, by the use of a hand-operated lever, or by using an electrically powered (110

V AC) motor. An optional bellows attachment provides suction to the tubing and greatly increases the pumping capacity.

To evacuate, simply pump by hand, or connect the motor. If a portable generator is used, take care to place it some distance away from the well where fumes cannot affect sample quality. Field measurements of pH, temperature, and specific conductivity should be taken for each standing water volume removed.

3.3 MONITOR WELL SAMPLING

After evacuation of an adequate volume of water from the well as specified by SOP 3.2, sampling can begin. Sampling of the monitor well should occur as soon as possible after evacuation, preferably immediately and must occur within 24 hours of completion of purging activities. Of the methodologies used for monitor well evacuation (described in SOP 3.2) it is recommended that samples be collected only by using either the bailer, inertia pump, or the bladder pump. Due to the manner in which the other pumps (suction lift and submersible pumps) operate and the potential effect on the quality of the samples, it is not advisable to collect samples for volatile organic analysis with them.

3.3.1 Sample Collection

Prior to collecting the groundwater samples, the appropriate sample containers and preservatives should be set out and readily available for sample collection. Ideally, the sample containers should be cleaned and prepared by the laboratory that is going to conduct the analysis. Some of the parameters for which samples are to be collected will require a preservative. The Quality Assurance Plan (Section 4.0) provides details on sample container size and preservatives to be used. The following are potential sampling methods:

3.3.1.1 Bailer Sample Collection If a bailer is used for sample collecting, the same bailer used to purge the well may be used to sample it. An effort will be made to keep the rope from touching the ground or the casing. The bailer will be lowered slowly into the water. Do not let the bailer free fall into the water. Attempt to lower the bailer to the same depth in the well each time. Retrieve the bailer smoothly but quickly and

empty the water into the sample container in a steady stream. Samples should be collected in the following order: Volatile Organics, Total Organic Carbon, Semivolatile Organics, and any other compounds. Once collected, the samples should be labeled using a waterproof label and waterproof ink, sealed in plastic bags, and placed on ice in an ice chest and cooled to 4°C. The sample number, amount collected, and time collected should be recorded on a chain-of-custody form and in a logbook.

3.3.1.2 Bladder or Inertia Pump Sample Collection If a bladder pump or an inertia pump is used, the same tubing that was used to purge the well may be used to sample it. The samples should be collected in the following order: Volatile Organics, Total Organic Carbon, Semivolatile Organics, and any other compounds. When collecting samples for the analysis of volatile compounds, the pumping rate should not exceed 100 milliliters per minute. After these samples are collected the pumping rate can be increased for collection of other samples. Once collected, the samples should be labeled using a waterproof label and waterproof ink, sealed in plastic bags, and placed on ice in an ice chest cooled to 4°C. The sample number, amount collected, and time collected should be recorded on a chain-of-custody form and in a logbook.

3.3.2 Cross-Contamination Minimization

As with purging, the sequence of monitor well sampling should be done, whenever possible, from the well least likely to be contaminated to the well most likely contaminated to reduce the potential for cross-contamination. If this information is not available, an attempt should be made to sample upgradient wells first and then downgradient wells.

3.3.3 Collection for Metal Analysis

If analysis for metals is required, water samples that contain high concentrations of sediment may be field filtered before the sample is collected for metal analysis. A hand pump and a filter device can be used, or an in-line filter (0.45 micron) in conjunction with the bladder or inertia pump. The groundwater sample should be run through the filter and collected in a clean sample container. It is recommended that a second sample should be sent to the laboratory for analysis. All equipment should be

decontaminated as described in SOP 3.5 before filtering and between sampling locations.

3.3.4 Use of Dedicated Equipment

If possible, the equipment used to sample a well should be dedicated equipment. If a bailer is used, each well should have a dedicated bailer that is stored in the well. Another alternative which is preferred over non-dedicated sampling equipment is a disposable bailer which may be used for a single well sampling. If a bladder pump is used, each well should have dedicated tubing. *Dedicated equipment should still be decontaminated as described in SOP 3.5 prior to use.* By using dedicated equipment, the chances of cross-contamination are greatly reduced.

3.3.5 Collection for Volatile Organic Analysis

Special care should be taken when collecting samples to be analyzed for volatile compounds. The water should be transferred slowly from the bailer, bladder, or inertia pump to the sample container to reduce the potential for aeration of the samples. Samples requiring the analysis for organics should not be filtered or transferred from one container to another because losses of organic compounds onto the walls of the containers or aeration may occur. Samples to be analyzed for Total Organic Carbon (TOC) should be handled and analyzed as materials containing volatile organics. No headspace should exist in the sample containers for volatile compounds or TOC to minimize the possibility of volatilization of organics.

3.4 FIELD DOCUMENTATION

For documentation purposes, all information pertinent to field observations and sampling will be recorded in a field logbook with consecutively numbered pages. Entries in the log book will include at least the following:

- Location and sampling activity and address,
- Purpose of sampling,
- Number and approximate volume of samples taken,
- Description of sampling point,

- Date and time of collection,
- Collector's sample identification number(s),
- Sample distribution (e.g., chemical laboratory, geotechnical laboratory, etc.),
- Sample preservation,
- Field observations,
- Any field measurements made, such as pH, temperature, specific conductivity, or other field parameters,
- Weather conditions.

The documentation in the log book will be sufficient to reconstruct the sampling situation without relying on the collector's memory.

3.5 DECONTAMINATION AND CROSS-CONTAMINATION CONTROL

Personnel will wear appropriate protective clothing during decontamination as required by the Health and Safety Plan. All protective equipment (gloves, boots, etc.) will be decontaminated after use or they will be disposed in drums, labeled, dated, and stored until disposed at an approved facility.

3.5.1 Cross-Contamination Control Procedures

In order to minimize the possibility of cross-contamination, strict cross-contamination control procedures should be followed. These procedures include:

- Sample jars should be kept in limited access areas until used.
- Clean equipment should be wrapped in aluminum foil or plastic sheeting prior to use.
- Clean plastic sheeting shall be placed at the sampling area and all equipment should be placed on the sheets. This plastic shall be discarded after each use.
- Equipment refueling shall be performed in designated areas. These areas should be at a distance from any sampling points, to minimize the potential that vapors from fuel will affect sample quality.

- All purge water, decontamination water, and discarded gloves should be containerized for disposal.

3.5.2 Sampling Equipment Decontamination

All equipment used to collect groundwater samples should be decontaminated prior to the collection of the samples and in between sample locations. Decontamination of this equipment will be accomplished by the following procedures:

- Wash equipment thoroughly with laboratory, phosphate free detergent (i.e., Alconox) and de-ionized water using a brush to remove any particulate matter or surface film.
- Triple rinse equipment thoroughly with clean deionized water.
- Rinse equipment thoroughly with methanol.
- Triple rinse with clean deionized water.

In the event that metals become a primary concern, sampling equipment will be rinsed with 10% HNO₃ prior to the methanol rinse. The sampling equipment will be wrapped in aluminum foil or visqueen after decontamination until reuse. This equipment will be decontaminated in areas established near the perimeter of the sampling area. Rinsate samples will be collected as indicated in the Quality Assurance Plan.

3.5.3 Pump Decontamination

If the well has been purged or sampled using any of the pumps as discussed in SOP 3.2, the pumps used need to be decontaminated between sample points. Decontamination of the pumps includes washing with soap and rinsing the outside portion of the pumps (especially those pumps that are placed inside the wells) as well as running water through the pump. It is recommended that a sufficient volume of distilled water or de-ionized water be run through the pumps to clean them out.

**QUALITY ASSURANCE PLAN FOR THE
GROUNDWATER SAMPLING AND ANALYSIS PLAN**

4.1 PROJECT DESCRIPTION

Cedar Chemical Corporation (CCC) has retained Woodward-Clyde Consultants (WCC) to develop a Sampling and Analysis Plan (SAP) for the collection of groundwater samples at their facility located in Vicksburg, Mississippi. WCC also developed as part of the SAP a Quality Assurance Plan (QAP) to standardize and update their analytical procedures, quality assurance requirements and sampling techniques. The objective of this QAP is to assist CCC in identifying and improving the quality of the data obtained for their groundwater monitoring program. This QAP focuses primarily on listing the analytical Quality Assurance/Quality Control (QA/QC) procedures to determine the quality of the data generated. Therefore, this QAP has been designed to be implemented concurrently with the SAP.

**4.2 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT OF DATA
IN TERMS OF PRECISION, ACCURACY, COMPLETENESS,
REPRESENTATIVENESS, AND COMPARABILITY**

The definitions of precision, accuracy, completeness, representativeness, and comparability as presented in Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-0050/80, Office of Monitoring Systems and Quality Assurance and Office of Research and Development, U. S. Environmental Protection Agency, Washington, D. C. 20460, December 29, 1990) are reproduced as follows:

Precision is "a measure of mutual agreement among individual measurements of the same property."

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Accuracy is "the degree of agreement of a measurement with an accepted reference or true value."

Completeness is "a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions."

Representativeness "expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition."

Comparability "expresses the confidence with which one data set can be compared to another."

The overall precision of the field sampling and laboratory analysis will be evaluated employing field duplicates at a frequency of once per 20 field samples of a given matrix.

The precision of the laboratory analyses will be evaluated employing laboratory duplicate sample analyses for the organic constituents and employing laboratory matrix spike duplicate analyses for the volatile, and pesticide organic contaminants.

The accuracy of the laboratory analyses will be evaluated employing method blanks and the recovery from a single matrix spike analysis for the inorganic constituents and employing matrix spike duplicate analyses for the volatile, and pesticide organic contaminants.

The accuracy of the laboratory analyses of the inorganic constituents will be further evaluated employing laboratory control samples.

Although a completeness goal of 100 percent is desirable, an overall completeness goal of 90 percent may be realistically achieved under normal conditions of sampling and laboratory analysis.

The measurements will be made such that the results are as representative of the sample being characterized as is readily achieved with the application of the specified U. S. EPA methods.

The data obtained during the course of this project will be as comparable with that obtained by another laboratory employing the same U. S. EPA methods as is readily achieved with the specified U. S. EPA methods.

The quality assurance objectives for measurement data in terms of precision, accuracy, and completeness are presented in Tables 5a through 5e.

SAMPLING PROCEDURES

The procedures and equipment for groundwater, sampling are presented herein. These procedures were developed in general accordance with the EPA Engineering Support Branch Standard Operating Procedures Manual (SOPQAM) issued in 1986 and updated in 1990.

5.1 GROUNDWATER SAMPLING

Wells at the site will be sampled to evaluate current groundwater quality as part of the characterization. The sampling procedures in this section pertain to sampling monitor wells.

5.1.1 Equipment

The equipment to be utilized for groundwater sampling will consist of the following:

- Dedicated or decontaminated stainless steel centrifugal submersible pumps
- Teflon bladder pumps
- Dedicated or decontaminated teflon or stainless steel bailer, with bottom check valves
- Electronic water measuring device
- Container of known volume for measurement of volume of water removed

Teflon bladder pumps are installed in shallow wells and stainless steel centrifugal pumps are installed in deep wells. The bladder pumps are preferable over centrifugal pumps, but the bladder pumps do not provide the necessary pressures and flow rates in the deeper wells.

5.1.2 Procedure

The groundwater elevation will be measured from all the monitor wells of the facility. Each well will have a permanent, easily identified reference point from which its water level measurement is taken. An electronic device will be used to measure depth to the surface of the groundwater. This device used to detect the water level surface will be sufficiently sensitive so that reproducible measurements to ± 0.01 foot can be obtained. Three replicate measurements will be made.

A survey for non-aqueous phase liquids (NAPL) will be conducted prior to any sampling or purging on the wells. This survey will be conducted on wells to be sampled that have sufficient room to insert a 1.25-inch diameter bailer. Immiscible layers have not been found to be present in any of the monitor wells at the facility. To check for the presence of a separate floating NAPL, a clear acrylic bailer will be lowered into the well to just below the liquid surface and then withdrawn and examined for presence of floating NAPL. The bailer will then be lowered all the way to the bottom of the well, withdrawn and examined to check for presence of a dense NAPL. If NAPL is found, samples at the NAPL will be collected and identified/characterized in an analytical laboratory.

The field measurements for the wells designated for sampling will include depth to standing water and total depth of the well to the bottom of the intake screen structure. This information will be used to calculate the volume of stagnant water in the well and provide a check on the integrity of the well (e.g., identify siltation problems).

Should the total depth measurement show that over ten percent of the screen area is blocked, indicating sediment in the bottom of the screen, the well will be redeveloped prior to sampling. This redevelopment will be by overpumping, swabbing, bailing or other appropriate method until the sediment thickness is less than the length of the

bottom sump. Well volumes removed during redevelopment will not count toward the three well volumes for purging. Redevelopment tools will be decontaminated between wells.

To reduce the potential for cross-contamination, the non-dedicated equipment (i.e., water level measuring devices, etc.) will be decontaminated between monitor wells. Since the wells are to be purged after using the water level meter, and prior to sampling, the meter probe will be decontaminated by rinsing with deionized water between locations. If NAPL is sampled, the sampling equipment will be disposed and a new bailer will be used for other wells to check for NAPL. If NAPL is not detected, the bailer will be decontaminated in accordance with Section 5.4.

Well Evacuation

The water standing in a well prior to sampling may not be representative of in situ groundwater quality. Therefore, the standing water in the well will be removed prior to sampling so that formation water can replace the stagnant water.

Typically, three to five well volumes will be evacuated from the well using the equipment listed in Section 5.1.1. A well volume is defined as the volume of water in the well between the water surface and the bottom of the well. The well volume is the product of the height of the water column in the well in feet times the number of gallons per foot (e.g., 0.66 gallons per foot for a 4-inch well). The specific conductance, temperature and pH will be recorded, after each well volume, during purging to aid in determining whether the well has been purged sufficiently for sampling.

If a well does not produce three well volumes in 24-hours, that well will be purged to dryness at the end of the 24-hour period and sampled as soon as it has recovered sufficiently.

The purged wells will be sampled immediately after purging if enough water is available. In low-yielding wells, it may be necessary to allow the wells to recovery prior to

sampling. These wells will be sampled as soon as sufficient water is available. However, in all cases, the wells will be sampled within 24 hours of purging.

Sample Withdrawal

To verify that the groundwater sample is representative of the formation water, it is important to minimize physically altering or chemically contaminating the sample during the withdrawal process. In order to minimize the possibility of sample contamination, only dedicated or decontaminated sampling equipment will be used.

The following sampling techniques will be observed during the groundwater monitoring well sampling operation:

- The bailer (if used) will be equipped with a bottom filling check valve to minimize agitation or aeration of the sample.
- Sampling pumps will be operated carefully in a continuous manner to minimize aerating of samples.
- Sampling equipment will never be dropped into the well, because this may cause some degassing of the water upon impact.
- The groundwater will be placed directly into the sample container in a way that will minimize agitation and aeration. Sample containers will be filled in such a way to minimize head space.
- Clean sampling equipment will not be placed directly on the ground or any potentially contaminated surface prior to insertion into the well.

Samples will be collected and containerized in order of the parameters' volatilization sensitivity. Sample containers will be labeled as described in Section 5.2. Sample preservation, holding time, and container requirements are listed in Table 6. The samples will be packed into coolers as they are collected. Shipment will be next-day delivery (except Saturdays and holidays). The samples will be shipped no later than one day from the day they are collected (two days if collected on Saturdays or holidays).

Field Analyses

Field tests will be conducted during purging and on groundwater samples from each well. These tests are pH, conductivity and temperature. Samples will be collected in clean bottles for field analysis. A temperature measurement will be conducted first, as this parameter changes most rapidly, followed by pH and specific conductivity. Field measurements will be recorded in the field log book and on the groundwater sampling report form (Figure 4). A total of four replicates will be measured for each parameter.

5.1.3 Documentation

Groundwater sampling will be documented in the field log book as described in Section 5.3 as well as on a groundwater sampling report form for each well sampled. A copy of the sampling report form is presented as Figure 1. Pertinent information includes evacuation methodology, volumes purged, field measurements and sample identification.

5.2 SAMPLE DESIGNATION

All samples will be identified by a unique numbering system. Additional identification will consist of sample type (soil, water, etc.), location (well number or site coordinates, etc.), and analysis.

Labels will be used for sample security, identification, and integrity. Information on the sample container will include the following:

- WCC project number
- Sample station number
- Date and time of sample collection
- Designation of the sample as a grab or composite
- Type of sample and a very brief description of the sampling location
- The signature(s) of the sampler(s)
- Whether the sample is preserved or unpreserved

- The general types of analyses to be conducted
- Any other relevant comments

All of the containers for each sample set will bear the same number. The anticipated numbering system will consist of a unique identification number. Matrix spikes and matrix spike duplicates will be designated by the letters MS or MSD, respectively, following the sample identification.

Once this information has been put on the sample label, the sample label will be affixed to the jar. The sample identification will be used to identify each sample in the master field log book and other field documentation logs.

5.3 FIELD DOCUMENTATION

In addition to forms specific to sampling method (groundwater collection report, etc.), sampling activities will be documented in a bound field log book with consecutively numbered pages. The documentation in the field log book will include:

- WCC project name and number
- Location and sampling activity and address
- Purpose of sampling
- Number and approximate volume of samples taken
- Description of sampling point
- Date and time of collection
- Collector's sample identification number(s)
- Sample distribution (e.g., chemical laboratory, geotechnical laboratory, etc.)
- Sample preservation
- Field observations
- Any field measurements made, such as pH, specific conductivity or other field parameters
- Weather conditions

The documentation in the log book will be sufficient to reconstruct the sampling situation without relying on the collector's memory.

Groundwater Collection Report Form

A sample collection log specific to groundwater sampling will be completed for each monitor well sampled at the site. These reports will include static groundwater elevation, volumes purged, weather conditions, etc. A copy of the report is presented on Figure 2.

Field Specific Sampling and Test Reports

Any onsite field testing with a Photoionization Detector (PID or HNu), pH, and conductivity meters will be recorded either in the sampling reports or on separate reports specific to testing procedure. Screening results with an HNu, if applicable, will be included with sampling reports.

5.4 DECONTAMINATION PROCEDURES

All sampling equipment will be decontaminated before entering the site and leaving the site. In addition, equipment will be decontaminated between sample locations to prevent cross-contamination. Washwater that is collected during decontamination will be containerized for disposal/treatment by Cedar.

The sampling equipment that comes in direct contact with the sample (e.g., bailers, etc.) will be decontaminated using the following procedures:

1. Clean with tap water and laboratory detergent using a brush if necessary to remove particulate matter and surface films.
2. Rinse thoroughly with tap water.
3. Rinse thoroughly with deionized water.

4. Rinse twice with solvent.
5. Rinse thoroughly with organic-free water and allow to air dry as long as possible.
6. If organic-free water is not available, allow equipment to dry as long as possible. Do not rinse with deionized or distilled water.
7. Wrap with aluminum foil, if appropriate, to prevent contamination if equipment is to be stored or transported.

Solvents will not be used for cleaning of plastic items. Plastics may be used (instead of foil) to wrap equipment after cleaning if all traces of solvents have been removed. All decontamination fluids, except for tap water, must be applied using non-interfering containers and applicators. These should be made of glass, stainless steel or Teflon. Pump sprayers, because of the presence of rubber and greased or oiled leather gaskets and seals, are generally only acceptable for applying tap water.

To verify the adequacy of the decontamination, rinsate samples from the sampling equipment will be obtained. The rinsate samples will be analyzed for the same parameters as the media that was sampled with the equipment.

Personnel will wear appropriate protective clothing during decontamination as required by the Health and Safety Plan. All protective equipment (gloves, boots, etc.) will be decontaminated after use or they will be disposed of in drums, labeled, dated, and stored for ultimate disposal at an approved facility. Disposable safety equipment will be considered to be contaminated after use and will be packaged and disposed of in an approved manner.

5.5 SAMPLE CONTROL AND HANDLING

Sample coolers will be under direct observation of WCC personnel at all times, or secured with custody seals to detect tampering. If samples are not attended, they will

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be under secured storage. All samples will be turned over to the WCC Field Operations Task Leader or his designee at the end of each day, along with copies of the field log book and chain-of-custody (COC) forms.

The samples preparation area will be selected as to avoid contamination from process or vehicular equipment, exhaust gases or any other vapors that *might* compromise the integrity of the sample. Samples will be placed in coolers containing ice directly upon retrieval. Samples will be put into refrigeration at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ or stored in coolers and maintained at $4^{\circ}\text{C} \pm 2^{\circ}$ in a secured storage area. Prior to shipment, a person, other than the one who packed the cooler, will verify the samples, COC and other documentation.

All sampling bottles and chemical preservatives (if required) will be provided by the laboratory. Holding times, container materials, and preservation are specified in Table 6.

Sample custody is a crucial part of any field or laboratory operation.

A sample is said to be under custody provided that one of the following four criteria are maintained:

- It is in actual possession of the responsible person.
- It is in view, following physical possession.
- It was in possession of said personnel and was locked or secured and sealed to prevent tampering.
- It is in a secure area.

In order to maintain and document sample integrity, chain-of-custody procedures will be strictly followed during sample collection, handling, transportation, storage, analysis, and disposal. Samples will be handled by the fewest people possible.

The sampling episode will be documented in the field at the time of sample collection using water resistant ink and log books, preprinted forms, sample tags or sample labels, custody seals and chain-of-custody records.

Custody seals will be employed on each sample container and sampling shuttle or chest.

Sample tags or labels, will be affixed to each sample container to provide unambiguous sample identification, matrix, sample location, date and time of collection, chemical preservation, physical treatment, and analyses.

Chain-of-custody forms, such as presented in Figure 3, will be employed for all field and quality control samples. The chain-of-custody record, initiated in the field, will be placed in a zip-lock bag and taped to the inside cover of the sample shipping chest for transport

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to the laboratory. The condition of the samples on receipt in the laboratory will also be recorded on this chain-of-custody form.

Internal chain-of-custody will be documented by the analytical laboratory employing check in and out records for samples and sample extracts or digestates. Each time a sample or sample extract or digestate is accessed the following information will be recorded:

- Date and time
- Individual
- Sample identification
- Operation performed

CALIBRATION PROCEDURES AND FREQUENCY

7.1 RESPONSIBILITIES

Measuring and test equipment used in the field and laboratory will be subjected to a formal calibration program. The program will require equipment of the proper type, range, accuracy, and precision to provide data compatible with the specified requirements and desired results. Calibration of measuring and test equipment may be performed internally using in-house reference standards, or externally by agencies or manufacturers.

The responsibility for the calibration of laboratory equipment rests with the laboratory. WCC site personnel are responsible for the calibration of WCC field equipment and field equipment provided by subcontractors.

7.2 CALIBRATION PROCEDURES

Documented and approved procedures will be used for calibrating measuring and test equipment. Widely accepted procedures, such as those published by EPA, ASTM, or procedures provided by manufacturers in equipment manuals, will be adopted.

Calibrated equipment will be uniquely identified by using either the manufacturer's serial number, a WCC equipment identification number, or other means. This identification, along with a label indicating when the next calibration is due (only for equipment not requiring daily calibration), will be attached to the equipment. If this is not possible, records traceable to the equipment will be readily available for reference.

It will be the responsibility of all personnel to check the calibration status from the due date labels or records prior to using the equipment.

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Measuring and test equipment will be calibrated at prescribed intervals and/or as part of operational use. Frequency will be based on the type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience. Equipment will be calibrated, whenever possible, using reference standards having known relationships to nationally recognized standards (e.g., National Institute of Standards and Technology) or accepted values of physical constants. If national standards do not exist, the basis for calibration will be documented.

Physical and chemical reference standards will be used only for calibration. Equipment that fails calibration or becomes inoperable during use will be removed from service and segregated to prevent inadvertent use and will be tagged to indicate the fault. Such equipment will be recalibrated and repaired to the satisfaction of the Laboratory personnel or WCC site personnel, as applicable. Equipment that cannot be repaired will be replaced.

Records will be prepared and maintained for each piece of calibrated measuring and test equipment to indicate that established calibration procedures have been followed. Records for subcontractor field equipment and WCC equipment used only for this specific project will be kept in the project files. Laboratory calibration records will be maintained by the laboratory.

7.2.1 Field Equipment Calibration

Field equipment calibrated will be according to the manufacturer's recommendations or more frequently, as listed below:

- The pH meter will be calibrated each time it is turned on employing two buffer solutions which bracket the pH of the field samples. A single point continuing calibration check will be performed at a frequency of 10 percent, at the conclusion of the measurements, or every two hours, whichever is more frequent. The temperature-adjusted calibration check standard must be within 0.1 pH unit of the value observed during the

initial calibration for the measurement process to be considered in control.

- The conductivity meter will be calibrated based on manufacturer's recommendations employing an aqueous potassium chloride (KCl) solution. A single point continuing calibration check will be performed at a frequency of 10 percent, at the conclusion of the measurements, or every two hours, whichever is more frequent. The temperature-adjusted calibration check must be within ± 10 percent of the value observed during the initial calibration for the measurement process to be considered in control.
- Temperature - Temperature will be measured using mercury-in-glass thermometers that have been calibrated against a mercury-in-glass thermometer that is NIST traceable.
- HNu - The instrument will be calibrated to methane on a daily basis (minimum), according to the manufacturer's specifications.

Calibration of field equipment will be documented in the field log book and maintained in the project files.

7.2.2 Laboratory Equipment Calibration

Laboratory equipment calibration will be in accordance with the following:

Statement of Work for Organic Analysis Multi-Media Multi-Concentration, SOW 2/88, Revisions 9/88, 4/89, and 5/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., May 1989 (EPA, 1989).

Statement of Work for Inorganic Analysis Multi-Media Multi-Concentration, SOW No. 788, Revisions 2/89 and 6/89, Office of Solid Waste and Emergency

Response, U. S. Environmental Protection Agency, Washington, D. C.,
June 1989.

The highest quality calibration standards readily available commercially will be utilized to provide initial and continuing instrument calibrations. These standards will consist of single component and/or multi-component standards, as appropriate.

The analytical instrumentation will be calibrated daily to provide acceptable performance. Major instrumentation and typical operating conditions are presented in Table 7.

7.2.2.1 GC/MS Calibration

The GC/MS instrumentation will be calibrated for each 12-hour shift to provide acceptable performance.

Compliance with U. S. EPA GC/MS instrument tuning mass spectral abundance criteria will be demonstrated at the beginning of every 12-hour shift that standards, samples, or associated quality control samples are analyzed.

The mass spectral abundance criteria for volatile analyses will be demonstrated by the injection or purge and trap thermal desorption of 50 ng of bromofluorobenzene (BFB). A simple straight-forward data processing of mass spectral scans will be performed to meet the BFB tuning criteria presented in Table 8.

The initial GC/MS calibration will be performed utilizing a multicomponent standard or standards containing all the target compounds, surrogates, and internal standards. The calibration will be performed at a minimum of four levels for all target compounds and at five levels for most target compounds.

A single level continuing GC/MS calibration verification will be performed during any subsequent 12-hour shift using a multicomponent standard or standards containing all

the target compounds, surrogates, and internal standards. The calibration will be performed using the next to lowest to mid-level standard.

7.2.2.2 GC/ECD Calibration

The GC/ECD instrumentation will be calibrated for each 72-hour period of operation to provide acceptable performance.

Linearity will be demonstrated for aldrin, 4,4'-DDT, endrin and dibutylchlorendate over three concentration levels employing Evaluation Standard Mixes A, B, and C. Also, the degradation of 4,4'-DDT and endrin will be monitored employing the data from the analysis of these standards.

The initial calibration for all the target compounds and the surrogate, dibutylchlorendate, will be performed at a single concentration level.

Following completion of the initial calibration and the analysis of the first five samples, the GC/ECD calibration will be verified and then subsequently, following the analysis of each five samples.

7.2.2.3 ICP and Furnace AA Calibration

The ICP and furnace AA instrumentation will be calibrated for each 24-hour period of operation or whenever the instrumentation is set up.

A two-point ICP initial calibration will be performed employing a zero and a non-zero level. The flame AA initial calibration will be performed employing a zero and three non-zero levels.

The inorganic initial calibrations will be verified employing a certified solution obtained from the U. S. EPA, NIST (formerly NBS), or commercial source as available.

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Each initial calibration will be verified at a single concentration level employing standards that are totally independent of those employed for the initial calibration.

A continuing calibration check will be performed at a frequency of ten percent during the inorganic analytical run sequence or every 2 hours, whichever is more frequent.

An initial calibration blank or continuing calibration blank will be analyzed immediately following each calibration.

Any additional inorganic analyte, analyzed employing a calibration curve, will be processed, as appropriate, in a manner identical to that discussed above for ICP, flame AA, furnace AA, or cyanide determinations.

ANALYTICAL METHODOLOGY

The analytical methods required and references to complete this project are presented in Table 9. The references are listed as follows:

Statement of Work for Organic Analysis Multi-Media Multi-Concentration, SOW 2/88, Revisions 9/88, 4/89, and 5/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C. May 1989.

Statement of Work for Inorganic Analysis Multi-Media Multi-Concentration, SOW No. 788, Revisions 2/89 and 6/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., June 1989.

Test Methods for Evaluating Solid Waste - Physical/Chemical Methods. Third Edition, EPA SW-846, U. S. Government Printing Office (955-001-00000-1), Washington, D. C., 1986.

DATA REDUCTION, REPORTING AND VALIDATION

All analytical concentration results will be reported unambiguously as concentrations in $\mu\text{g/L}$ or mg/L for aqueous samples.

9.1 DATA REDUCTION

All concentrations associated with samples or prepared sample extracts or digestates will be taken directly from multiplied quantitation reports. Multiplied quantitation reports relate the instrumentally measured extract or digestate concentrations to those of the original sample. GC/MS concentration data will be taken, to the extent possible, directly from the data systems following an internal standard calibration for the volatile compounds and following an external calibration for the pesticides.

ICP and AA concentrations, other than mercury, for the prepared sample digestates will be taken directly from the respective data systems following an external standard calibration.

9.2 DATA REPORTING

All CLP TCL and TAL parameters will be reported employing the standard CLP hard copy and diskette formats.

Each hard copy data package will provide thorough coverage according to the following areas:

- Case Narrative
- Chain-of-Custody Records
- Quality Control Summary
- Sample Data Results

- Calibration Data
- Raw Quality Control Data
- Raw Sample Data
- Complete Case File Purge

The case narrative will provide the following information:

- Sample Identifications
- Parameters Characterized
- Analytical Methods Employed
- Any Deviations from the Analytical Methods
- All Problems Encountered
- Any Corrective Actions Taken

The field and laboratory chain-of-custody records will document the fact that the evidentiary integrity of the samples was maintained.

The quality control data and sample data results will be presented in a concise and convenient tabulated summary.

The complete case file purge will include weigh logs, sample preparation records, instrument log book pages, log book pages, bench sheets, sample tracking records, correspondence, and all information not provided else where in the data package.

The calibration data, raw quality control data, and raw sample data will be sufficient to permit reproduction of the calculation of any of the reported values.

The diskette deliverable will provide all quality control information and sample data presented in the various U. S. EPA CLP forms.

All other parameters will be reported employing CLP-like hard copy format, i.e., summarized sample and quality control data will be accompanied by all raw calibration, sample, and quality control data.

9.3 DATA VALIDATION

All CLP analytical data will be subjected to data validation by WCC.

The purpose of data validation is to determine if the data conform to specifications and are suitable for the intended project usage.

Data validation, according to Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-0050/80, Office of Monitoring Systems and Quality Assurance and Office of Research and Development, U. S. Environmental Protection Agency, Washington, D. C. 20460, December 29, 1980), is "a systematic process for reviewing a body of data against a set of criteria to provide assurance that data are suitable for their intended use and entails editing, screening, checking, auditing, verification, certification and review.

The CLP organic TCL and inorganic TAL data will be subjected to validation employing Functional Guidelines for Evaluating Organic Analyses, (Hazardous Site Evaluation Division, U. S. Environmental Protection Agency, February, 1988) and Functional Guidelines for Evaluating Inorganic Analyses (Hazardous Site Evaluation Division, U. S. Environmental Protection Agency, July, 1988), respectively. These two documents detail the data acceptance, qualification, and rejection paths and specify the data validation data qualifiers to be employed. The data validation data qualifiers are enumerated as follows:

Data Validation Organic Data Qualifiers		Data Validation Inorganic Data Qualifiers	
U	Not detected	U	Not detected
J	Estimated value	J	Estimated value
R	Reject, not usable	R	Reject, not usable
N	Presumptive evidence of presence	UJ	Not detected, quantitation limit estimated
NJ	Presumptive evidence of present, estimated value		
UJ	Not detected, quantitation limit estimated		

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If the pesticide concentration obtained on the confirmation column differs from that on the quantitation column by greater than 20 percent, the two-column confirmation data will be considered suspect. The data for any such analyte will be rejected unless the analyte has been confirmed by GC/MS or alternately confirmed on a third column by GC/ECD.

The non-CLP data will be reviewed by WCC with respect to holding times, initial and continuing calibrations, method blanks, laboratory control samples, samples, matrix spike, and matrix spike duplicates or duplicates.

10.1 GC/MS INSTRUMENT PERFORMANCE FOR VOLATILES

Compliance with U. S. EPA GC/MS instrument tuning mass spectral abundance criteria will be demonstrated at the beginning of every 12-hour shift that standards, samples, or associated quality control samples are analyzed.

The mass spectral abundance criteria for volatiles by the injection or purge and trap thermal desorption of 50 ng of bromofluorobenzene (BFB). A simple straightforward data processing of mass spectral scans will be performed to meet the BFB tuning criteria presented in Table 8.

The GC/MS instrumentation will be calibrated to provide acceptable performance for each 12-hour shift following demonstration of BFB compliance.

The initial GC/MS calibration will be performed utilizing a multi-component standard or standards containing all the target compounds, surrogates, and internal standards. The calibration will be performed at a minimum of four levels for all target compounds and at five levels for most target compounds.

Designated System Performance Check Compounds (SPCCs) will be monitored during the initial calibration to ensure that the minimum average relative response factor is 0.050 or greater for each semivolatile, is 0.250 or greater for the purgeable volatile, bromoform and is 0.300 or greater for each of the remaining purgeable volatiles.

Designated Calibration Check Compounds (CCCs) will be monitored during the initial calibration to ensure that the percent relative standard deviation for the relative response factors for each compound is 30 percent or less.

Compliant sample analysis may be performed only after these minimum average response factor and percent relative standard deviation criteria are met. If the minimum average response factor and percent difference criteria are not met, the system should be evaluated and corrective action taken before samples are analyzed.

A single level GC/MS continuing calibration verification will be performed during any subsequent 12-hour shift using a multi-component standard or standards containing all the target compounds, surrogates, and internal standards. The calibration will be performed using the next to lowest to mid-level standard.

The designated SPCCs, employed with the initial calibration, will be monitored during the continuing calibration to ensure that minimum response factors in the semivolatiles is 0.050 or greater and is 0.250 or greater for the volatile, bromoform, and is 0.300 or greater for each of the remaining volatiles.

Similarly, the CCCs, employed with the initial calibration, will be monitored during the continuing calibration to ensure that the percent difference for the relative response factor for each compound in the continuing calibration is within 25 percent of that for the initial calibration.

Compliant sample analysis may be performed only after minimum response factor and percent relative standard deviation criteria are met. If the minimum response factor and percent difference criteria are not met, the system should be evaluated and corrective action taken before samples are analyzed.

10.2 GC/ECD INSTRUMENT PERFORMANCE FOR PESTICIDES

Linearity will be evaluated over three concentration levels employing aldrin, 4,4'-DDT, endrin, and dibutylchlorodate in Evaluation Standard Mixes A, B, and C. The percent relative standard deviation for the calibration factors of each of these compounds, except 4,4'-DDT, must be less than ten percent. If the relative standard deviation is greater than ten percent, the 4,4'-DDT quantitation will be performed in terms of a calibration curve.

Degradation will be evaluated in terms of 4,4'-DDT and endrin response from the above standards. The combined 4,4'-DDT and endrin degradation must be 20.0 percent or less.

The initial and continuing GC/ECD calibrations will be performed using a multi-component standard or standards containing the surrogate and all target compounds. Stability will be monitored by comparing each calibration factor from a continuing calibration with that from the initial calibration. The percent difference for the calibration factor from the continuing calibration must be 15.0 percent or less for a quantitation run and 20.0 percent or less for a confirmation run.

10.3 ICP AND FURNACE AA INSTRUMENT PERFORMANCE

The initial ICP calibrations will be verified employing a certified solution obtained from U. S. EPA, NIST, with standards independent of those employed for the initial calibration. The percent of true value achieved with the initial calibration verification standard must be within ± 10 , ± 20 , and ± 15 percent for ICP and AA other than cold vapor mercury, cold vapor AA mercury, and cyanide, respectively. If criteria are not met, the analytical run sequence must be terminated and the problem corrected prior to proceeding.

Continuing calibration checks will be performed at a frequency of ten percent during the analytical sequence or every two hours, whichever is more frequent.

Linearity near the Contract Required Detection Limit (CRDL) must be verified for both ICP and AA employing a CRDL standard analyzed at the beginning and end of the analytical run sequence or a minimum of twice per eight-hour shift. The CRDL standard must be analyzed subsequent to the initial calibration verification. Each ICP metal except aluminum, barium, calcium, iron, magnesium, potassium, and sodium must be monitored at twice the instrument detection limit (IDL) or twice the CRDL, whichever is greater and for AA at the IDL or CRDL, whichever is greater.

A calibration blank is analyzed each time the instrument is calibrated. A calibration is performed at the beginning and end of a run sequence and in between at a frequency

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of ten percent or every two hours, whichever is more frequent. If the initial or continuing calibration blank concentration exceeds the Contract Required Detection Limit, the analytical run sequence must be terminated, with all data subsequent to the last compliant calibration blank discarded, the problem corrected, and the instrument recalibrated prior to proceeding.

Instrument detection limits, ICP interelement correction factors, and ICP linear ranges are determined quarterly.

An ICP interference check sample is analyzed at the beginning of a quarter as well as at the beginning and end of a run sequence, or at a minimum of twice per eight-hour shift, to verify the appropriateness of the interelement correction and background correction factors. If any true value is exceeded by 20 percent or greater, the analytical run sequence must be terminated, with all data subsequent to the last compliant interference check sample discarded, the problem corrected, and the instrument recalibrated prior to proceeding.

Each time a set of 20 field samples of a given matrix is processed or new reagents or materials are employed, a laboratory method blank will be processed and analyzed.

Each time a set of samples is processed, a laboratory control sample from the U. S. EPA, as available and appropriate for the individual analytical work request, will be processed and analyzed with a frequency of one per 20 or fewer samples of a similar matrix. An aqueous laboratory control sample is *not required* for mercury or cyanide.

Duplicate sample analyses will be performed with a frequency of one per 20 field samples of a similar matrix type.

Matrix spike sample analyses will be performed with a frequency of one per 20 field samples of a similar matrix type.

A five-fold serial dilution and reanalysis is performed for all ICP samples at a frequency of one per 20 or fewer samples of a given matrix. If the analyte concentration is 50

times or more greater than the CRDL, then the concentration from the five-fold dilution must agree within ten percent of the original analysis or a chemical or physical interference will be suspected and all associated data will be flagged with an "E."

All furnace AA measurements other than those for the full method of standard additions will be performed in terms of duplicate injections. The percent relative standard deviation must be 20 percent less for all concentrations greater than the CRQL or another set of duplicate injections must be performed. If the precision is still non-compliant, flag the reported values with a "W."

All furnace AA sample measurements other than those for matrix spikes and full method of standard additions will be performed employing a single point post digestion spike at twice the CRDL. If the recovery of the post digestion spike for the preparation blank is outside the 85 to 115 percent quality control limits, the spiking solution will be verified and the preparation blank reanalyzed. If the recovery remains out of control, the problem will be corrected, and the samples associated with that blank will be reanalyzed.

If the recovery of the post digestion spike is less than 40 percent, the digestate will be diluted by a factor of five or ten, spiked and analyzed. If the post digestion spike recovery remains less than 40 percent, the reported value will be flagged with a "W."

If the post digestion spike recovery is 40 percent or greater and the sample response is less than 50 percent of that of the spike, the sample will be reported as not detected at the IDL.

If the recovery of the post digestion spike is 40 percent or greater but the sample response is less than 50 percent of the spike, the sample will be reported down to the IDL. If the spike recovery is between 85 and 115 percent, then the sample must be analyzed by the method of standard additions.

If the correlation coefficient from the method of standard additions is less than 0.995, then analysis by the method of standard additions will be repeated once. If the

correlation coefficient remains less than 0.995, the results from the analysis with the higher correlation coefficient will be reported with a "+" flag.

10.4 METHOD PERFORMANCE FOR VOLATILES

A minimum of one purgeable volatile method blank will be analyzed per 12-hour shift. Method blanks will be analyzed with a greater frequency, as necessary, to demonstrate the absence of any significant system contamination. The method blank must be free of all TCL volatiles at a level greater than the CRQL except for the common solvents, methylene chloride, acetone, toluene and 2-butanone, which must not exceed five times the CRQL.

A minimum of one Pesticide method blank will be prepared for every 20 or fewer samples of a similar matrix and level each time samples are extracted or new reagents are employed. The method blank will be analyzed on each system utilized to analyze corresponding field samples. The method blank must be free of all TCL Pesticides at a level greater than the CRQL.

Surrogate compounds for purgeable volatile or pesticide will be included in each standard, sample, or associated quality control sample. The recovery of surrogate compounds, added at the beginning of the sample preparation, must meet the surrogate quality control limits as presented in Table 10. If any volatile surrogate recovery in the same fraction is outside the quality control limits or is less than ten percent, the sample must be reanalyzed.

Matrix spike and matrix spike duplicate sample analyses for purgeable volatile or pesticide will be performed with a frequency of one per 20 field samples of a similar matrix type. The advisory matrix spike control limits are presented in Table 11.

Internal standard compounds will be included in each purgeable volatile standard, sample, sample extract or associated quality control sample. The response of each internal standard compound will be examined with respect to retention time shifts and changes in absolute area response. If the retention time shifts greater than 30 seconds

or the area response changes by a factor of two, i.e., -50 percent to +100 percent, with respect to that in the continuing calibration verification standard, the sample or sample extract will be reanalyzed.

10.5 METHOD PERFORMANCE FOR METALS

Each time a set of up to 20 field samples of a given matrix is processed or new reagents or materials are employed, a laboratory method blank will be processed and analyzed.

Each time a set of 20 or fewer samples of a given matrix is processed for metals and cyanide, a laboratory control sample from the U. S. EPA, as available and appropriate for the individual analytical work request, or from a commercial source will be processed and analyzed.

Matrix spike sample analyses will be performed with a frequency of one per 20 field samples of a similar matrix type.

10.6 SAMPLING, PRESERVATION, HANDLING, AND SHIPMENT METHOD PERFORMANCE

Trip blanks and rinsate blanks will be employed to assess the potential for the introduction of contamination. Trip blanks will be employed for only the purgeable volatile fraction. Trip blanks will be employed for each shipping chest or cooler which contains purgeable volatiles. An equipment rinsate blank will be collected for analysis during each sampling event. Table 12 summarizes the field QA samples.

PERFORMANCE AND SYSTEM AUDITS

Laboratory performance will be subject to external audits in terms of commercially available quarterly blind performance evaluation samples and semi-annual onsite laboratory evaluations for each laboratory actively engaged in this project. Such activities are consistent with those taken by the U. S. EPA to monitor performance of participants in its Contract Laboratory Program (CLP). Demonstrated acceptable performance achieved with a current U. S. EPA CLP onsite laboratory evaluation or a current U. S. EPA CLP quarterly blind performance evaluation sample may be substituted in lieu of either a project onsite laboratory evaluation or quarterly blind performance evaluation samples.

Quality control samples obtained from the U. S. EPA, NIST (formerly NBS), or commercial sources will be analyzed, as available, with each batch of samples analyzed for the inorganic analytes. For mercury quality control samples will be analyzed only for sediments.

Field activity documentation will be reviewed for accuracy and completeness. A selected number of sample labels, chain-of-custody records, and analytical work requests will be reviewed for accuracy and completeness. Chain-of-custody records will be reviewed to determine if all custody transfers were documented and the dates and times of transfers were recorded.

The field notebooks will be examined to determine if proper recording format is being consistently followed and that documentation is adequate to explain or reconstruct any field activities.

The results of each audit activity will be summarized in a written report which focuses attention on each area of non-conformance, enumerates all required and/or recommended corrective actions, and enumerates all corrective actions instituted.

PREVENTIVE MAINTENANCE

The primary objective of a preventive maintenance program is to help verify the timely and effective completion of a measurement effort.

WCC's preventive maintenance program is designed to minimize the downtime of crucial sampling equipment due to component failure. In implementing this program, efforts are focused in three primary areas.

- Establishment of maintenance responsibilities
- Establishment of maintenance schedules for major and/or critical instrumentation and apparatus, and documentation of maintenance activities in equipment logs
- Establishment of an adequate inventory of critical spare parts and equipment

Subcontract laboratories will be inspected to verify that similar preventive maintenance programs are in operation, and are properly documented.

Instruments allocated for use on this project will be maintained by qualified personnel according to the manufacturers instructions.

Instrument redundancy, to the extent possible, coupled with an extensive stock of spare parts and expendable materials onsite will serve to minimize downtime.

Selected critical spare parts for gas chromatographs, mass spectrometers, and cold vapor AAs will be maintained. Such critical spare parts for major instruments include the following items:

- Gas Chromatograph
 - Columns
 - Injector inserts
 - Carrier gas scrubbers
 - Spare detectors or detector parts
 - Gas regulators
 - Flow controllers

- Mass Spectrometer
 - Filaments
 - Electron multipliers
 - Ion source parts
 - Electronic boards
 - Vacuum pumps
 - Jet separators

- ICP
 - Torches
 - Nebulizers
 - RF power tubes
 - Photomultiplier tubes

- AA
 - Lamps
 - Photomultiplier tubes

Routine maintenance will be performed on an "as needed" basis and preventative maintenance will be performed on a scheduled basis. The frequency of the scheduled preventative maintenance is enumerated in parenthesis to the right of the task. Such maintenance for major instruments includes the following:

- **Gas Chromatograph**
 - Changing septum
 - Changing injector insert
 - Performing column maintenance
 - Cleaning detector (12 months)
 - Changing traps on vents (3 months)

- **Mass Spectrometer**
 - Changing filaments
 - Cleaning ion source (6 months)
 - Cleaning analyzer (12 months)
 - Cleaning or changing electron multiplier (6 months)
 - Changing vacuum pump oil (6 months)
 - Changing traps on vacuum pumps (3 months)

- **ICP**
 - Clean nebulizer (3 months)
 - Cleaning torch (6 months)
 - Changing RF power tube (12 months)
 - Changing photomultiplier

- **AA**
 - Changing graphite tube and platform
 - Changing photomultiplier tube
 - Changing lamp
 - Cleaning burner head
 - Cleaning nebulizer

**SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA
PRECISION, ACCURACY AND COMPLETENESS**

The precision of the method for organic compounds will be expressed in terms of the relative percent difference (RPD) for matrix spike recoveries calculated as follows:

$$RPD = \frac{(R_{MS} - R_{MSD})}{\frac{(R_{MS} + R_{MSD})}{2}} \times 100$$

where RPD, R_{MS} , and R_{MSD} are relative percent difference, matrix spike recovery and matrix spike duplicate recovery, respectively.

The accuracy of the method for organic compounds will be expressed as the percent recovery calculated as follows:

$$\%R = 100 \frac{(SSR - SR)}{SA}$$

where %R, SSR, SR and SA are percent recovery, spiked sample result, sample result and spike added, respectively.

The matrix spike recovery and relative percent difference control limits for volatile and organochlorine pesticide contaminants are presented in Table 11.

The percent recovery for surrogate spikes will be calculated as follows:

$$\%R = 100 \frac{SSSR}{SSA}$$

where %R, SSSR and SSA are percent recovery, spiked surrogate sample result, and surrogate spike added, respectively.

Should analysis of the pesticide fraction require dilution by a factor of five or greater, the surrogate recoveries for that fraction will be reported as diluted out.

The surrogate recovery control limits for volatile contaminants are presented in Table 10.

The precision of the method for inorganic analytes will be expressed in terms of the relative percent difference (RPD) for each component calculated as follows:

$$RPD = \frac{(SR - DSR)}{\frac{(SR + DSR)}{2}} \times 100$$

where RPD, SR and DSR are relative percent difference, sample result, and duplicate sample result, respectively.

The precision will be reported as noncalculable should the parameter value for either the sample result or the duplicate sample result be below the quantitation limits.

The accuracy of the method for inorganic analytes will be expressed as the percent recovery calculated as follows:

$$\%R = 100 \frac{(SSR - SR)}{SA}$$

where %R, SSR, SR and SA are percent recovery, spiked sample result, sample result and spike added, respectively. Percent recovery will not be calculated and reported if the sample concentration exceeds the spike added concentration by a factor of four or more.

The relative percent difference and matrix spike recovery control limits are presented in Table 11.

The recovery for laboratory control samples or performance evaluation samples will be calculated as follows:

$$\%R = 100 \frac{O}{T}$$

where %R, O and T are percent recovery, observed value, and true or accepted value, respectively.

If required, the overall completeness for sample data acquired will be included in the final report calculated as follows:

$$\%C = 100 \frac{V}{T}$$

where %C, V and T are percent completeness, amount of valid data acquired, and the total amount of valid data expected to be obtained under normal conditions.

The Quality Assurance Program provides the mechanism for providing rapid corrective action in any potential problem area to minimize the possibility of producing data of questionable validity.

These corrective actions are intended to eliminate both immediate problems, such as errors involving chain-of-custody procedures, sampling procedures, analytical procedures, improperly functioning instrumentation, or reporting procedures, as well as long-term problems involving systematic errors.

The CLP documents

Statement of Work for Organic Analysis Multi-Media Multi-Concentration, SOW 2/88, Revisions 9/88, 4/89, and 5/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., May 1989.

Statement of Work for Inorganic Analysis Multi-Media Multi-Concentration, SOW No. 788, Revisions 2/89 and 6/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., June 1989.

proposed as the principal protocols for the bulk of all the analytical determinations specify the control limits. Table 10 enumerates the quality control limits for the CLP organic surrogate recoveries and matrix spike recoveries and relative percent differences, respectively.

The two CLP documents

Functional Guidelines for Evaluating Organic Analyses, (Hazardous Site Evaluation Division, U. S. Environmental Protection Agency, February 1988).

Functional Guidelines for Evaluating Inorganic Analyses, (Hazardous Site Evaluation Division, U. S. Environmental Protection Agency, July 1988), respectively.

specify the data acceptability limits.

The corrective action procedure entails completion of the following activities:

- Definition of the problem.
- Assignment of responsibility for investigating the problem, as necessary.
- Investigation and determination of the cause of the problem, as necessary.
- Determination of the corrective action to eliminate the problem, as necessary.
- Assignment of responsibility for implementing the corrective action.
- Verification that the corrective action has eliminated the problem.

The corrective action request form presented in Figure 4 will be employed to document all activities undertaken to complete all corrective actions. The corrective action form may be initiated by any project individual, i.e., *responsible individual*, who observes a major problem. If more than one distinct problem is involved, each problem and associated corrective action will be documented on an individual form.

The QA officer will review the description submitted of both the potential problem and the recommended corrective action. If a corrective action is not warranted, an explanation will be provided to the individual initiating the request for the corrective action. If a corrective action is obviously warranted and the appropriate actions are readily apparent, specific actions will be assigned to specific individuals.

The specific steps taken to correct deficiencies may include such actions as the following:

- Resampling
- Performing additional decontamination of field equipment
- Providing additional training of field personnel
- Preparation of new standards and/or reagents
- Recalibration of equipment
- Providing additional training of laboratory personnel

If the need for a corrective action is indeterminate or the appropriate course of action required to provide a corrective action is not apparent, the matter will be investigated more fully prior to reaching a decision as to whether corrective action is warranted and if so what actions are to be taken. If corrective action is deemed appropriate, specific actions will be assigned to specific individuals. The QA officer will subsequently review all activities undertaken to provide the corrective action to ensure that the original problem has been eliminated and that diligence is maintained to preclude its reoccurrence.

QUALITY ASSURANCE REPORT TO MANAGEMENT

The project quality assurance officer will submit a quarterly quality assurance report to the Project Manager. This report will include a periodic assessment of data accuracy, precision and completeness. It will enumerate any changes made in the quality assurance project plan, results of performance or system audits, any significant quality assurance problems encountered and corrective actions proposed or implemented during the past quarter. This report will also include any data validation reports completed during the past quarter.

TABLE 1

**ANALYTICAL PARAMETER SUMMARY
AS A FUNCTION OF MATRIX**

Matrix	Category/Parameter			
	CLP Organic Compounds	Additional Organic Compound	CLP Inorganic Analyte	Additional Inorganic Analytes
Groundwater	TCL Purgeable Volatiles Toxaphene	Dinoseb	Arsenic	pH¹ Conductance¹ Temperature¹

NOTE:

¹ Field analyses.

TABLE 2

**TARGET COMPOUND LIST (TCL) VOLATILES AND
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)¹**

Volatiles	CAS Number	Quantitation Limits
		Water µg/l
1. Chloromethane	74-87-3	10
2. Bromomethane	74-83-9	10
3. Vinyl Chloride	75-01-4	10
4. Chloroethane	75-00-3	10
5. Methylene Chloride	75-09-2	5
6. Acetone	67-64-1	10
7. Carbon Disulfide	75-15-0	5
8. 1,1-Dichloroethane	75-35-4	5
9. 1,1-Dichloroethane	75-34-3	5
10. 1,2-Dichloroethane (Total)	540-59-0	5
11. Chloroform	67-66-3	5
12. 1,2-Dichloroethane	107-06-2	5
13. 2-Butanone	78-93-3	10
14. 1,1,1-Trichloroethane	71-55-6	5
15. Carbon Tetrachloride	56-23-5	5
16. Vinyl Acetate	108-05-4	10
17. Bromodichloromethane	75-27-4	5
18. 1,2-Dichloropropane	78-87-5	5
19. cis-1,3-Dichloropropane	10061-01-6	5
20. Trichloroethane	79-01-6	5
21. Dibromochloromethane	124-48-1	5
22. 1,1,2-Trichloroethane	79-00-5	5
23. Benzene	71-43-2	5
24. trans-1,3-Dichloropropane	10061-02-6	5
25. Bromoform	75-25-2	5
26. 4-Methyl-2-pentanone	108-10-1	10
27. 2-Hexanone	591-78-6	10
28. Tetrachloroethane	127-18-4	5
29. Toluene	108-88-3	5
30. 1,1,2,2-Tetrachloroethane	79-34-5	5
31. Chlorobenzene	108-90-7	5
32. Ethyl Benzene	100-41-4	5
33. Styrene	100-42-5	5
34. Xylenes (Total)	1330-20-7	5

TABLE 2 (Continued)

**TARGET COMPOUND LIST (TCL) VOLATILES AND
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)¹**

NOTES:

- ¹ Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

Source: Statement of Work for Organic Analysis Multi-Media Multi-Concentration, SOW 2/88, Revisions 9/88, 4/89, and 5/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., May 1989.

TABLE 3

**TARGET COMPOUND LIST (TCL) TOXAPHENE AND
CONTRACT REQUIRED QUANTITATION LIMIT (CRQL)¹
AND DINOSEB METHOD DETECTION LIMIT²**

Pesticide	CAS Number	Quantitation Limits <u>Water</u> µg/l
Toxaphene	8001-35-2	1.0
Dinoseb	-	0.7

NOTES:

Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

Sources:

- ¹ Statement of Work for Organic Analysis Multi-Media Multi-Concentration, SOW 2/88, Revisions 9/88, 4/89, and 5/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., May 1989.
- ² Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, Third Edition, EPA SW-46, U. S. Government Printing Office (955-001-00000-1), Washington, D. C., 1986.

TABLE 4

TARGET ANALYTE LIST (TAL) COMPOUND

Analyte	Contract Required Detection Limit ¹ ($\mu\text{g/l}$)
Arsenic	10

NOTE:

¹ The Contract Required Detection Limit (CRDL) is instrument detection limits obtained in pure water. The detection limits for samples may be considerably higher depending on the sample matrix.

Source: Statement of Work for Inorganic Analysis Multi-Media Multi-Concentration, SOW No. 788, Revisions 2/89 and 6/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., June 1989.

TABLE 5a

PRECISION, ACCURACY AND COMPLETENESS OBJECTIVES

Measurement Parameters	Volatile (Purgeable) Organic Compounds ¹
Method	EPA CLP Method for the Determination of Volatile (Purgeable) Organic Compounds
Water or Low Level Soils	Purge and Trap
Medium Level Soils	Purge and Trap of Methanol Solvent Extract
	Packed or Capillary Column Gas Chromatography/ Mass Spectrometry
Reference	<u>Statement of Work For Organic Analysis Multi-Media Multi-concentration</u> , SOW 2/88, Revisions 9/88, 4/89 and 5/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., May 1989
Experimental Conditions	Spiked and unspiked field samples
Surrogate Percent Recovery	Compound specific ²
Precision	Compound specific ³
(Relative Percent Difference Matrix Spike & Matrix Spike Duplicate)	
Accuracy	Compound specific ³
(Percent Recovery Matrix Spike & Matrix Spike Duplicate)	
Completeness	90 Percent

NOTES:

- ¹ See Table 2 for an enumeration of these parameters and Contract Required Quantitation Limits (CRQLs).
- ² See Table 10 for an enumeration of spike surrogate compounds and control limits.
- ³ See Table 11 for an enumeration of matrix spike compounds and control limits.

TABLE 5b

PRECISION, ACCURACY AND COMPLETENESS OBJECTIVES

Measurement Parameter	Dinoseb
Method	8150
Water	Separatory Funnel Solvent Extraction
Low and Medium Soils	Ultrasonic Solvent Extraction
Reference	SW-846, 3rd Edition, 11/86
Experimental Conditions	Spiked and unspiked field samples
Surrogate Percent Recovery	Not Applicable
Precision (Relative Percent Difference)	Compound specific ²
Accuracy (Percent Recovery)	Compound specific ²
Completeness	90 Percent

NOTES:

- ¹ See Table 3 for an enumeration of this parameter and Method Detection Limit (MDL).
- ² See Table 12 for an enumeration of matrix spike compounds and control limits.

TABLE 5c

PRECISION, ACCURACY AND COMPLETENESS OBJECTIVES

Measurement Parameter	Toxaphene ¹
Method	EPA CLP Method for the Determination of Pesticides
Water	Continuous Liquid-Liquid or Separatory Funnel Solvent Extraction
Low and Medium Soils	Ultrasonic Solvent Extraction Packed and/or Capillary Column Gas Chromatography/Electron Capture Detection
Reference	<u>Statement of Work for Organic Analysis Multi-Media Multi-Concentration</u> , SOW 2/88, Revisions 9/88, 4/89 and 5/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., May 1989
Experimental Conditions	Spiked and unspiked field samples
Surrogate Percent Recovery	Compound specific ²
Precision (Relative Percent Difference)	Compound specific ³
Accuracy (Percent Recovery)	Compound specific ³
Completeness	90 Percent

NOTES:

- ¹ See Table 4 for an enumeration of this parameter and Contract Required Quantitation Limit (CRQL).
- ² See Table 10 for an enumeration of surrogate spike compounds and control limits.
- ³ See Table 11 for an enumeration of matrix spike compounds and control limits.

TABLE 5d

PRECISION, ACCURACY AND COMPLETENESS OBJECTIVES

Measurement Parameter	Selected Target Analyte List (TAL) Metals Other Than Mercury ¹
Method	EPA Method 200.7 CLP-M Inductively Coupled Plasma-Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes Nitric Acid-Hydrochloric Acid Digestion Inductively Coupled Plasma-Atomic Emission Spectroscopy
Reference	<u>Statement of Work for Inorganic Analysis Multi-Media Multi-Concentration</u> , SOW No. 788, Revisions 2/89 and 6/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., June 1989
Experimental Conditions	Spiked and unspiked field samples
Precision (Relative Percent Difference)	±20 percent provided both sample and duplicate greater than 5 times Contract Required Detection Limit (CRDL) ±CRDL if either sample or duplicate less than 5 times CRDL
Accuracy (Percent Recovery)	75 to 125 percent except for calcium, magnesium, potassium or sodium, for aluminum and iron in soil, or if the sample concentration exceeds the spike concentration by a factor of four or more Not calculated if sample concentration exceeds spike concentration by a factor of four or more
Completeness	90 Percent

NOTE:

¹ See Table 4 for an enumeration of these parameters and Contract Required Detection Limits (CRDLs).

TABLE 5e

PRECISION, ACCURACY AND COMPLETENESS OBJECTIVES

Measurement Parameter	Target Analyte List (TAL) Arsenic by Atomic Absorption Furnace Technique ¹
Method	EPA Method 206.2 CLP-M Arsenic Atomic Absorption Furnace Technique Nitric Acid-Hydrogen Peroxide Digestion Atomic Absorption Furnace Technique
Reference	<u>Statement of Work for Inorganic Analysis Multi-Media Concentration</u> , SOW No. 788, Revisions 2/89 and 6/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., June 1989
Experimental Conditions	Spiked and unspiked field samples
Precision (Relative Percent Difference)	±20 percent provided both sample and duplicate greater than 5 times CRDL ±CRDL if either sample or duplicate less than 5 times CRDL
Accuracy (Percent Recovery)	75 to 125 percent unless the sample concentration exceeds the spike concentration by a factor of four or more Not calculated if sample concentration exceeds spike concentration by a factor of four or more
Completeness	90 Percent

NOTE:

¹ See Table 4 for an enumeration of the Contract Required Detection Limits (CRDLs).

TABLE 6

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter or Category/Matrix	Container	Preservation	Holding Time
Volatiles			
Aqueous	Two 40 ml glass vials with 0.125 inch Teflon-faced silicone septa and open-top polyethylene screw closures cleaned according to Protocol B and maintained according to 300 Series Quality Control and documentation. ^{1,2}	Cool, 4° C, zero headspace or Cool, 4° C, zero headspace, HCl to pH < 2 ³	7 days of collection or 14 days of collection
Pesticides			
Aqueous	One 32 oz/1000 ml amber glass wide-mouth bottles with Teflon-faced screw closures cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Cool, 4° C, adjust pH to between 5 and 9 ⁴	7 days of collection 40 days of extraction
Metals			
Aqueous	One 32 oz/1000 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	HNO ₃ to pH < 2 (metals grade)	180 days of collection

NOTES:

¹ Statement of Work for Maintenance of Quality-Controlled Prepared Sample Container Repository, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C. July 1987.

TABLE 6 (Continued)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Sample container cleaning protocols include:

Protocol	Specifications
A	<ul style="list-style-type: none"> • Laboratory Grade Detergent Wash and Rinse • Acid, Deionized Water and Solvent Rinses • Oven Drying, Capping and Packing under quality controlled conditions.
B	<ul style="list-style-type: none"> • Laboratory Grade Detergent Wash and Rinse • Multiple Deionized Water Rinses • Oven Drying, Capping and Packing under quality controlled conditions.
C	<ul style="list-style-type: none"> • Laboratory Grade Detergent Wash and Rinse • Acid Rinse • Multiple Deionized Water Rinses • Air Drying, Capping and Packing under quality controlled conditions.

2 300 Series Quality Control and documentation provides:

- Certificate of Analysis
- Retention of a virgin container from each lot for one year should additional testing be required
- Lot numbered labels provided for traceability

3 Add four drops of 10 percent solution of $\text{Na}_2\text{S}_2\text{O}_3$ per 40 ml vial if residual chlorine present.

4 Add 0.75 ml 10 percent solution of $\text{Na}_2\text{S}_2\text{O}_3$ per liter if residual chlorine present.

TABLE 7

TYPICAL OPERATING PARAMETERS FOR MAJOR INSTRUMENTATION

Parameter	Instrumentation or Apparatus and Typical Operating Conditions
Volatiles Enumerated in Table 2	<p>Gas chromatograph/mass spectrometers with packed and/or capillary column inlets and data system suitable for processing, library searching, and archiving acquired data.</p> <p>Operated according to manufacturer's instructions to meet tuning criteria specified in Table 8 for volatiles and to achieve quantitation limits specified in Table 2.</p> <p>Automatic liquid sampler.</p> <p>Purge and trap unit with automatic sampler.</p>
Toxaphene and Dinoseb Enumerated in Table 4	<p>Gas chromatograph equipped with electron capture detector, capillary and packed column inlets, and data system suitable for processing acquired data.</p> <p>Operated according to manufacturer's instructions to achieve quantitation limits specified in Table 4.</p> <p>Automatic liquid sampler.</p>
Aqueous	<p>One-liter continuous liquid extraction units or extractions two-liter separatory funnels.</p>
Solvent Extract Concentration	<p>Kuderna-Danish evaporative concentrators.</p> <p>Micro Snyder concentrators.</p> <p>Nitrogen blowdown evaporative concentrator.</p>
Metals Digestion	<p>Beakers, watch glasses and hot plates.</p>
Arsenic	<p>Inductively Coupled Plasma (ICP) atomic emission spectrometer with data system suitable for background correction and data processing.</p> <p>Operated according to manufacturer's instructions to achieve quantitation limits specified in Table 4.</p> <p>Peristaltic pump.</p> <p>Automatic liquid sampler.</p>

TABLE 7 (Continued)

TYPICAL OPERATING PARAMETERS FOR MAJOR INSTRUMENTATION

Parameter	Instrumentation or Apparatus and Typical Operating Conditions
	Atomic absorption spectrometer with double beam optical system and Zeeman or Smith Hieftje background correction. (Graphite furnace with L'vov platforms flame.) Data system suitable for processing data.
	Operated according to manufacturer's instructions to achieve quantitation limits specified in Table 4.
	Automatic liquid sampler.

TABLE 8

**4-BROMOFLUOROBENZENE (BFB)
KEY IONS AND ION ABUNDANCE CRITERIA**

Mass	Ion Abundance Criteria
50	15 to 40% of mass 95
75	30 to 60% of mass 95
95	base peak, 100% relative abundance
96	5 to 9% of mass 95
173	less than 2% of mass 174
174	greater than 50% of mass 95
175	5 to 9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5 to 9% of mass 176

NOTES:

Source: Statement of Work for Organic Analysis Multi-Media Multi-Concentration, SOW 2/88, Revisions 9/88, 4/89 and 5/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., May, 1989.

**TABLE 9
ANALYTICAL METHOD SUMMARY**

Category/Parameter	Method	Reference
Purgeable Volatile Target Compound List (TCL) Compounds	USEPA CLP SOW 2/88	1, 2
Non-TCL Tentatively Identified Compound (TIC) Purgeable Volatile	USEPA CLP SOW 2/88	1, 2
Arsenic	USEPA SOW 788	3
Dinoseb	USEPA Method 8150	4
pH		5
Specific Conductance		5
Temperature		5

REFERENCES:

- 1 Statement of Work for Organic Analysis Multi-Media Multi-Concentration, SOW 2/88, Revisions 9/88, 4/89, and 5/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., May 1989.
- 2 Tentative non-TCL compound identifications and quantitation will be made as specified in SOW 2/88. For Purgeable Volatile and Semivolatile fractions, respectively, up to 10 and 20 of the largest non-TCL components exceeding ten percent of the nearest uninterfered with standard will be library searched employing the current 50,000 entry 1989 NIST/EPA/MCDC mass spectral library. All library matches will be manually reviewed by an experienced mass spectroscopist prior to making the final tentative identification.
- 3 Statement of Work for Inorganic Analysis Multi-Media Multi-Concentration, SOW No. 788, Revisions 2/89 and 6/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., June 1989.
- 4 Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, Third Edition, EPA SW-846, U. S. Government Printing Office (955-001-00000-1), Washington, D. C., 1986.
- 5 Measured in the field.

**TABLE 10
SURROGATE SPIKE RECOVERY LIMITS
FOR WATER SAMPLES**

Analytical Fraction	Surrogate Compound	Water
Volatile	4-Bromofluorobenzene	86 - 115
	1,2-Dichloroethane-d ₄	76 - 114
	Toluene-d ₈	88 - 110
Pesticide	Dibutylchlorodate ¹	24 - 154
Dinoseb	Not Applicable	--

NOTE:

¹ Recovery limits are for advisory purposes only. They are not used to determine if a sample should be reanalyzed.

Source: Statement of Work for Organic Analysis Multi-Media Multi-Concentration, SOW 2/88, Revisions 9/8, 4/89 and 5/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., May, 1989.

TABLE 11

**MATRIX SPIKE RECOVERY AND RELATIVE PERCENT DIFFERENCE
CONTROL LIMITS FOR WATER SAMPLES**

Analytical Category	Matrix Spike Compound	Water	
		Relative Percent Difference	Percent Recovery
Volatile	1,1-Dichloroethene	14	61 - 145
	Trichloroethene	14	71 - 120
	Chlorobenzene	13	75 - 130
	Toluene	13	76 - 125
	Benzene	11	76 - 127
Toxaphene	Lindane	15	56 - 123
	Heptachlor	20	40 - 131
	Aldrin	22	40 - 120
	Dieldrin	18	52 - 126
	Endrin	21	56 - 121
	4,4'-DDT	27	38 - 127
Dinoseb	2,4-D	69	28 - 125
	2,4,5-TP (Silvex)	58	37 - 128

NOTES:

Sources: Statement of Work for Organic Analysis Multi-Media Multi Concentration, SOW 2/88, Revisions 9/88, 4/89 and 5/89, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D. C., May, 1989.

Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, Third Edition, EPA SW-846, U. S. Government Printing Office (955-001-00000-1), Washington, D. C., 1986.

**TABLE 12
FIELD QA SAMPLES**

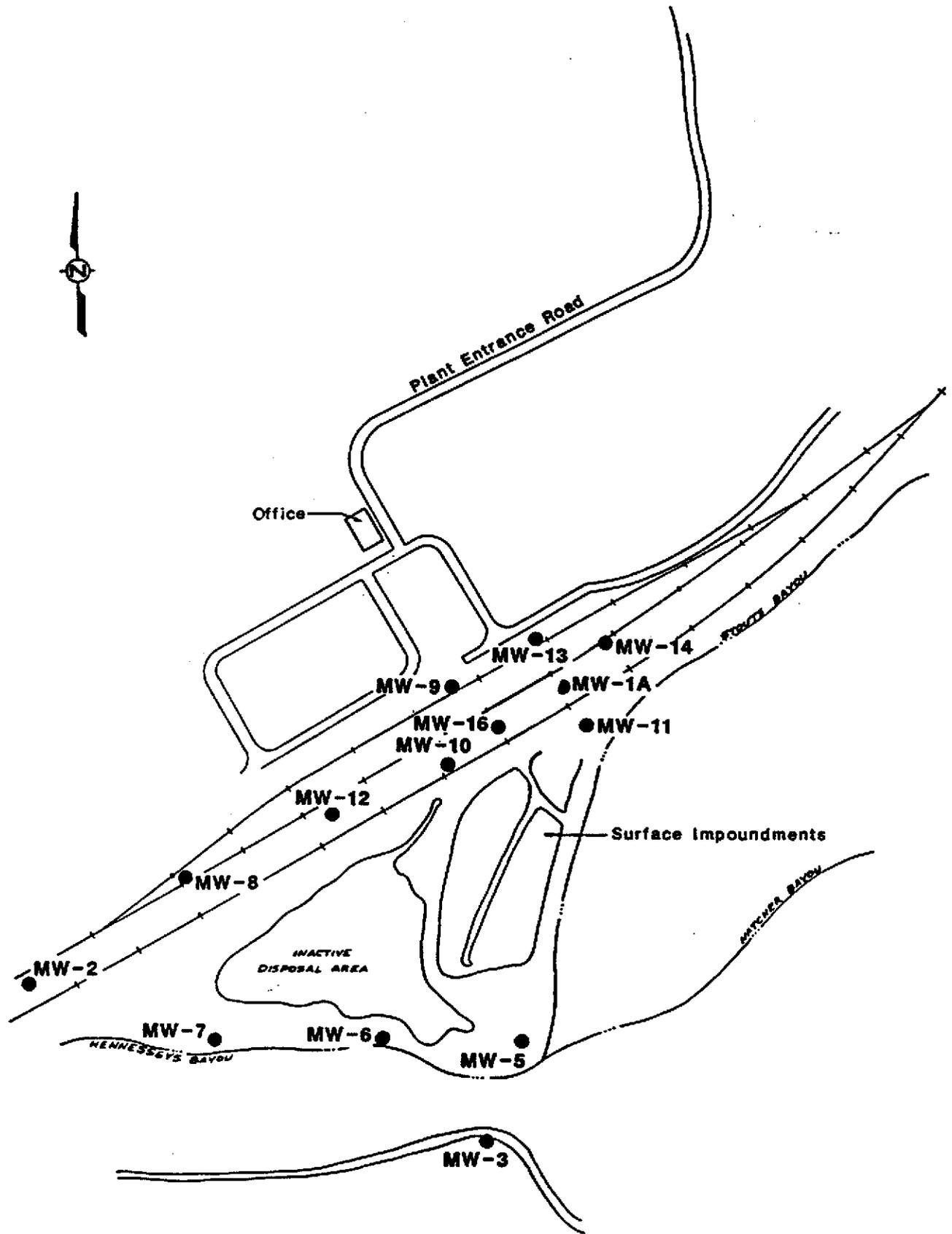
Sample Type¹	Number of Trip Blanks²	Number of Rinsates⁴	Number of MS/MSD⁵
Groundwater Samples	1/Shipment	1/Event	1/20

NOTES:

- ¹ See QAPP for additional analytical information.
- ² Trip blanks analyzed for volatiles only and will be one per sample shipment container.
- ³ Twenty samples or fraction thereof per sampling event. A sampling event is the period over which the specific sample type is collected.
- ⁴ Rinsates will be analyzed for the same parameters as the groundwater samples.
- ⁵ Matrix Spiked/Matrix Spiked Duplicate will be spiked in the laboratory. Matrix Spike and Matrix Spike Duplicates are separate samples.

FIGURE 1

ACTIVE GROUND WATER MONITORING WELLS



CEDAR CHEMICAL CORPORATION
VICKSBURG CHEMICAL DIVISION
VICKSBURG, MISSISSIPPI

Woodward-Clyde Consultants
Consulting Engineers, Geologists
and Environmental Scientists
Baton Rouge, Louisiana

SCALE: 1"=400'
DRAWN BY: SB
CHKD. BY:

DATE: 5/91
DATE:

ACTIVE GROUNDWATER MONITORING WELLS

FILE NO. 90B451C
FIG. NO. 1

FIGURE 2

GROUND WATER COLLECTION REPORT



GROUND WATER COLLECTION REPORT

PROJECT NUMBER AND NAME _____ LOCATION _____
 COLLECTOR/OPERATOR _____ WELL NO. _____
 TYPE OF SAMPLE _____ () GRAB () COMPOSITE () OTHER _____
 METHOD OF SAMPLING IF OTHER THAN MONITOR WELL _____ SHUTTLE NO. _____

MONITOR WELL INFORMATION

EVACUATION: DATE/TIME _____ METHOD OF EVACUATION _____
 INITIAL DEPTH TO WATER LEVEL _____ TOP OF CASING TO BOTTOM _____
 GALLONS PER WELL VOLUME _____ TOTAL GALLONS EVACUATED _____
 FINAL DEPTH TO WATER _____ ELEVATION TOP OF CASING _____

SAMPLING: DATE/TIME _____ METHOD OF SAMPLING _____
 DEPTH TO WATER LEVEL _____

SAMPLE DATA

FIELD REPLICATE #1	TEMP. _____	pH _____	CONDUCTIVITY _____
FIELD REPLICATE #2	TEMP. _____	pH _____	CONDUCTIVITY _____
FIELD REPLICATE #3	TEMP. _____	pH _____	CONDUCTIVITY _____
FIELD REPLICATE #4	TEMP. _____	pH _____	CONDUCTIVITY _____

GENERAL INFORMATION

WEATHER CONDITIONS AT TIME OF SAMPLING _____
 SAMPLING CHARACTERISTICS _____
 CONTAINERS AND PRESERVATIVES _____

 RECOMMENDATIONS/OBSERVATIONS _____

SAMPLE ID NUMBERS _____
 SAMPLING PERSONNEL _____ TIME _____ TO _____
 _____ DATE _____
 (SIGNED)

LOCK OR SEAL NUMBER _____ REPLACEMENT SEAL NUMBER _____

FIGURE 3

CHAIN-OF-CUSTODY RECORD

FIGURE 4

CORRECTIVE ACTION REQUEST FORM

**QUALITY ASSURANCE
CORRECTIVE ACTION REQUEST FORM**

Originator (Signature/Title)

Date

Nature of Problem

Recommended Corrective Action

Reviewed By (Signature/Title)

Date

Investigation Required

Action Assigned To

Date Due

Assigned By (Signature/Title)

Recommended Corrective Action

Completed By (Signature/Title)

Date

Reviewed By OA Officer (Signature)

Date

Corrective Action Required

Completed By (Signature/Title)

Date

Reviewed By OA Officer (Signature)

Date

APPENDIX B

WCC HEALTH AND SAFETY PLAN

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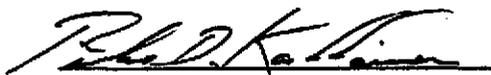
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HEALTH AND SAFETY PLAN

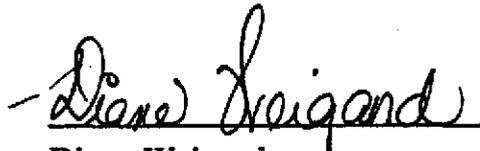
Client: Cedar Chemical Corporation
Project: RFI Field Investigation, Groundwater Assessment, and Interim Measures
Project Manager: Richard D. Karkkainen
Project Number: 90B451C
Date of Plan: April 17, 1992
Estimated Dates of Work: Pending EPA and MSDEQ
Expiration Date: Pending EPA and MSDEQ

1.1 HEALTH AND SAFETY PLAN APPROVALS



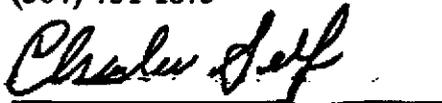
Richard D. Karkkainen
Project Manager
(504) 751-1873

5/8/92
Date



Diane Weigand
Health and Safety Officer
Baton Rouge Business Unit
(504) 751-1873

5/8/92
Date



Charles Self, C. I. H.
Corporate Health and Safety Officer
(318) 439-2683

5/8/92
Date

This Health and Safety Plan establishes guidelines and requirements for the safety of field personnel during the conduct of the field activities associated with the referenced project. The specific activities addressed by this plan are defined in Section 3.0. All employees of Woodward-Clyde Consultants (WCC) involved in this project are required to abide by the provisions of this plan. They are required to read this plan and sign the attached Compliance Agreement.

The health and safety guidelines and requirements presented are based on a review of available information and an evaluation of potential hazards. This plan outlines the health and safety procedures and equipment required for activities at this site to minimize the potential for exposures of field personnel. This plan may be modified by the project manager, the corporate health and safety officer, and the Baton Rouge health and safety officer in response to additional information obtained regarding the potential hazards to field investigative personnel. This plan has been prepared for the exclusive use of WCC Personnel and WCC subcontractors. WCC liability is extended to WCC Personnel and WCC Subcontractors only.

2.1 KEY PERSONNEL

Project management will be handled out of the Baton Rouge Operating Unit of WCC. The following is a description of job responsibilities and authorities:

Project Manager: Richard D. Karkkainen, (504) 751-1873

For this project, the Project Manager has the following responsibilities:

- To see that the project is performed in a manner consistent with the WCC Health and Safety Program.

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- To have an approved Health and Safety Plan prepared and properly implemented for this project.
- To provide the Business Unit Health and Safety Officer with project information related to health and safety matters and development of the Health and Safety Plan.
- To implement the Health and Safety Plan.
- To insure compliance with the Health and Safety Plan by WCC and contractor personnel.
- To coordinate with the Business Unit Health and Safety Officer on health and safety matters.

The Project Manager has the authority to take the following actions:

- To determine matters relating to schedule, cost, and personnel assignments on hazardous waste management projects.
- To temporarily suspend field activities, if the health and safety of personnel are endangered, pending further consideration by the Business Unit Health and Safety Officer.
- To temporarily suspend an individual from field activities for infractions of Health and Safety Plan, pending further consideration by the Business Unit Health and Safety Officer.

Health and Safety Officer: Diane Weigand (504) 751-1873

The Health and Safety Officer has the following responsibilities:

- To interface with the Project Manager as may be required in matters of health and safety.

- To approve a Health and Safety Plan for the project.
- To appoint or approve a Site Safety Officer to assist in implementing the Health and Safety Plan.
- To monitor compliance with the approved Health and Safety Plan.
- To assist the Project Manager in seeing that proper health and safety equipment is available for the project.
- To approve personnel to work on this site with regard to medical examinations and health and safety training.

The Health and Safety Officer has the authority to take the following actions:

- To suspend work or otherwise limit exposures to personnel, if a Health and Safety Plan appears to be unsuitable or inadequate.
- To direct personnel to change work practices, if they are deemed to be hazardous to health and safety of personnel.
- To remove personnel from the project, if their actions or condition endangers their health and safety or the health and safety of co-workers.

WCC Site Safety Officer: Rod Schwertner (318) 439-2683

The Site Safety Officer (SSO) has the following responsibilities:

- To direct health and safety activities onsite.
- To report safety-related incidents or accidents to the Project Manager and Business Unit Health and Safety Officer.

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- To assist the Project Manager in all aspects of implementing the Health and Safety Plan.
- To maintain health and safety equipment onsite, as specified in Health and Safety Plan.
- To perform health and safety activities onsite, as specified in the Health and Safety Plan, and report results to the Project Manager and the Business Unit Health and Safety Officer.

The SSO has the authority to take the following actions:

- To temporarily suspend field activities, if the health and safety of personnel are endangered, pending further consideration by the Business Unit Health and Safety Officer.
- To temporarily suspend an individual from field activities for infractions of the Health and Safety Plan, pending further consideration by the Business Unit Health and Safety Officer.

WCC Corporate Health and Safety Officer: Charles Self, C.I.H. (318) 439-2683

The WCC CHSO has the following responsibilities:

- Direct the implementation of the Health and Safety Program of the operating group and provide recommendations for improvement of the program.
- Coordinate health and safety activities of the operating units in the operating group.
- Determine need for project Health and Safety Plans.
- Review and approve Health and Safety Plans.
- Monitor implementation of Health and Safety Plans.

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- Investigate reports of incidents or accidents and report accidents or incidents to the CHSA and EVPP.
- Assist CHSA with employee health and safety training in the operating group.
- Determine whether an accidental exposure or injury merits a change in the *affected individual's work assignments and whether changes in work practices are required.*
- Coordinate business units with regard to health and safety equipment needs.

The WCC CHSO has the authority to take the following actions:

- Approve or disapprove Health and Safety Plans.
- Direct operating unit HSO to prepare project Health and Safety Plans.
- Access project files.
- Direct changes in personnel work practices to improve health and safety of employees involved in hazardous waste management projects.
- Remove individuals from projects, if their conduct jeopardized their health and safety or that of co-workers.
- Suspend work on any project that jeopardizes the health and safety of personnel involved.

2.2 SITE LOCATION

Cedar Chemical Corporation is located less than a mile south of Interstate 20 within the city of Vicksburg, Mississippi. To the north and west of the site is light residential properties. To the East of the site is light industrial properties including the Vicksburg water treatment facility and an asphalt mixing and gravel drying operation. To the South of the site is light residential to rural properties.

2.3 SITE DESCRIPTION

Cedar Chemical Corporation is located off Highway 61 on Rifle Range Road. The facility is comprised of a North Plant and a South Plant and occupies approximately 650

acres. Currently, the only active production areas of the plant include the nitric acid IRFNA and potassium nitrate plants. All other portion of the plant are no longer in operation. Resources such as a potable water supply, electricity, and telephone service are available at the plant office located at the facility entrance on Rifle Range Road. Chemicals onsite relative to the plants include anhydrous ammonia, nitric acid, potassium chloride, potassium hydroxide, sodium hydroxide, sulphuric acid, chlorine, and nitrogen tetroxide, and nitrogen dioxide. Chemicals onsite related to past production activities include atrazine, dinoseb, methyl parathion, monosodium methane arsonate (MSMA), and toxaphene. Other chemicals that have been detected onsite include carbon tetrachloride, chloroform, 1,1-dichloroethylene, ethylbenzene, methylene chloride, toluene, and xylene.

The work sites concerning this plan are associated with the South and North Plants (Figure 1 of this Appendix) and include several Solid Waste Management Units (SWMUs) and other Areas of Concern (AOCs).

2.4 SITE HISTORY

In the past, Cedar Chemical Corporation produced various types of pesticides and herbicides such as dinoseb, toxaphene, atrazine, and monosodium methane arsonate. All of these chemicals or raw material used to manufacture them have been detected in the soil and water by Cedar Chemical Corporation and the state of Mississippi. Concentrations range from non detected to an average of about 5 part per million (ppm). Chlorinated solvents have been detected in sludge sediments in the ppm range for carbon tetrachloride, methylene chloride, chloroform, and 1,1,-dichloroethylene. The source of the chlorinated solvents is unknown as well as the source of xylene, toluene, and ethylbenzene, which have been detected in the range of 2-15 ppm.

PURPOSE AND SCOPE OF PROPOSED WORK

WCC will perform work as required in a Consent Decree, effective April 17, 1992. This Consent Decree requires Interim Measures activities, a Groundwater Assessment Program, and a RCRA Facility Investigation be conducted at the facility. These three workplans require geophysical borings, monitor well sampling and installation, subsurface soil sampling, and surface soil sampling. Some construction in conjunction with sump closure may be included in the Interim Measures activities.

The following hazards have been identified and will be protected against:

- Heat stress.
- Biological hazardous.
- Physical hazards.
- Skin contact with organic contaminants.

4.1 BIOLOGICAL HAZARDS

If clearing has not been conducted or if biological hazards develop during work activities, practical guidelines for prevention of exposure to pests should be implemented.

4.2 HEAT STRESS HAZARDS

If heat stress becomes a concern, the heat stress casualty prevention plan, presented in Appendix A of Appendix B shall be implemented.

4.3 PHYSICAL HAZARDS

Personnel should be cognizant of the fact that when protective equipment such as respirators, gloves, and protective clothing are worn, visibility and manual dexterity are impaired. In addition, personnel should be alert to physical hazards such as slipping/tripping/falling potentially associated with dismantled process equipment and piping remnants/ladders/stairways in various stages of disrepair, and uneven ground surface due to foundation fragments distributed throughout the site. Drilling personnel should abide by standard safety guidelines applicable to drilling operation presented in Appendix B.

4.4 CHEMICAL HAZARDS

Due to past production activities at the facility, pesticides, herbicides, chlorinated solvents, and volatile organic solvents have been detected onsite during site characterization efforts conducted by Cedar Chemical Corporation and the state of Mississippi. The constituents detected included dinoseb, toxaphene, atrazine, carbon tetrachloride, methylene chloride, chloroform, 1,1-dichloroethylene, xylene, toluene, and ethylbenzene at concentrations reported in the parts per million range. Of the constituents detected onsite, carbon tetrachloride, methylene chloride, and chloroform are classified by OSHA and/or ACGIH as known or suspected human carcinogens.

The constituents detected onsite are present in low concentrations. However, exposure to these chemicals may potentially occur through inhalation, ingestion, and/or direct contact. Chemical exposure via multiple exposure pathways is cumulative, therefore it is important to recognize potential exposure situations and to take precautions to minimize exposure to chemical hazards by all routes.

The following potential exposure routes and associated health hazards have been identified:

Inhalation: Chemical hazards associated with inhalation exposures may include irritation of the mucous membranes and respiratory tract or with more severe exposures, may include systemic effects. Table 1 presents recommended exposure limits for potential airborne constituents.

Ingestion. Ingestion of chemical will be controlled onsite by prohibiting eating, smoking, or drinking in the Exclusion Zone and by requiring all field personnel to conduct decontamination procedures prior to leaving the Exclusion Zone.

Direct Contact: Skin and eye contact with chemical hazards may potentially result in irritation, rashes, or burns. If a person should exhibit symptoms of eye or skin irritation, he/she should report to the SSO for immediate medical attention.

Potential hazards may be minimized by utilizing appropriate personal equipment designed to protect the body against contact with known or anticipated chemical hazards. Personal protective equipment is classified by the EPA by the level of protection afforded and is divided into four categories designated as Level A, B, C, and D with Level A providing the most extensive level of protection.

The levels of protection required for the field activities specified by the work scope are presented in Section 5.1

Chemical information sheets for each constituent known to be present at the site are presented in Appendix C. These sheets provide important information concerning physical/chemical properties, chemical/reactive hazards, exposure potentials, health hazards and symptoms of exposures, and appropriate treatment following exposure.

**TABLE 1
EXPOSURE LIMITS FOR POTENTIAL AIRBORNE CONTAMINANTS**

Constituent	ACGIH TWA	OSHA PEL-TWA	STEL	IDLH
+ Toxaphene	0.5 mg/m ³	0.5 mg/m ³	1 mg/m ³	200 mg/m ³
Atrazine	5 mg/m ³	5 mg/m ³	--	--
+ Carbon Tetrachloride	5 ppm	2 ppm	--	Ca
Methylene Chloride	50 ppm	500 ppm	--	Ca
Chloroform	10 ppm	2 ppm	--	Ca
Xylene	100 ppm	100 ppm	150 ppm	1000 ppm
Toluene	100 ppm	100 ppm	150 ppm	2000 ppm
Ethylbenzene	100 ppm	100 ppm	125 ppm	2000 ppm
Lime Kiln Dust	10 mg/m ³	10 mg/m ³	--	--
Ammonia	25 ppm	50 ppm	35 ppm	500 ppm

+ Potential Skin Irritant

Ca Potential Human Carcinogen (Cancer Causing);

-- No IDLH level established or no STEL established.

GENERAL HEALTH AND SAFETY REQUIREMENTS

5.1 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) required to prevent contact with known or anticipated chemical hazards has been divided into four categories by the USEPA, Levels A, B, C and D, according to the degree of protection afforded. The following personnel protective equipment will be provided to personnel involved in site characterization work at the site.

Mobilization - Level D Protection

- Boots, steel toe and shank
- Hard hat
- safety glasses with side shields

Modified Level D Protection

- Coveralls, chemical resistant; tyvek (polycoated tyvek if splash hazard exists)
- Gloves (outer), chemical resistant, Polyvinyl Alcohol (PVAL)
- Gloves (inner), chemical-resistant, latex
- Boots, chemical-resistant (or bootie covers), steel toe and shank
- Safety glasses with side shields
- Hard hat (with faceshield if splash hazard exists)

Modified Level C Protection

- To include Modified Level D; PPE mentioned above
- Full-face air purifying respirators with organic vapor/pesticide/HEPA combination filter cartridges.

Tyvek coveralls will be discarded after each use or when they become worn or punctured. Suit materials are resistant to all known or anticipated chemicals at the site. If the disposable protective suits appear to be deteriorating under chemical action, the Site Safety Officer should be notified.

In addition to the personal protective equipment listed above, general safety equipment available for use will include a first aid kit, portable eye wash and fire extinguisher.

5.2 WORK ZONES

During activities conducted in Modified Level D PPE the setup of work zones as defined by the United States Environmental Protection Agency (U.S. EPA) will be required. Management of this project shall be conducted in such a manner which will restrict access to the job site by unauthorized personnel. If Level D action levels established in Table 2 are exceeded resulting in an upgrade to Level C PPE, work zones as described in the following paragraphs shall be implemented.

To minimize the movement of contaminants from the site to uncontaminated areas, three work zones will be set up during activities conducted under Level C PPE. The three work zones will include the following:

- Zone 1: Exclusion Zone
- Zone 2: Contamination Reduction Zone
- Zone 3: Support Zone

The exclusion zone is the zone where contamination does or could occur. Observations by the site safety officer will determine the extent of the zones. All persons entering this zone must wear at a minimum the level of protection set forth in Section 5.1 (Level C PPE).

Between the exclusion zone and support zone is the personnel contamination reduction zone (CRZ) which provides a transition zone between the contaminated and clean areas of the site. This zone will be located directly outside of the exclusion zone and will be defined as 10-foot zone directly outside the exclusion zone.

The support zone will be an uncontaminated area from which operations will be directed. It is essential that contamination from the site be kept out of this area. Included in this area will be a storage area for decontaminated clothing, additional personal protective equipment, etc.

One additional work zone will be set up for decontaminating equipment.

5.3 DECONTAMINATION PROCEDURES

Cedar Chemical Corporation will have a minimum of one personnel decontamination station, strategically located in the work area or in the contamination reduction zone (CRZ) if applicable. The decontamination station will have at least the following items:

- An adequate-sized plastic sheet for flooring
- Boot wash equipment
 - Water/alconox solution container
 - Rinse water container
 - Long-handled plastic brush
- Waste container (disposable PPE, tape, etc.)
- Hand wash equipment
 - Water/alconox solution container
 - Rinse water container
 - Paper towels

5.3.1 Equipment Decontamination

Decontamination of sample collection equipment will be accomplished by the following procedure:

1. Washing in a detergent solution (Alconox)
2. Triple rinsing with clean deionized water
3. Rinsing with methanol
4. Triple rinsing with clean deionized water

Decontamination of equipment shall be conducted in Modified Level D PPE as listed in Section 5.1. While utilizing methanol for deconning equipment, personnel shall position themselves upwind of decontamination operations to minimize inhalation exposures to methanol vapors. If this is not feasible, respiratory protection as listed under level C PPE in Section 5.1 shall be worn during methanol use.

5.3.2 Personnel Decontamination

Decontamination of personnel will be performed at a designated location at the perimeter of the work area. Decontamination will consist primarily of soap and water washings and water rinse of exterior protective gear to remove contaminants, followed by doffing of the gear.

Coveralls should be removed by turning the clothing inside out. A general sequence of doffing procedures is outlined below. The extent of washing required, or modifications to the sequence, may be specified as appropriate.

Personnel will be decontaminated by the following procedure:

- Wash and rinse outer protective coverall
- Wash work gloves and boots
- Remove outer protective clothing
- Rinse respirator if worn
- Wash hands and face

Contaminated disposable PPE and all decontamination fluids shall be containerized onsite for subsequent disposal by the direction of Cedar Chemical Corporation.

5.4 MEDICAL EXAMINATION

Before commencing any of the field or laboratory activities defined in Section 3.0, all WCC personnel and all WCC subcontractors must take an annual WCC-approved medical examination as part of WCC's medical surveillance program.

5.5 SAFETY TRAINING DOCUMENTATION

Prior to commencing any of the field activities defined in Section 3.0, all WCC personnel working on site will supply certificate or equivalent, attesting to completing 40 hours of training as required by OSHA, in 29 CFR 1910.120, to the SSO. Site supervisors will be required to supply documentation indicating that an additional 8 hours of training has been completed. Escorted visitors may be allowed in a defined area without 40 hours training at the discretion of the WCC SSO and the WCC project supervisor.

Documentation concerning respirator fit testing, in accordance with OSHA, 29 CFR 1910.134 shall be required of any WCC employee wearing a respirator.

5.6 COMPLIANCE AGREEMENT

The Project Manager and the Baton Rouge Health and Safety Officer shall hold meetings with all WCC field personnel before work commences. During the meeting, all personnel shall be provided with a copy of this safety plan; the plan shall be reviewed and discussed and questions answered. Signed Compliance Agreement Forms shall be collected by the Project Manager and filed by the Baton Rouge Health and Safety Officer. Individuals refusing to sign the form will not be allowed to work on the site.

5.7 PROJECT MANAGER NOTIFICATION

All field personnel must inform the Project Manager or his designated representative before entering the site. The "buddy system" will be employed during all project work. This means that at least two members of the field crew must be on site whenever work is performed. Personnel must be in visual contact with each other or carry two-way radios at all times.

5.8 PROJECT SAFETY LOG

A project safety log will be used to record the names, entry and exit dates and times of all WCC and subcontractor personnel and of project site visitors; accidents, injuries, and illnesses; incidence of safety infractions by field personnel; air quality and personal

exposure monitoring data; and other information related to safety matters. All accidents, illnesses or other incidence shall be reported immediately to the WCC Project Manager, and the WCC Baton Rouge Health and Safety Officer and subsequently documented for filing on the HS-502 Incident Report Form.

5.9 PROHIBITIONS

- Smoking, eating, drinking, chewing gum or tobacco, storing food or food containers shall not be permitted on the work site. Good personal hygiene should be practiced by field personnel to avoid ingestion of contaminants or spread of contaminated materials.
- Ignition of flammable liquids within, on, or through improvised heating devises or space heaters.
- Approach or entry into areas or spaces where toxic of explosive concentrations of gases or dust may exist without proper equipment available to enable safety entry.
- Conduct of onsite operations without off site back up personnel.

5.10 SITE SAFETY MEETINGS

During all site characterization activities, daily safety meetings will be held by the site safety officer to review and plan the specific health and safety aspects of scheduled work for that day.

LABORATORY CONSIDERATIONS

The laboratory director must be informed of any contaminant level in the samples that would require special handling procedures to prevent risk to the health and safety of laboratory personnel.

PERSONAL PROTECTIVE EQUIPMENT

This section outlines the general usage guidelines for personal protective equipment.

7.1 HEAD PROTECTION

Hard hats must be worn by all personnel working onsite.

7.2 EYE PROTECTION

Safety glasses with side shields or goggles must be worn by all personnel performing activities where potential for eye or face exposure exists due to splash, dust, or vapor, etc. An eyewash station will be set up by the site safety officer prior to commencing field activities and should be placed so that it could be used quickly in an emergency.

7.3 SKIN PROTECTION

Due to the potential for skin absorption and carcinogenic properties chemical resistant gloves and coveralls shall be worn by all personnel during subsurface and sample handling activities. These will be disposed of in a designated sealable drum after each use of when they become worn or punctured.

7.4 FOOTWEAR

Chemical-resistant boots with steel toes and shanks will be worn by field personnel engaged in the field activities at the site. Chemical-resistant booties can be substituted for chemical resistant boots, although work boots to be covered must always maintain steel toes and shanks.

7.5 RESPIRATORY PROTECTION

For respiratory protection against possible volatile organics, full-face air purifying respirators (APR) will be required if Level D air monitoring action levels are exceeded. Specific cartridges to be utilized with the APRs will be combination organic vapor/ammonia filter cartridges. All personnel must be properly fit-tested for the specific brand and size respirator to be used. Documentation of fit testing is to be provided to WCC SSO prior to commencement of work. A respirator which has not been successfully fit-tested cannot be used by an individual on the project. To ensure a proper fit, no facial hair will be allowed that will interfere with mask operation. The site safety officer will determine if facial hair represents such an interference. Air purifying respirators will only be used if the following conditions are met:

- The oxygen content of the air is greater than 19.5 percent.
- Concentration of air contaminants are known and monitored.
- The contaminants of concern all have good warning properties (i.e., odor threshold below PEL value).
- The protection factor is adequate and PELs are not exceeded.
- If concentrations of air contaminants exceed IDLH value, personnel must immediately evacuate.
- Cartridges are changed daily or whenever breakthrough occurs, whichever occurs first.
- Each person has been fit-tested for the specific brand and size of respirator used.
- The respirator is MSHA- and/or NIOSH-approved.

AIR QUALITY MONITORING

The primary goal of onsite air quality monitoring will be compliance with the specified contaminant action levels. The secondary goal will be documentation of personal exposures as required by OSHA 1920.120.

8.1 AIR QUALITY SURVEY

During modified Level D field activities at the site, an air quality survey will be performed utilizing an HNu-photoionization detector (PID) equipped with an 11.7 eV probe, or equivalent instrument to characterize volatile organics and ammonia concentrations onsite. During Level C field activities, additional sampling utilizing colorimetric tubes specific for detecting chloroform, methylene chloride, and carbon tetrachloride will be used along with the HNu for total organic vapors. At least two sampling events utilizing each of these tubes will be conducted in the breathing zone of personnel closest to the subsurface activities at the site. Table 2 lists air monitoring action levels for Level D and C work.

TABLE 2 AIR MONITORING ACTION LEVELS FOR LEVEL C AND D WORK			
Contaminant	Instrument*	Reading	Action Taken
Volatile Organic	HNu or equivalent	<5 ppm	Continued Work in Modified D Level
		5 - 25 ppm	Upgrade to Level C and Expand Work Zones; Commence additional colorimetric tube sampling
		>25 ppm	Evacuate Area

* Sustained reading above background (for 15 minutes continuous) which shall not be exceeded within worker breathing zones or exclusion zones.

EMERGENCIES/ACCIDENTS

A site map and direction to Vicksburg Hospital are included in Figure 1. Illnesses, injuries, and accidents occurring onsite must be attended to immediately in the following manner:

- Remove the injured or exposed person(s) from immediate danger.
- Render FIRST AID if necessary. Decontaminate affected personnel, if necessary.
- Call ambulance for transport to local. This procedure should be followed even if there is no apparent serious injury. Emergency numbers are listed on the following section.
- Evacuate other personnel onsite to a safe place until the engineer (assisted by the Site Safety Officer) determines that it is safe for work to resume.
- Report the accident to the Health and Safety Officer immediately.
- Develop procedures, in accordance with the Health and Safety Officer, Site Safety Officer, and Project Manager to prevent a recurrence.

In the event that an emergency site evacuation should be necessary for any reason, the Site Safety Officer will render an alarm using a horn and all personnel shall leave the site. The assembly point will be designated in the field. Personnel will not return to the site until an all-clear has been received from the Site Safety Officer

9.1 EMERGENCY NUMBERS

For any on-site Emergency dial 911.

<u>Emergency Service</u>	<u>Telephone</u>
Fire Department	636-1121
Ambulance	911
Sheriff	636-1761
Vicksburg Police Department	636-2511
National Response Center (NRC)	1-800-424-8802
Poison Control Center	1-800-535-0525
Vicksburg Medical Center	636-2611
Parkview Medical Center	631-2131
Mississippi Emergency Management Agency	1-800-222-6362
MSDEQ - (Bob Rogers)	961-5171
MSDEQ - (After Hours)	1-352-9100

PERSONNEL ASSIGNMENTS

WCC personnel and subcontractors authorized to work on this project and enter the site are:

Project Manager:	Richard D. Karkkainen
Baton Rouge Health and Safety Officer:	Diane Weigand
Site Safety Officer:	Rod Schwertner
Field Personnel:	Tom Warren, Cheryl Warren
Subcontractor:	Burns Engineering

10.1 PROJECT SAFETY PERSONNEL

Personnel responsible for implementing this Safety Plan are the Project Manager and Site Safety Officer. Their specific responsibilities and authorities for all accountable WCC personnel are listed in this plan as well as Table 2-1 of the WCC Health and Safety manual dated November 1990.

SAFETY PLAN COMPLIANCE AGREEMENT

I, _____(print name), have received a copy of the Safety Plan for the Interim Measures, Groundwater Assessment, and RFI Field Investigation Workplans for Cedar Chemical Corporation, Vicksburg, Mississippi (WCC Project No. 92B007C). I have read the plan, understand it, and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the safety requirements specified in the plan.

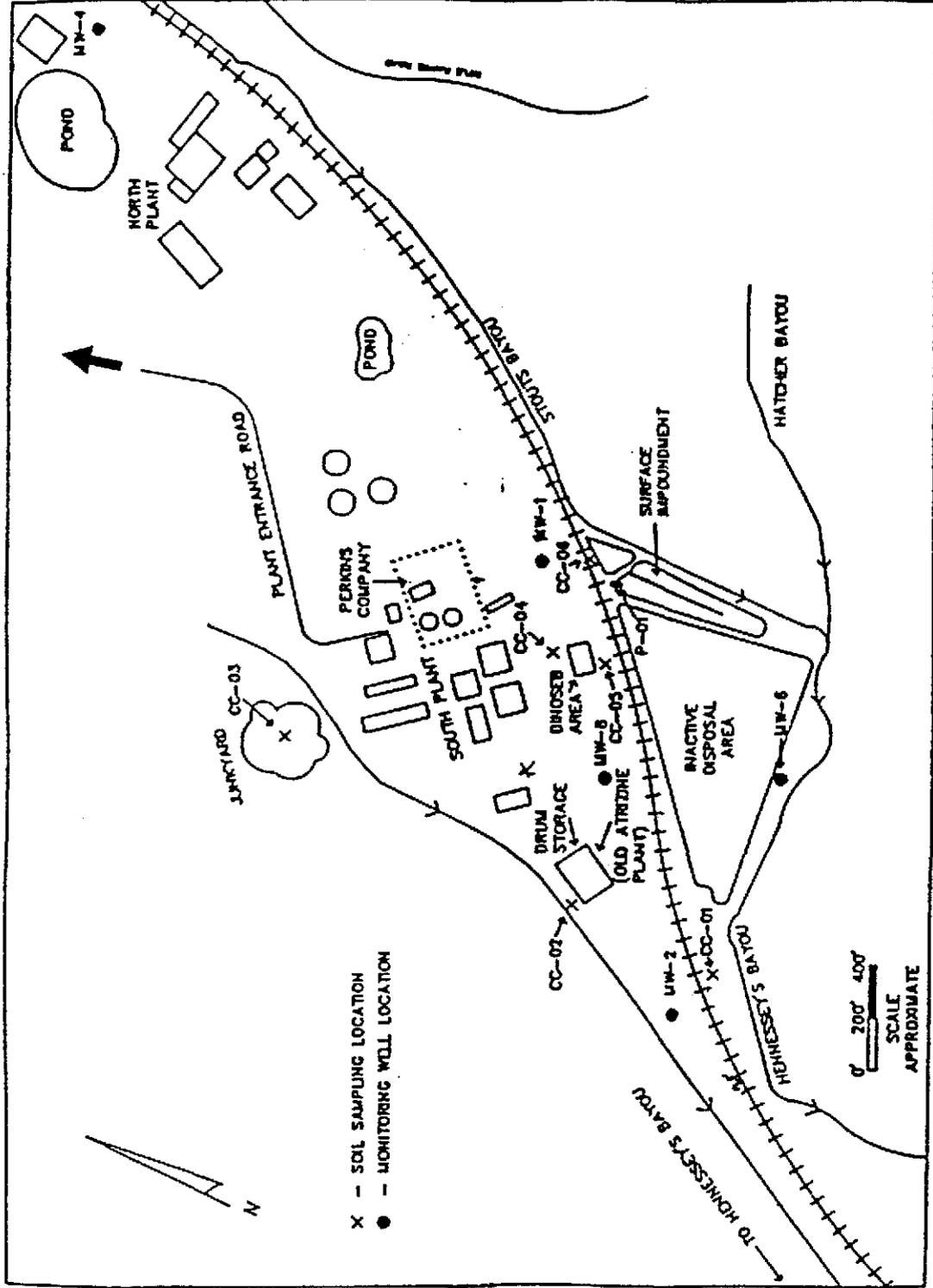
Signed:

Signature

Date

Firm: _____

FIGURE 1 - Appendix B



DIRECTIONS TO THE NEAREST HOSPITAL:
 Follow the Plant entrance road to Rifle Range Road,
 Continue on Rifle Range Road to Business 61,
 Take Interstate 20 E and exit on the Halls Ferry Road
 Cross N. Interstate to Frontage Road,
 The hospital is located on Frontage Road.

APPENDIX A OF APPENDIX B

HEAT STRESS CASUALTY PREVENTION PLAN

APPENDIX A

HEAT STRESS CASUALTY PREVENTION PLAN

Due to the increase in ambient air temperatures and the affects of protective outer wear decreasing body ventilation, there exists an increase in the potential for injury, specifically, heat casualties. Site personnel will be instructed in identification of a heat stress victim, the first-aid treatment procedures for the victim and the preventing of heat stress casualties.

A. IDENTIFICATION AND TREATMENT

1) Heat Exhaustion

- a) Symptoms: Usually begins with muscular weakness, dizziness, nausea, and staggering gait. Vomiting is frequent. The bowels may move involuntarily. The victim is very pale, his skin is clammy skin, and he may perspire profusely. The pulse is weak and fast, his breathing is shallow. He may faint unless he lies down. This may pass, but sometimes it remains and death could occur.

- b) First Aid: Immediately remove the victim to the Personnel Decontamination Reduction Zone in a shady or cool area with good air circulation. Remove all protective outer wear. Call a physician. Treat the victim for shock. (Make him lie down, raise his feet 6 to 12 inches and loosen all clothing.) Transport victim to a medical facility as soon as possible.

2) Heat Stroke

- a) Symptoms: This is the most serious of heat casualties due to the fact that the body excessively overheats. Body temperatures often are between 107 degrees to 110 degrees Fahrenheit. First there is often pain in the head, dizziness, nausea, oppression, and the skin is dry, red and hot. Unconsciousness follows quickly and death is imminent if exposure continues. The attack will usually occur suddenly.
- b) First Aid: Immediately evacuate the victim to a cool and shady area in the Personnel Decontamination Reduction Zone. Remove all protective outer wear and all personal clothing. Lay him on his back with his head and shoulders slightly elevated. It is imperative that the body temperature be lowered immediately. This can be accomplished by applying cold wet towels, ice bags, etc., to the head. Sponge off bare skin with cool water or place him in a tub of cool water. The main objective is to cool him without chilling him. Give no stimulants. Transport the victim to a medical facility as soon as possible.

B. PREVENTION OF HEAT STRESS

- 1) One of the major causes of heat casualties is the depletion of body fluids. On the site there will plenty of fluids available. Personnel should replace water and salts loss from sweating. Salts can be replaced by either 0.1 percent solution, more heavily salted foods, or commercial mixes such as Gatorade. The commercial mixes are advised for personnel on low sodium diets.
- 2) A work schedule should be established so that the majority of the work day will be during the morning hours of the day before ambient air temperature levels reach their highs.

- 3) A work/rest guideline will be implemented for personnel required to wear Level B or Level C protection. This guideline is as follows:

<u>Ambient Temperatures</u>	<u>Maximum Working Time</u>
Above 90°F	1/2 hour
80°-90°F	1 hour
70°-80°F	2 hours
60°-70°F	3 hours
50°-60°F	4 hours
40°-50°F	5 hours
30°-40°F	6 hours
Below 30°F	8 hours

A sufficient period will be allowed for personnel to "cool down". This may require shifts of workers during operations.

C. HEAT STRESS MONITORING

For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism. Monitoring of personnel wearing protective clothing should commence when the ambient temperature is 70 degrees Fahrenheit or above. Frequency of monitoring should increase as the ambient temperature increases or if slow recovery rates are indicated. When temperatures exceed 80 degrees Fahrenheit, workers must be monitored for heat stress after every work period.

- Heart rate should be measured at the radial pulse for 30 seconds as early as possible in the resting period. The heart rate at the beginning of the rest period should not exceed 110 beats per minute. If the heart rate is higher, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. If the pulse rate is 100 beats per minute at the beginning of the next rest period, the following work cycle should be shortened by 33 percent.

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- Body temperature should be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature at the beginning of the rest period should not exceed 99 degrees Fahrenheit. If it does, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. However, if the oral temperature exceeds 99.7 degrees Fahrenheit at the beginning of the next period, the following work cycle should be further shortened by 33 percent. Oral temperature should be measured again at the end of the rest period to make sure that it has dropped below 99 degrees Fahrenheit.
- Body water loss due to sweating should be measured by weighing the worker in the morning and in the evening. The clothing worn should be similar at both weighings; preferably, the worker should be weighed nude. The scale should be accurate to plus or minus one-quarter pound. Body water loss should not exceed 1.5 percent of the total body weight. If it does, workers should be instructed to increase their daily intake of fluids by the weight lost.

Ideally, body fluids should be maintained at a constant level during the work day. This requires replacement of salt lost in sweat as well.

Good hygiene standards must be maintained by frequent changes of clothing and daily showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

APPENDIX B OF APPENDIX B

SAFETY GUIDELINES FOR DRILLING

APPENDIX B

SAFETY GUIDELINES FOR DRILLING

Drill rig maintenance and safety is the responsibility of the drill rig operator. However, safety requires the attention and cooperation of every worker and visitor to the job. The following is provided as a general guideline for safe drilling practices onsite.

OFF-ROAD MOVEMENT OF DRILL RIGS

The following safety guidelines relate to off-road movement:

- o Before moving a drill rig, first walk the route of travel, inspecting for depressions, slumps, gullies, ruts and similar obstacles.
- o Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven or hilly ground.
- o Discharge all passengers before moving a drill rig on rough or hilly terrain.
- o Engage the front axle (for 4x4, 6x6, etc., vehicles or carriers) when traveling off-highway on hilly terrain.
- o Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill.
- o Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely, not at an angle.
- o Use the assistance of someone on the ground as a guide when lateral or overhead clearance is narrow.

- o After the drill rig has been moved to a new drilling site, set all brakes and/or locks. When grades are steep, block the wheels.
- o Never travel off-road with the mast (derrick) of the drill rig in the raised or partially raised position.
- o Tie-down loads on the drill rig and support trucks during transport.

OVERHEAD AND BURIED UTILITIES

The use of a drill rig near electrical power lines and other utilities requires that special precautions be taken by both supervisors and members of the exploration crew. Electricity can shock, it can burn and it can cause death.

Overhead and buried utilities should be located, noted and emphasized on all boring location plans and boring assignment sheets.

Before raising the drill rig mast (derrick) on a site in the vicinity of power lines, walk completely around the drill rig. Determine what the minimum distance from any point on the drill rig to the nearest power line will be when the mast is raised and/or being raised. Do not raise the mast or operate the drill rig if this distance is less than 20 feet.

Keep in mind that both hoist lines and overhead power lines can be moved toward each other by the wind.

CLEARING THE WORK AREA

Prior to drilling, adequate site cleaning and leveling should be performed to accommodate the drill rig and supplies and provide a safe working area. Drilling should not be commenced when tree limbs, unstable ground or site obstructions cause unsafe tool handling conditions.

NOTE: In coordination with the Drilling Crew, the Site Health and Safety Manager will review the precautions taken to insure that the drill rig is leveled and stabilized.

HOUSEKEEPING ON AND AROUND THE DRILL RIG

The first requirement for safe field operations is that the drilling crew safety supervisor understands and fulfills the responsibility for maintenance and "housekeeping" on and around the drill rig.

Suitable storage locations should be provided for all tools, materials and supplies so that they can be conveniently and safely handled without hitting or falling on a member of the drill crew or a visitor.

Avoid storing or transporting tools, materials or supplies within or on the mast (derrick) of the drill rig.

Pipe, drill rods, bits casing, augers and similar drilling tools should be orderly stacked on racks or sills to prevent spreading, rolling or sliding.

Penetration or other driving hammers should be placed at a safe location on the ground or be secured to prevent movement when not in use.

Work areas, platforms, walkways, scaffolding and other accessways should be kept free of materials, obstructions and substances such as ice, excess grease or oil that could cause a surface to become slick or otherwise hazardous.

Keep all controls, control linkages, warning and operation lights and lenses free of oil, grease and/or ice.

Do not store gasoline in any portable container other than a non-sparking, red container with a flame arrester in the fill spout and having the word "gasoline" easily visible.

SAFE USE OF HAND TOOLS

There are almost an infinite number of hand tools that can be used on or around a drill rig. "Use the tool for its intended purpose" is the most important rule. The following are a few specific and some general suggestions which apply to safe use of several hand tools that are often used on and around drill rigs.

- o When a tool becomes damaged, either repair it before using it again or get rid of it.
- o When using a hammer, any kind of hammer for any purpose, wear safety glasses and require all others near you to wear safety glasses.
- o When using a chisel, any kind of chisel, for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- o Keep all tools cleaned and orderly stored when not in use.
- o Replace hook and heel jaws when they become visibly worn.
- o When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform, should the wrench slip or the joint suddenly let go.

SAFE USE OF WIRE LINE HOISTS, WIRE ROPE AND HOISTING HARDWARE

The use of wire line hoists, wire rope, and hoisting hardware should be as stipulated by the American Iron and Steel Institute's Wire Rope Users Manual.

All wire ropes and fittings should be visually inspected during use and thoroughly inspected at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper weaving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting

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hardware and any other feature that would lead to failure. Wire ropes should be replaced when inspection indicates excessive damage according to the wire rope users manual.

If a ball-bearing-type hoisting swivel is used to hoist drill rods, swivel bearings should be inspected and lubricated daily to assure that the swivel freely rotates under load.

If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device, do not hoist more than 1 foot (0.3m) of the drill rod column above the top of the mast (derrick), do not hoist a rod column with loose tool joints and do not make up, tighten or loosen tool joints while the rod column is being supported by a slipping device. If drill rods should slip back into the borehole, do not attempt to break the fall of the rods with your hands.

Most sheaves on drill rigs are stationary with a single-part line. The number of parts of line should never be increased without first consulting with the manufacturer of the drill rig. Wire ropes must be properly matched with each sheave.

The following procedures and precautions must be understood and implemented for safe use of wire ropes and rigging hardware.

Use tool-handling hoists only for vertical lifting of tools (except when angle-hole drilling). Do not use tool-handling hoists to pull on objects away from the drill rig; however, drills may be moved using the main hoist as the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.

When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or the feed mechanism of the drill.

When attempting to free a mired vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle or drill rig carrier and stay as far away as possible from the wire rope. Do not attempt to use tool hoists to free a mired vehicle or drill rig carrier.

To minimize shock loading of a wire rope, always apply loads smoothly and steadily.

Some additional safety guidelines that should be followed are:

- o Protect wire rope from sharp corners or edges.
- o Replace faulty guides and rollers.
- o Replace worn sheaves or worn sheave bearings.
- o Replace damaged safety latches on safety hooks before use.
- o Know the safe working load of the equipment and tackle being used. Never exceed this limit.
- o Periodically inspect and test clutches and brakes of hoists.
- o Know and do not exceed the rated capacity of hooks, rings, links, swivels, shackles and other lifting aids.
- o Always wear gloves when handling wire ropes.
- o Do not guide wire ropes on hoist drums with your hands.
- o After installation of a new wire rope, lift a light load to allow the wire rope to adjust.
- o Never carry out any hoisting operations when the weather conditions are such that hazards to personnel, the public or property are created.
- o Never leave a load suspended when the hoist is unattended.

- o Keep your hands away from hoists, wire rope, hoisting hooks, sheaves and pinch points as slack is being taken up and when the load is being hoisted.
- o Never hoist a load over members of the crew.

SAFE USE OF AUGERS

The following general procedures should be used when advancing a boring with continuous-flight or hollow-stem augers:

- o Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear and the engine running at low RPM.
- o The operator and tool handler should establish a system of responsibility for the various activities required for auger drilling, such as connecting and disconnecting auger sections and inserting and removing the auger fork. The operator must assure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.
- o Use only the manufacturer's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench or any other tools during rotation.
- o Whenever possible, use tool hoists to handle auger sections.
- o Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.

- o Never allow feet to get under the auger section that is being hoisted.
- o When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason whatever.
- o Never use your hands or feet to move cuttings away from the auger.
- o When cleaning augers, be sure the drill rig is in neutral and the augers are stopped from rotating.

SAFETY DURING ROTARY AND CORE DRILLING

Rotary drilling tools should be safety-checked before use. In particular, check for the following:

- o See that water swivels and hoisting plugs are lubricated and checked for frozen bearings before use.
- o Check rod chuck jaws periodically and replace them when necessary.
- o Check the capacities of hoists and sheaves against the anticipated weight on the drill rod string plus other expected hoisting loads. Inspect all cables daily.

These other special precautions should be taken for safe rotary or core drilling:

- o Drill rods should not be braked during lowering into the hole with drill rod chuck jaws.
- o Drill rods should not be held or lowered into the hole with pipe wrenches.
- o If a string of drill rods are accidentally or inadvertently released into the hole, do not attempt to grab the falling rods with your hands or a wrench.

- o In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.
- o When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use your hands to clean drilling fluids from drill rods.
- o If work must progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit should be equipped with a rough surface and fitted cover panels of adequate strength to hold drill rig personnel.
- o Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.
- o Inspect all hydraulic lines periodically and replace as needed.

START-UP

All drill rig personnel and visitors should be instructed to "stand-clear" of the drill rig immediately prior to and during starting of an engine.

Make sure all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers are in the correct, non-actuating positions, and the cathead rope is not on the cathead before starting a drill rig engine.

SAFETY DURING DRILLING OPERATIONS

Safety requires the attention and cooperation of every worker and site visitor.

Do not drive the drill rig from hole to hole with the mast (derrick) in the raised position.

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Before raising the mast (derrick) look up to check for overhead obstructions.

Before raising the mast (derrick), all drill rig personnel and visitors (with exception of the operator) should be cleared from the area immediately to the rear and the sides of the mast. All drill rig personnel and visitors should be informed that the mast is being raised prior to raising it.

Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig must be first leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig should be releveled if it settles after initial set up. Lower the mast (derrick) only when leveling jacks are down and do not raise the leveling jack pads until the mast (derrick) is lowered completely.

Before starting drilling operations, secure and/or lock the mast (derrick) if required according to the drill manufacturer's recommendations.

The operator of a drill rig should only operate a drill rig from the position of the controls. The operator should shut down the drill engine before leaving the vicinity of the drill.

Do not consume alcoholic beverages or other depressants or chemical stimulants prior to starting work on a drill rig or while on the job.

Watch for slippery ground when mounting/dismounting from the platform.

All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel, site visitors or animals from stepping or falling into the hole. All open boreholes should be covered, protected, or backfilled adequately and according to local or state regulations on completion of the drilling project.

"Horsing around" within the vicinity of the drill rig and tool and supply storage areas should never be allowed, even when the drill rig is shut down.

Be careful when lifting heavy objects.

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Before lifting a relatively heavy object, approach the object by bending at the knees, keeping your back vertical and unarched while obtaining a firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping your back vertical and unarched. In other words, perform the lifting with the muscles in your legs, not with the muscles in your lower back.

Drilling operations should be terminated during an electrical storm.

**APPENDIX C OF APPENDIX B
CHEMICAL INFORMATION SHEETS**

AMMONIA

- Hazardous substance (EPA)

Description: NH_3 , ammonia is a colorless, strongly alkaline, and extremely soluble gas with a characteristic pungent odor.

Code Numbers: CAS 7664-41-7 RTECS BO0875000 UN 1005

DOT Designation: Nonflammable gas.

Synonyms: Anhydrous ammonia.

Potential Exposures: Ammonia is used as a nitrogen source for many nitrogen-containing compounds. It is used in the production of ammonium sulfate and ammonium nitrate for fertilizers and in the manufacture of nitric acid, soda, synthetic urea, synthetic fibers, dyes, and plastics. It is also utilized as a refrigerant and in the petroleum refining and chemical industries. It is used in the production of many drugs (A-41) and pesticides (A-32).

Other sources of occupational exposure include the silvering of mirrors, glue-making, tanning of leather, and around nitrating furnaces. Ammonia is produced as a by-product in coal distillation and by the action of steam on calcium cyanamide, and from the decomposition of nitrogenous materials.

Incompatibilities: Strong oxidizers, calcium, hypochlorite bleaches, gold, mercury, silver, halogens.

Permissible Exposure Limits in Air: The Federal standard for ammonia is an 8-hour time-weighted average of 50 ppm (35 mg/m³). NIOSH has recommended 50 ppm expressed as a ceiling and determined by a 5-minute sampling period. ACGIH as of 1983/84 has set TWA values of 25 ppm (18 mg/m³). The tentative STEL value is 35 ppm (27 mg/m³). The IDLH level is 500 ppm.

Determination in Air: Collection by midget impinger and colorimetric analysis using Nessler's reagent (A-10). Ammonia may also be determined using long-duration detector tubes (A-11).

Permissible Concentration in Water: EPA in 1976 (A-3) proposed a limit of 0.02 mg/l (as unionized ammonia) for the protection of freshwater aquatic life. As of 1980, EPA (2) first proposed adding ammonia to the list of priority toxic pollutants and developing criteria for it, but then withdrew the proposal. NAS/NRC proposed (A-2) a limit of 0.5 mg/l for drinking water.

Routes of Entry: Inhalation of gas, ingestion, skin and eye contact.

Harmful Effects and Symptoms: *Local* — Contact with anhydrous liquid ammonia or with aqueous solutions is intensely irritating to the mucous membranes, eyes, and skin. Eye symptoms range from lacrimation, blepharospasm, and palpebral edema to a rise of intraocular pressure, and other signs resembling acute-angle closure glaucoma, corneal ulceration, and blindness. There may be corrosive burns of skin or blister formation. Ammonia gas is also irritating to the eyes and to moist skin.

Systemic — Mild to moderate exposure to the gas can produce headache, salivation, burning of throat, anosmia, perspiration, nausea, vomiting, and substernal pain. Irritation of ammonia gas in eyes and nose may be sufficiently intense to compel workers to leave the area. If escape is not possible, there may be severe irritation of the respiratory tract with the production of cough, glottal edema, bronchospasm, pulmonary edema, or respiratory arrest. Bronchitis or pneumonia may follow a severe exposure if patient survives. Urticaria is a rare allergic manifestation from inhalation of the gas.

Points of Attack: Lungs, respiratory system, eyes.

Medical Surveillance: Preemployment physical examinations for workers in ammonia exposure areas should be directed toward significant changes in the skin, eyes, and respiratory system. Persons with corneal disease, and glaucoma, or chronic respiratory diseases may suffer increased risk. Periodic examinations should include evaluation of skin, eyes, and respiratory system, and pulmonary function tests to compare with baselines established at preemployment examination.

First Aid: If this chemical gets into the eyes, irrigate immediately. If this chemical contacts the skin, flush with water immediately. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Do not induce vomiting.

Personal Protective Methods: Where ammonia hazards exist in concentrations above the standard, respiratory, eye, and skin protection should be provided. Fullface gas masks with ammonia canister or supplied air respirators, both with full facepieces, afford good protection. In areas where exposure to liquid ammonia occurs, goggles or face shields, as well as protective clothing impervious to ammonia and including gloves, aprons, and boots should be required. Where ammonia gas or concentrated ammonia solution is splashed in eyes, immediate flooding of the eyes with large quantities of water for 15 minutes or longer is advised, followed at once by medical examination.

In heavy concentrations of ammonia gas, workers should be outfitted with complete self-contained protective suits impervious to ammonia, with supplied air source, and full headpiece and facepiece. Appropriate clothing should be worn to prevent any possible skin contact with liquids of >10% content or reasonable probability of contact with liquids of <10% content. Wear eye protection to prevent any possibility of eye contact with liquids of >10% NH₃ content. Employees should wash immediately when skin is wet or contaminated with liquids of >10% content. Remove nonimpervious clothing immediately if wet or contaminated with liquids containing >10% and promptly remove if liquid contains <10% NH₃. Provide emergency showers and eyewash if liquids containing >10% NH₃ are involved.

Respirator Selection:

- 100 ppm: CCRS/SA/SCBA
- 300 ppm: CCRSF
- 500 ppm: GMS/SAF/SCBAF
- Escape: GMS/SCBA

Disposal Method Suggested: Dilute with water, neutralize with HCl and discharge to sewer (A-38). Recovery is an option to disposal which should be considered for paper manufacture, textile treating, fertilizer manufacture and chemical process wastes (A-57).

References

- (1) National Institute for Occupational Safety and Health, *Criteria for a Recommended Standard: Occupational Exposure to Ammonia*, NIOSH Doc. No. 74-136, Washington, DC (1974).
- (2) U.S. Environmental Protection Agency, "Toxic Pollutant List: Proposal to Add Ammonia," *Federal Register*, 45, No. 2, 803-806 (January 3, 1980) Rescinded by *Federal Register*, 45, No. 232, 79692-79693 (December 1, 1980).
- (3) National Research Council, *Committee on Medical and Biologic Effects of Environmental Pollutants, Ammonia*, Baltimore, MD, University Park Press (1979).
- (4) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report, 2*, No. 1, 65-68, New York, Van Nostrand Reinhold Co. (1982).
- (5) See Reference (A-61).
- (6) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report, 3*, No. 3, 49-53, New York, Van Nostrand Reinhold Co. (1983).
- (7) See Reference (A-60).
- (8) Parmeggiani, L., Ed., *Encyclopedia of Occupational Health & Safety*, Third Edition, Vol. 1, pp 148-150, Geneva, International Labour Office (1983).

ATRAZINE

ATZ

<p>Common Synonyms 2-Chloro-4-ethylamino-6-isopropylamino-s-triazine Atrazine Herbicide</p>		<p>Solid crystals White</p> <p>Sinks in water.</p>
<p>AVOID CONTACT WITH SOLID AND DUST. PEOPLE AWAY Wear goggles and self-contained breathing apparatus. Stay upwind. Use water spray to "knock down" dust tablets and remove discharged material. Notify local health and pollution control agencies.</p>		
<p>Not flammable POISONOUS GASES MAY BE PRODUCED WHEN HEATED.</p>		
Fire		
Exposure	<p>CALL FOR MEDICAL AID</p> <p>DUST POISONOUS IF INHALED. Irritating to eyes, nose and throat. Move victim to fresh air. If in eyes, hold eyelids open and flush with plenty of water. If breathing is difficult, give oxygen.</p> <p>SOLID POISONOUS IF SWALLOWED. Irritating to skin and eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. If in EYES, hold eyelids open and flush with plenty of water. If SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. If SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.</p>	
Water Pollution	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water streams. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>	
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Use warning-water containers. Should be removed. Chemical and physical treatment.</p>		<p>2. LABEL 2.1 Category: None 2.2 Class: Not pertinent</p>
<p>3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: To be developed 3.2 Formula: C₆H₉N₃Cl 3.3 MSD/UN Designation: 6.1/1000 3.4 DOT ID No.: 1000 3.5 CAS Registry No.: 1912-24-9</p>		<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Solid 4.2 Color: White 4.3 Odor: Data not available</p>
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Dust mask, goggles, rubber gloves. 5.2 Symptoms Following Exposure: Irritates eyes and skin. If ingested, irritates mouth and stomach. 5.3 Treatment of Exposure: EYES: Flush with copious amounts of water for 15 min. SKIN: Wash with large amounts of water. INGESTION: no specific antidote; induce vomiting and give a saline laxative and supportive therapy. 5.4 Threshold Limit Value: 5 mg/m³ 5.5 Short Term Inhalation Limit: Data not available 5.6 Toxicity by Ingestion: Grade 2; oral rat LD₅₀ = 3000 mg/kg 5.7 Lethal Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors are nonirritating to eyes and throat. 5.9 Liquid or Solid Irritant Characteristics: Causes sunburn of the skin and first-degree burns on short exposure and may cause second-degree burns on long exposure. 5.10 Odor Threshold: Data not available 5.11 IDLH Value: Data not available</p>		

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: Not flammable 6.2 Flammable Limits in Air: No reaction 6.3 Fire Extinguishing Agents: Not pertinent 6.4 Fire Extinguishing Agents Not to be Used: Data not available 6.5 Special Hazards of Combustion Products: Irritating hydrogen chloride and toxic oxides of nitrogen may be formed. 6.6 Behavior in Fire: Not pertinent 6.7 Ignition Temperature: Not pertinent 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Not pertinent 6.10 Autoxidative Flame Temperature: Data not available 6.11 Self-Heating Air to Fuel Ratio: Data not available 6.12 Plasma Temperature: Data not available</p>		<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) II</p>												
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Bases: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Meter Ratio (Reagent to Product): Data not available 7.8 Reactivity Group: Data not available</p>		<p>11. HAZARD CLASSIFICATIONS</p> <p>11.1 Code of Federal Regulations: Not listed 11.2 HAS Hazard Rating for Bulk Water Transportation: <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>0</td> </tr> <tr> <td>Health</td> <td>0</td> </tr> <tr> <td>Vapor Weight</td> <td>0</td> </tr> <tr> <td>Liquid or Solid Weight</td> <td>2</td> </tr> <tr> <td>Poisons</td> <td>0</td> </tr> </tbody> </table> <p>Water Pollution Human Toxicity: 3 Aquatic Toxicity: 2 Aesthetic Effect: 3 Reactivity Other Chemicals: 1 Water: 1 Self Reaction: 0</p> <p>11.3 NFPA Hazard Classification: Not listed</p> </p>	Category	Rating	Fire	0	Health	0	Vapor Weight	0	Liquid or Solid Weight	2	Poisons	0
Category	Rating													
Fire	0													
Health	0													
Vapor Weight	0													
Liquid or Solid Weight	2													
Poisons	0													
<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: 12.6 mg/l /48 hr rainbow trout/TL₅₀/fresh water 8.2 Waterfowl Toxicity: >2000 mg/kg LD₅₀ Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: None</p>		<p>12. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 215.7 12.3 Boiling Point at 1 atm: Decomposes 12.4 Freezing Point: 347°F = 175°C = 348°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: (rel.) 1.2 at 20°C (solid) 12.8 Liquid Surface Tension: Not pertinent 12.9 Liquid Water Interfacial Tension: Not pertinent 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: (rel.) -8,500 Btu/lb = -2,300 cal/g = -220 x 10³ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data not available 12.28 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available</p>												
<p>9. SHIPPING INFORMATION</p> <p>9.1 Grades of Purity: Various grades, 70-80%. Mixture with sodium chlorate and sodium metaborate. 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open</p>														
<p>NOTES</p>														

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
 1145 CATALYN STREET
 SCHENECTADY, NY 12303-1836 USA
 (518) 377-8855



No. 410

CARBON TETRACHLORIDE

Revisor A

Date December 1980

SECTION I. MATERIAL IDENTIFICATION			
MATERIAL NAME: CARBON TETRACHLORIDE OTHER DESIGNATIONS: Tetrachlormethane, Perchlormethane, Methane Tetrachloride, CCl ₄ , GE Material D5B50, CAS #000 056 235 MANUFACTURER: Available from several suppliers, including: Linden Chemicals & Plastics PO Drawer J, Phone: (314) 843-1310 Moundsville, WV 26041			
SECTION II. INGREDIENTS AND HAZARDS		%	HAZARD DATA
Carbon Tetrachloride		ca 100	8-hr TWA 5 ppm (skin) or 30 mg/m ³ * Human, oral LDLo 43 mg/kg Human, inhalation LCLo 1000 ppm TCLo 20 ppm (CNS) Hamsters and mice have developed cancer on long term feeding.
*ACGIH (1980 Intended Changes List). OSHA 8-hr TWA is 10 ppm. NIOSH has proposed a 10-hr TWA of 2 ppm. ACGIH and NIOSH recommend labeling as a suspected human carcinogen. (skin) notation indicates absorption through the skin can contribute significantly to overall exposure.			
SECTION III. PHYSICAL DATA			
Boiling point at 1 atm, deg C --- 76.7		Specific gravity, 25/4 C --- 1.585	
Vapor pressure @ 20 C, mm Hg ---- ca 91		Melting point, deg C ----- -23	
Vapor density (Air=1) ----- 5.3		Volatiles, % ----- ca 100	
Solubility in water @ 20 C, wt % - 0.08		Molecular weight ----- 153.8	
Appearance & Odor: A clear, colorless liquid with a characteristic sweetish odor. Odor recognition threshold (100% of test panel): 21.4 ppm in air when prepared from CS ₂ ; 100 ppm in air when prepared from CH ₄ . Odor may not be objectionable at acutely toxic levels.			
SECTION IV. FIRE AND EXPLOSION DATA			LOWER
Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	UPPER
Extinguishing Media: It is nonflammable. Use that which is appropriate for the surrounding fire. Use water spray to cool fire-exposed containers. When involved in a fire situation, this material will emit highly toxic and irritating fumes and gases. Metals, such as aluminum and magnesium, can react violently with carbon tetrachloride when hot or burning. Firefighters must wear self-contained breathing apparatus and full protective gear to fight fires involving this material.			
SECTION V. REACTIVITY DATA			
This material is stable under normal conditions of handling and use. It does not polymerize. Thermal-oxidative decomposition will produce toxic, corrosive fumes, including phosgene and hydrogen chloride. Violent reactions or explosions can occur with incompatible materials, such as barium, lithium, sodium, and potassium metal, powdered aluminum, magnesium, dimethylformamide (above 65 C), fluorine, etc. (See NFPA, "Manual of Hazardous Chemical Reactions".)			

SECTION VI. HEALTH HAZARD INFORMATION	TLV 5 ppm (skin) (See Sect. II)
<p>Carbon tetrachloride is highly toxic and irritating by inhalation and ingestion (mean lethal dose is 5-10 ml). It is toxic by skin absorption. Excessive exposure may result in CNS depression and/or gastrointestinal symptoms.* It is irritating to skin and eyes. Eye contact or systemic effects can produce visual disturbances (haze, blind spots, narrowing of visual field, etc.). Skin contacts can cause defatting & dermatitis.</p> <p>Kidney & liver damage can occur from severe acute or chronic exposure. It is a suspected carcinogen in humans.</p> <p style="text-align: center;">FIRST AID:</p> <p>Eye Contact: Flush eyes with running water for 15 minutes, including under the eyelids. Get medical help if irritation persists or when visual disturbances occur.</p> <p>Skin Contact: Remove contaminated clothing promptly. Wash exposed skin with soap and water. Get medical help for repeated or gross exposures.</p> <p>Inhalation: Remove to fresh air. Restore and/or support breathing; have qualified person administer oxygen if needed. Get medical help.</p> <p>Ingestion: Contact physician for gastric lavage. (If medical help and advice is not readily available, give water to drink and induce vomiting.)</p> <p>*Also cardiac arrhythmias.</p>	
SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES	
<p>Notify safety personnel when large spills occur. Evacuate area. Provided maximum exhaust ventilation. Clean-up personnel must use protection against contact and inhalation (see Sect. VIII). Contain spill; pick up liquid for disposal. Small spills and residues can be absorbed on paper, vermiculite, etc. and allowed to evaporate in a hood. Prevent release of CCl₄ to surface water or sewers. Spills or discharges in 24 hours of 5000 lb or more (proposed RQ* is 1000 lb) must be reported to U.S. Government.</p> <p>DISPOSAL: Consider recovery and reuse, if feasible. Scrap may be burned in approved, high temperature incinerator with scrubber or it may be disposed of as hazardous waste (EPA number U211 or F001 as a spent degreasing solvent under RCRA). Follow Federal, State and Local regulations.</p> <p>*Reportable Quantity.</p>	
SECTION VIII. SPECIAL PROTECTION INFORMATION	
<p>Provide general and local exhaust ventilation to meet TLV. Exhaust hoods need 100 fpm min. face velocity. Ventilate sumps and low lying areas. Use air-supplied or self-contained respirators above TLV, with full face piece above 100 ppm.</p> <p>PVA or neoprene gloves and protective clothing needed to prevent skin contact. Wear safety goggles and/or face shield for eye protection.</p> <p>An eyewash station and chemical safety shower should be readily accessible.</p> <p>Provide preplacement and twice a year medical exams. Workers with obesity, diabetes, alcoholism or pulmonary problems should have a physician's approval before working with CCl₄. Retain medical records for 30 years after termination of employment.</p> <p>Provide training to those exposed to CCl₄ in the workplace. Monitor vapor levels in the workplace.</p>	
SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS	
<p>Store in closed containers in a cool, dry, well-ventilated, low fire-risk area. Protect containers against physical damage. Keep away from sources of heat, direct sunlight, and incompatible materials (see Sect. V). Prevent exposure of vapors to high temperature to prevent decomposition to toxic and corrosive gases and vapors. No smoking in areas where vapors may be present.</p> <p>Prevent contact with the skin or eyes. Avoid exposure to vapors. Use good personal hygiene.</p> <p>CCl₄ toxicity is markedly increased by the synergistic effects of alcohol. When possible, substitute a less hazardous solvent for CCl₄. DOT Classification - ORM-A</p>	
<p>DATA SOURCE(S) CODE: 1-12,15,16,21-26,31,37,38,43</p> <p><small>Judgments as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations and assumes no responsibility as to the accuracy or suitability of such information for application to purchaser's intended purposes or for consequences of its use.</small></p>	<p>APPROVALS: MIS CRD <i>J. M. [Signature]</i></p> <p>Industrial Hygiene and Safety <i>[Signature]</i> 12-9-80</p> <p>MEDICAL REVIEW: 16 Dec. 1980</p>

Material Safety Data Sheet

From Genium's Reference Collection
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No. 53

CHLORINE
 (Revision B)
 Issued: July 1979
 Revised: April 1988

SECTION 1. MATERIAL IDENTIFICATION

25

Material Name: CHLORINE

Description (Origin/Uses): Used mainly to manufacture chlorinated lime for bleaching fabrics; as a versatile reagent in organic chemistry; in water purification; and as a military poison gas (bertholite).

Other Designations: Bertholite; Molecular Chlorine; Cl₂; NIOSH RTECS No. FO2100000;
CAS No. 7782-50-5

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.



HMIS
 H 3
 F 0 R 1
 R 1 I 4
 PPG* S 4
 *See sect. 8 K 0

SECTION 2. INGREDIENTS AND HAZARDS

Chlorine, CAS No. 7782-50-5

%
 ca 100

EXPOSURE LIMITS

IDLH* Level: 30 ppm
OSHA PEL
 Ceiling: 1 ppm, 3 mg/m³
 TLV-STEL: 3 ppm, 9 mg/m³
NIOSH REL
 15-Min Ceiling: 0.5 ppm, 1.45 mg/m³
Toxicity Data**
 Rat, Inhalation, LC₅₀: 293 ppm (1 Hr)
 Mouse, Inhalation, LC₅₀: 137 ppm (1 Hr)

*Immediately dangerous to life and health
 **See NIOSH, RTECS, for additional data with references to irritative and mutagenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: ca -29°F (-34°C)
Vapor Pressure: >760 Torrs (Normal Atmospheric Pressure)
Vapor Density (Air = 1): 1.4085 at 68°F (20°C)

Melting Point: ca -150°F (-101°C)
Molecular Weight: 71 Grams/Mole
Water Solubility: Slight

Appearance and Odor: A greenish yellow, noncombustible gas; pungent, suffocating, nauseating odor. Its odor-recognition threshold is reported to be ca 0.3 ppm.

SECTION 4. FIRE AND EXPLOSION DATA

LOWER UPPER

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air
*	*	% by Volume

* *

Extinguishing Media: *Chlorine will not burn, but it supports combustion of materials already involved in a fire. Use agents that will extinguish the surrounding fire. Use a water spray to cool fire-exposed tanks and to protect personnel attempting to stop a chlorine leak.
Unusual Fire or Explosion Hazards: Chlorine is a reactive/explosive gas. Fight fires involving it from the maximum possible distance; this gas greatly increases the flammability hazards of other combustibles that are present. **Warning:** Flammable gases, vapors, and mists form dangerously explosive mixtures with chlorine gas.
Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Fire fighters must use the maximum personal protective equipment available. If possible, have specially trained personnel remove intact cylinders of chlorine from the fire area and protect them with any available resource such as directed water spray.

SECTION 5. REACTIVITY DATA

Chlorine is stable in closed, pressurized containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Chemical Incompatibilities: Chlorine reacts dangerously with acetylene, ammonia, hydrogen, ether, fuel gas, hydrocarbons, turpentine, finely divided metals, diborane, benzene, and acetaldehyde (see Genium ref. 84, pp. 49-28 and 491M-53 to 491M-56).

Conditions to Avoid: Do not allow open flame, unprotected heaters, lighted tobacco products, electric sparks, or excessive heat in work areas because chlorine gas can form explosive mixtures with other gases. Do not heat pressurized storage tanks or cylinders containing chlorine because they may explode. Do not allow chlorine to be directly exposed to incompatible chemicals (see above).

Hazardous Products of Decomposition: Toxic gases such as carbon monoxide, phosgene, and hydrogen chloride (Genium Industrial MSDSs 35, 66, 30) can be produced in fires involving chlorine and other combustibles.

SECTION 6. HEALTH HAZARD INFORMATION

Chlorine is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks, Warning: This material is a powerful respiratory irritant. The most important acute health effect of exposure is lung damage from hydrochloric acid (HCl) caused by the reaction of chlorine with the moisture in the upper respiratory tract (URT). Fatal pulmonary edema (lungs filled with fluid) may be delayed from 24 to 48 hours after exposure. Erosion of teeth, decreased lung capacity, and increased susceptibility to tuberculosis are chronic effects in workers who handle this gas. **Medical Conditions Aggravated by Long-Term Exposure:** Cardiac, pulmonary, or respiratory problems. Administer preplacement and periodic medical exams emphasizing the respiratory system to workers who regularly handle chlorine. **Target Organs:** Respiratory system. **Primary Entry:** Inhalation, skin contact. **Acute Effects:** Burning and severe irritation of the eyes, skin, and URT; wheezing, shortness of breath; nausea; vomiting; headache; dizziness; and (delayed) pulmonary edema. **Chronic Effects:** Reduced respiratory capacity may result from chronic low-level exposure to chlorine.

FIRST AID: Eyes. Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin.** Skin contact with chlorine causes severe damage from frostbite (cryogenic injury) as well as chemical burns. Irrigate the area with water and treat the exposed person accordingly. **Inhalation.** Remove exposed person to fresh air; restore and/or support his or her breathing as needed. Recommended treatment includes administering pure oxygen gas (O₂) as soon as symptoms of exposure develop (Genium ref. 39, p. 1975). Observe exposed person for respiratory effects. **Ingestion.** This type of exposure to chlorine is highly unlikely because it is a gas.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Preplan and carefully explain proper emergency procedures to relevant personnel. Notify safety personnel, evacuate all non-essential personnel, provide maximum explosion-proof ventilation, and eliminate all sources of ignition immediately. Cleanup personnel must wear protection against contact with and inhalation of vapor (see sect. 8). Try to shut off the flow of chlorine gas. Use a water spray to protect personnel attempting to stop the leak.

Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z): Not Listed

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste: Listed without Number

CERCLA Hazardous Substance, Reportable Quantity: 10 lbs (4.54 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines in 29 CFR 1910.133. **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. For emergency or nonroutine use (e.g., cleaning reactor vessels or storage tanks) wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves; boots; aprons; and clean, impervious, body-covering clothing to prevent any possibility of skin contact. **Ventilation:** Install and operate general and local ventilation systems powerful enough to maintain airborne levels of chlorine gas strictly below the OSHA PEL standard cited in section 2. Make all ventilation systems of maximum explosion-proof design, e.g., nonsparking, electrically grounded and bonded, etc. **Safety Stations:** Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. **Other:** Use enclosed-containment processing operations; otherwise, the ventilation systems may not be able to keep airborne levels of chlorine below the legal ceiling limit of 1 ppm (3 mg/m³) set by OSHA. Automatic air-monitoring sensing equipment connected to an alarm system is recommended for continual-use operations. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Avoid prolonged skin contact with this material.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store chlorine in a cool, dry, well-ventilated area away from organics, sources of ignition, any flammable or explosive materials, cylinders containing oxygen, and incompatible chemicals (see sect. 5). Use outside or detached storage. Store cylinders upright and secure them tightly. **Special Handling/Storage:** Chlorine is shipped/stored as a pressurized gas in cylinders or tank cars. Protect them against physical damage and regularly inspect them for cracks, leaks, or faulty valves. Follow standard safety procedures for handling compressed, corrosive gases. Electrically ground and bond all containers used in shipping and transferral operations to prevent static sparks. Do not drag or slide cylinders containing chlorine; move them in a carefully supervised manner with a suitable hand truck. Do not smoke in use or storage areas. **Engineering Controls:** All engineering systems (ventilation, production, etc.) must be of maximum explosion-proof design. Use chlorine in closed engineering systems to prevent dispersion of this gas into general work areas. Monitor all piping systems, reactor vessels, and holding tanks for unwanted moisture contamination or buildup. Liquid chlorine levels should be less than 85% of a tank's or cylinder's capacity. **Comments:** Perform all operations with chlorine carefully to prevent accidental ignition of explosive mixtures. Prevent any contact with incompatible chemicals (see sect. 5). Keep the valve-protection cap in place until immediately before using chlorine. Insert a check valve or trap into the transferral line to prevent a dangerous backflow into the original container. Use a pressure-reducing regulator when connecting a storage vessel to a lower-pressure piping system. A trained chemist or safety specialist familiar with the physical and chemical properties of this gas should be present during all work operations.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Chlorine

DOT Class: Nonflammable Gas

References: 1, 2, 12, 73, 84-94, 100, 103.

DOT Label: Nonflammable Gas and Poison

DOT ID No. UN1017

IMO Label: Poison Gas

IMO Class: 2.3

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Material Safety Data Sheet

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No. 315

CHLOROFORM
 (Revision D)
 Issued: August 1979
 Revised: April 1988

25

SECTION 1. MATERIAL IDENTIFICATION

Material Name: CHLOROFORM

Description (Origin/Uses): Used as a solvent for fats, oils, rubber, alkaloids, waxes, and resins; as a cleansing agent.

Other Designations: Trichloromethane; CHCl₃; NIOSH RTECS No. FS9100000; CAS No. 0067-66-3

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

HMIS
 H 2
 F 0
 R 0
 PPG*
 *See sect. 8

R 1
I 3
S 2
K 0

SECTION 2. INGREDIENTS AND HAZARDS

Chloroform, CAS No. 0067-66-3

EXPOSURE LIMITS

Ca 100

OSHA PEL
 Ceiling: 50 ppm, 240 mg/m³

ACGIH TLV, 1987-88
 TLV-TWA: 10 ppm, 50 mg/m³

NIOSH REL
 Ceiling: 2 ppm, 9.78 mg/m³

Toxicity Data*
 Human, Oral, LD₅₀: 140 mg/kg
 Rat, Oral, LD₅₀: 908 mg/kg

*See NIOSH, RTECS, for additional toxicity data with references to mutagenic, reproductive, tumorigenic, and irritative effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 142°F (61°C)
Melting Point: -82.3°F (-63.5°C)
Vapor Pressure: 158.4 Torr at 68°F (20°C)
Vapor Density (Air = 1): 4.13

Water Solubility (%): 0.822 ml of CHCl₃ per 100 ml of H₂O at 68°F (20°C)
% Volatile by Volume: 100
Molecular Weight: 119 Grams/Mole
Specific Gravity (H₂O = 1): 1.484 at 68°F (20°C)

Appearance and Odor: A heavy, colorless, clear, volatile liquid; characteristic, pleasant, ethereal, sweet odor (recognition threshold: 0.3 mg/m³); sweet taste.

SECTION 4. FIRE AND EXPLOSION DATA

			LOWER	UPPER
Flash Point and Method	Autoignition Temperature	Flammability Limits in Air		
*	*	% by Volume	*	*

Extinguishing Media: *Chloroform does not burn. Use an agent that will put out the surrounding fire.

Unusual Fire or Explosion Hazards: None reported.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Chloroform is stable if kept in closed containers and protected from air and sunlight. It does not undergo hazardous polymerization; however, even when stabilized with ethanol, this material develops acidity from prolonged exposure to air and light.

Chemical Incompatibilities: This material is incompatible with strong alkalies.

Conditions to Avoid: Avoid prolonged exposure to air and light and to strong alkalies.

Hazardous Products of Decomposition: Toxic and corrosive gases like hydrochloric acid (HCl), chlorine (Cl₂), carbon monoxide (CO), and oxides of chlorine (ClO_x) can be produced during fires.

SECTION 6. HEALTH HAZARD INFORMATION

Chloroform is listed as a suspected human carcinogen by ACGIH.

Summary of Risks: Exposure to this material affects the central nervous system (anesthesia); heart (arrhythmia, ventricular tachycardia, bradycardia); liver (necrosis, hepatoma); kidney (necrosis); and it is an embryonic toxin. Fatalities are associated with cardiovascular depression and ventricular fibrillation.

Medical Conditions Aggravated by Long-Term Exposure: Ailments of the heart, liver, and kidneys may be worsened by exposure to chloroform. **Target Organs:** Liver, kidneys, heart, skin, eyes. **Primary Entry:** Skin contact, inhalation.

Acute Effects: Dizziness, mental dullness, nausea, headache, fatigue, and anesthesia. **Chronic Effects:** Possible cancer.

FIRST AID

Eyes: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes.
Skin: Immediately wash the affected area with soap and water. **Inhalation:** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed.

Ingestion: Never give anything by mouth to someone who is unconscious or convulsing. If the exposed person is responsive, give him or her several glasses of milk or water to drink and induce vomiting. Repeat if large quantities were ingested.

Comments: Workers who are regularly exposed to chloroform require preplacement and periodic medical exams emphasizing kidney, liver, skin, and central nervous system functions. Carefully evaluate each exposure that produces a noticeable effect to determine the extent to which factors like alcohol or drugs have affected it.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel of a chloroform spill or leak. Provide ventilation. Cleanup personnel need protection against contact with and inhalation of vapor (see sect. 8). Chloroform vapor is heavier than air and will collect in low-lying areas. Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.

Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z)

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. U044

CERCLA Hazardous Substance, Reportable Quantity: 5000 lbs (2270 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield as a supplementary protective measure. Follow the eye- and face-protection guidelines in 29 CFR 1910.133. **Respirator:** Wear a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. For emergency or nonroutine use (e.g., cleaning reactor vessels or storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will not protect workers in oxygen-deficient atmospheres. **Other:** To prevent contact with skin, wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specific work environment. **Ventilation:** Install and operate general and local ventilation systems that are powerful enough to maintain airborne levels of chloroform below the OSHA PEL standard cited in section 2.

Safety Stations: Make eyewash stations, washing facilities, and safety showers available in use and handling areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do not wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do not eat, drink, or smoke in any work area. Avoid inhalation of vapor!

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store chloroform in closed containers away from light and alkalis.

Special Handling/Storage: Protect containers from physical damage. Do not transfer chloroform through plastic or rubber hoses or pipes.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Chloroform

DOT Class: ORM-A

DOT Label: None

DOT ID No. UN1888

IMO Label: Poison

IMO Class: 6.1

References: 1, 2, 12, 73, 84-94, 100, 103.

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Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD

Special Fire Fighting Procedures:

Self-contained air supply. Confine water used in fire fighting.

Unusual Fire and Explosion Hazards:

Noxious fumes may form. Material undergoes rapid exothermic decomposition at 190°C. Vapors may ignite.

SECTION V REACTIVITY DATA

Stability: Stable in normal use and storage.

Conditions to Avoid: Heating above 100°C. Product undergoes rapid exothermic decomposition at 190°C. Avoid ignition sources.

Incompatibility: Strong Bases and Strong Oxidizers

Hazardous Decomposition or Byproducts: Oxides of Nitrogen

Hazardous Polymerization: Will not occur. No known conditions to avoid.

SECTION VI HEALTH HAZARD DATA

Route(s) of Entry: Inhalation: Moderate Toxicity
 Skin: Readily Absorbed
 Ingestion: Highly Toxic

Health Hazards (Acute and Chronic):

Oral Ingestion: High Single Dose Oral Toxicity.
 LD₅₀ for Rats 25 mg/kg.
 May be fatal if swallowed.

Eye Contact: May cause severe irritation and corneal injury. Corneal injury should heal in 1-2 weeks.

Skin Contact: May cause slight irritation or mild burn. Colors the skin yellow.

Skin Absorption: Readily absorbed through skin, high toxicity. LD₅₀ rabbits 80mg/kg.

Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m³.

Carcinogenicity: NTP: Negative
 IARC Monographs: Negative
 OSHA Regulated: Negative

Signs and Symptoms of Exposure: Fatigue, sweating, thirst, and fever. Increased metabolic rate.

Medical Conditions Generally Aggravated by Exposure: Liver and kidney problems may be aggravated by extreme exposure.

Emergency and First Aid Procedures:

Oral Ingestion: Toxic by ingestion. Induce vomiting and seek medical help immediately.

Eye Contact: Flush immediately with continuous irrigation with flowing water for at least thirty minutes. Seek medical consultation immediately.

Skin Contact: Immediately flush skin with plenty of water for at least fifteen minutes while removing contaminated clothing. Consult physician. Wash clothing before reuse.

Inhalation: Remove to fresh air if effects occur. Consult physician.

Note to Physician:

Eyes: Stain for evidence of corneal injury. If cornea is burned, instill antibiotic steroid preparation frequently. Consult ophthalmologist. May cause temporary injury.

Overexposure: Treat for symptoms. No specific antidote. Human effects not established.

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to Be Taken in Case Material Is Released or Spilled:

Use proper safety equipment. Absorb spill with absorbant inert material such as oil-dry. Dike area for large spills. Keep out of streams and water supplies.

Waste Disposal Method:

Dispose of in non-crop area away from water supplies or in an approved landfill in accordance with State, Federal, and local regulations.

Precautions to Be Taken in Handling and Storing:

Do not get on skin, on clothing, or in eyes. Keep out of reach of children.

Other Precautions:

Do not breathe spray mists. Keep away from heat or flame.

SECTION VIII CONTROL MEASURES

Respiratory Protection:

None normally needed. During spraying use organic vapor respirator.

Ventilation: Required to control level of dinoseb.

Protective Gloves: Impervious rubber gloves

Eye Protection: Chemical workers' goggles

Other Protective Clothing or Equipment: Rubber boots and apron and body-covering clothing.

Work/Hygenic Practices: Shower after handling.

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No. 385

ETHYL BENZENE
(Revision A)
Issued: August 1978
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION 27

Material Name: ETHYL BENZENE

Description (Origin/Uses): Used as a solvent and as an intermediate in the production of styrene monomer.

Other Designations: Phenylethane; Ethylbenzol; C_8H_{10} ; CAS No. 0100-41-4

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.



NFPA

HMIS
H 2 R 1
F 3 I 3
R 0 S 2
PPG* K 4
*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

Ethyl Benzene, CAS No. 0100-41-4

%
Ca 100

EXPOSURE LIMITS

OSHA PELs
8-Hr TWA: 100 ppm, 435 mg/m³
15- Min STEL: 125 ppm, 545 mg/m³

ACGIH TLVs, 1988-89
TLV-TWA: 100 ppm, 435 mg/m³
TLV-STEL: 125 ppm, 545 mg/m³

Toxicity Data*
Human, Inhalation, TC_{L_0} : 100 ppm (8 Hrs)
Rat, Oral, LD_{50} : 3500 mg/kg

*See NIOSH, *RTECS* (DA0700000), for additional data with references to reproductive, irritative, and mutagenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 277°F (136°C)

Melting Point: -139°F (-95°C)

Vapor Pressure: 7.1 Torr at 68°F (20°C)

Vapor Density (Air = 1): 3.7

% Volatile by Volume: Ca 100

Molecular Weight: 106 Grams/Mole

Solubility in Water (%): Slight

Specific Gravity ($H_2O = 1$): 0.86258 at 77°F (25°C)

Appearance and Odor: A clear, colorless, flammable liquid; characteristic aromatic hydrocarbon odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method: 64°F (18°C) CC

Autoignition Temperature: 810°F (432.22°C)

LEL: 1% v/v

UEL: 6.7% v/v

Extinguishing Media: Use foam, dry chemical, or carbon dioxide to put out ethyl benzene fires. A water spray may be ineffective in extinguishing the fire, because it can scatter and spread the burning liquid. Use water spray to cool fire-exposed containers of ethyl benzene, to disperse ethyl benzene vapor, and to protect personnel attempting to stop an ethyl benzene leak. Unusual Fire or Explosion Hazards: This liquid can readily form explosive vapor-air mixtures, especially when heated. Ethyl benzene vapor is heavier than air and may travel a considerable distance to a low-lying source of ignition and flash back to its origin. Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Ethyl benzene is stable in closed containers during routine operations. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Hazardous chemical reactions can occur between ethyl benzene and strong oxidizing agents, acids, ammonia, and bases. Conditions to Avoid: Avoid any exposure to sources of ignition such as heat, sparks, open flame, and lighted tobacco products, etc., and to incompatible chemicals. Use caution when entering confined spaces, particularly low-lying areas where explosive concentrations of ethyl benzene vapor may be present. Provide good ventilation to such areas to prevent the concentration of this vapor. Hazardous Products of Decomposition: Thermal-oxidative degradation can include toxic gases such as carbon monoxide and/or aromatic hydrocarbon gases.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Ethyl benzene is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: Ethyl benzene vapor is severely irritating to the eyes and to the mucous membranes of the respiratory system. Sustained inhalation of excessive levels can cause depression of the central nervous system (CNS) characterized by dizziness, headache, narcosis, and coma. Skin contact with liquid ethyl benzene causes irritation; dermatitis and defatting can also develop. The acute oral toxicity of ethyl benzene is low; however, ingestion of it presents a serious aspiration hazard. Aspirating even a small amount into the lungs can result in extensive edema (lungs filled with fluid) and hemorrhaging of the lung tissue. No systemic effects are expected at the levels that produce pronounced, unignorable, disagreeable skin and eye irritation. The TLVs cited in section 2 are set to prevent this intolerable irritation. Medical Conditions Aggravated by Long-Term Exposure: None reported. Target Organs: Skin, eyes, respiratory system, and CNS. Primary Entry: Inhalation, skin contact. Acute Effects: Irritation of the skin, eyes, and respiratory system. Also, cardiac-rhythm disturbance due to sensitization; acute bronchitis, bronchospasm, pulmonary and laryngeal edema; euphoria; headache; giddiness; dizziness; and incoordination, as well as possible depression; confusion; and coma. Chronic Effects: None reported. First Aid: Eyes. Immediately

SECTION 6. HEALTH HAZARD INFORMATION, cont.

flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes. Skin. Rinse the affected area with plenty of water, then wash it with soap and water. Inhalation. Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. Ingestion. Unlikely. Should this type of exposure occur, the aspiration hazard must be considered. Do not induce vomiting unless directed to do so by a physician. To prevent aspiration by spontaneous vomiting, keep the victim's head low (between his or her knees). Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid. Note to Physician: Professional judgment is required as to whether or not to induce vomiting because of the possibility of aspiration. A gastric lavage may be administered, followed by saline catharsis, if this procedure is appropriate to the specific incident. Monitor cardiac and pulmonary functions.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately, and provide adequate explosion-proof ventilation. Cleanup personnel need protection against skin or eye contact with this liquid as well as inhalation of its vapor (see sect. 8). Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways. Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).

EPA Designations (40 CFR 302.4)

CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per the Clean Water Act (CWA), §§ 311 (b) (4) and 307 (a).

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). Respirator: Wear a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. Warning: Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. Other: Wear impervious gloves, boots, aprons, and gauntlets, etc., to prevent prolonged or repeated skin contact with this material. Ventilation: Install and operate general and local maximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of this material below the OSHA PEL standard cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. Contaminated Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment. Comments: Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale ethyl benzene vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store ethyl benzene in closed containers in a cool, dry, well-ventilated area away from sources of ignition and strong oxidizers. Protect containers from physical damage. Special Handling/Storage: Outside, isolated, detached, or remote storage is recommended for large quantities of ethyl benzene. Isolate bulk storage areas from acute fire hazards. Engineering Controls: Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. To prevent static sparks, electrically ground and bond all containers, pipelines, etc., used in shipping, transferring, reacting, production, and sampling operations. Other: Use safety cans for transferring small amounts of ethyl benzene.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Ethyl Benzene

DOT Hazard Class: Flammable Liquid

ID No. UN1175

DOT Label: Flammable Liquid

DOT Packaging Exceptions: 49 CFR 173.118

DOT Packaging Requirements: 49 CFR 173.119

IMO Shipping Name: Ethylbenzene

IMO Hazard Class: 3.2

IMO Label: Flammable Liquid

IMDG Packaging Group: II

References: 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

Judgments as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of such information, Genium Publishing Corp. extends no warranties, makes no representations and assumes no responsibility as to the accuracy or suitability of such information for application to purchaser's intended purposes or for consequences of its use.

Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: W Silverman, MD

METHANEARSONIC ACID, SODIUM SALT

MSA

<p>Common Synonyms Dodecyl methane arsonate Monosodium methane arsonate MSAA DBMA Dodecyl methyl arsonate Monosodium methyl arsonate</p>		<p>Solid Colorless solid; solution may be red or green</p> <p>Colorless</p> <p>Solid may float or sink in water; solid and solution mix with water.</p>
<p>Stop discharge if possible Avoid contact with solid and solution. Isolate and remove discharged material. Notify local health and pollution control agencies</p>		
<p>Fire</p>	<p>Not flammable POISONOUS GASES ARE PRODUCED WHEN HEATED. Wear goggles and self-contained breathing apparatus.</p>	
<p>Exposure</p>	<p>CALL FOR MEDICAL AID</p> <p>SOLID OR SOLUTION Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyes open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.</p>	
<p>Water Pollution</p>	<p>Dangerous to aquatic life in high concentrations. May be dangerous if it enters water intake. Notify local health and wildlife officials. Notify operators of nearby water intake.</p>	
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) toxic & -ing-poison, water air pollutant Should be removed Chemical and physical treatment</p>	<p>2. LABEL 2.1 Category: Poison 2.2 Class: 6</p>	
<p>3. CHEMICAL DESIGNATIONS 3.1 CB Compatibility Class: Not listed 3.2 Formula: $\text{CH}_3\text{AsO}(\text{OH})(\text{ONa})$ $\text{CH}_3\text{AsO}(\text{ONa})_2 \cdot 6\text{H}_2\text{O}$ 3.3 MSD/UN Designator: 6.1/1557 3.4 DOT ID No.: 1567 3.5 CAS Registry No.: 2163-90-6</p>	<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (see shipped): Solid or water solution 4.2 Color: Colorless; solutions may contain red or green dyes 4.3 Odor: None</p>	
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Protective clothing to prevent contact with skin; chemical goggles.</p> <p>5.2 Symptoms Following Exposure: Subacute poisoning by arsenicals causes salty taste, burning in throat and stomach, and vesicular pain. Acute toxicity indicated by headache, vomiting, stupor, convulsions, paralysis. About 1 ounce to 1 pound must be taken to cause these symptoms.</p> <p>5.3 Treatment of Exposure: INGESTION: cause vomiting; give water and repeat; give a saline cathartic such as sodium sulfate. SKIN: wash with soap and water. EYES: wash with water; consult physician if irritation remains.</p> <p>5.4 Threshold Limit Value: Data not available 5.5 Short Term Inhalation Limit: Not pertinent 5.6 Toxicity by Ingestion: Grade 2; $\text{LD}_{50} = 0.5-5 \text{ g/kg (rat)}$ 5.7 Lethal Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: None 5.9 Liquid or Solid Irritant Characteristics: Repeated contact may cause skin sensitivity. 5.10 Odor Threshold: Not pertinent 5.11 IDLH Value: Data not available</p>		

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: Not flammable 6.2 Flammable Limits in Air: Not flammable 6.3 Fire Extinguishing Agents: Not pertinent 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Toxic gases may be generated in fire. 6.6 Behavior in Fire: Not pertinent 6.7 Ignition Temperature: Not flammable 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Not flammable 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>	<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) SS</p>
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity With Water: None 7.2 Reactivity with Common Materials: None 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Bases: Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Water Reactions (Reactant to Product): Data not available 7.8 Reactivity Group: Data not available</p>	<p>11. HAZARD CLASSIFICATIONS</p> <p>11.1 Code of Federal Regulations: Poison, 6 11.2 NAE Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: Not listed</p>
<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: $> 1600 \text{ ppm/49 hr/Bluegill}$ $\text{sunfish/LC}_{50}/\text{fresh water}$ 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: Data not available</p>	<p>12. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>12.1 Physical State at 15°C and 1 atm: Solid or water solution 12.2 Molecular Weight: 162 (MSAA); 282 (DBMA hexahydrate) 12.3 Boiling Point at 1 atm: Decomposes Freezing Point: (MSAA) 243°F $= 117^\circ\text{C} = 300^\circ\text{K}$ (DBMA) 137°F = 58°C = 332°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: (MSAA) 1.0 at 80°C (solid) (MSAA solutions) 1.4-1.6 at 20°C (liquid) 12.8 Liquid Surface Tension: Not pertinent 12.9 Liquid Water Interfacial Tension: Not pertinent 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.18 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available</p>
<p>9. SHIPPING INFORMATION</p> <p>9.1 Grades of Purity: The solid dodecyl salt (DBMA) contains water crystallization. Solts are often shipped as solutions in water with concentrations up to about 50% solids. 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open</p>	<p>NOTES</p>

Material Safety Data Sheet

from Genium's Reference Collection
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GENIUM PUBLISHING CORP.

No. 310
METHYLENE CHLORIDE
(Revision F)

Issued: September 1985
Revised: November 1988

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SECTION 1. MATERIAL IDENTIFICATION

Material Name: METHYLENE CHLORIDE

Description (Origin/Uses): Used widely in paint removers, as a solvent for plastics, as a degreasing agent, in propellant mixtures for aerosol sprays, and as a blowing agent in foams.

Other Designations: Dichloromethane; Freon 30[®]; Methane Dichloride; Methylene Bichloride; Methylene Dichloride; CH₂Cl₂; CAS No. 0075-09-2

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

HMIS		NFPA	
H 2	R 1	1	
F 1	I 3	2	
R 0	S 3	3	
PCG*	K 1		

*See sect. 8



SECTION 2. INGREDIENTS AND HAZARDS/EXPOSURE LIMITS

Methylene Chloride, ca 100%

OSHA PEL

8-Hour TWA: 500 ppm

Ceiling: 1000 ppm Acceptable Maximum Peak
above the Ceiling: 2000 ppm for 5 Minutes in
Any 2-Hour Period

ACGIH TLV, 1988-89

TLV-TWA: 50 ppm, 175 mg/m³
(Adopted 1988-89)

Toxicity Data*

Rat, Oral, LD₅₀: 2136 mg/kg
Human, Inhalation, TC₀₁: 500 ppm (8 Hours)

*See NIOSH, RTECS (PA8050000), for additional data with references to irritative, reproductive, mutagenic, and tumorigenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 103.55°F (39.75°C) at 76 Torrs

Melting Point: -142°F (-96.7°C)

Vapor Density (Air = 1): 2.9

Vapor Pressure: 440 Torrs at 77°F (25°C)

Molecular Weight: 84.94 Grams/Mole

Solubility in Water (%): 1% by Weight

Specific Gravity (H₂O = 1): 1.3255 at 68°F (20°C)

% Volatile by Volume: Ca 100

Appearance and Odor: A clear, colorless, volatile liquid; distinctive, penetrating, ethereal odor. The odor will not serve as a useful warning property because concentrations of 100 ppm are not easily perceptible. Most persons can detect this odor at above 300 ppm.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point*

Autoignition Temperature: 1033°F (556°C)

LEL: 12% v/v

UEL: 19% v/v

Extinguishing Media: *Methylene chloride is not flammable under ordinary conditions. However, flammable vapor-air mixtures can form at approximately 212°F (100°C). Use water spray to cool fire-exposed containers and to flush spills away from exposures. Use extinguishing agents that will put out the surrounding fire. **Unusual Fire or Explosion Hazards:** Methylene chloride vapor is heavier than air and may collect and concentrate in low-lying, confined spaces. The high vapor pressure of methylene chloride means that when it is spilled, its vapor concentration in air can increase rapidly. If this vapor is heated, an explosion hazard is associated with the vapor-air mixture. Containers of this material may rupture violently if they are involved in fires. **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Methylene chloride is stable in closed containers during routine operations. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Methylene chloride can react dangerously with nitrogen tetroxide, liquid oxygen, potassium, sodium, sodium-potassium alloys, lithium, potassium hydroxide with N-methyl-N-nitroso urea, potassium t-butoxide, and finely powdered aluminum and magnesium. **Conditions to Avoid:** Avoid all exposure to sources of ignition, heat, and incompatible chemicals. Prolonged exposure to water may cause hydrolysis to highly corrosive hydrochloric acid when the temperature is above 140°F (60°C). In oxygen-enriched atmospheres or when heated (>212°F [100°C]), methylene chloride vapor can be readily ignited. **Hazardous Products of Decomposition:** Exposure to high temperature (from open flame, hot surfaces, uninsulated steam lines, welding arcs, etc.) can produce toxic and corrosive thermal-oxidative products of decomposition such as hydrogen chloride, carbon monoxide, and even small quantities of phosgene gas, which is extremely poisonous.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Methylene chloride is listed as a suspected human carcinogen by the ACGIH (which classifies it as a group A2 carcinogen). **Summary of Risks:** Accidental contact of liquid methylene chloride with skin or eyes causes painful irritation and possible burns if not promptly removed. Exposure by way of contaminated gloves, clothing, or paint remover formulations can produce these same irritant effects. Long-term exposure to mild or moderate doses of methylene chloride may cause a delayed (24 to 48 hours) onset of dizziness, headache, mental confusion, slurred speech, double vision, and sleeplessness. Medical recovery can be slow. Overexposure to methylene chloride can cause elevated levels of carboxy hemoglobin in the blood (this same effect results from overexposure to carbon monoxide). **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** Skin, eyes, respiratory system, CNS, liver, kidneys, and blood. **Primary Entry:** Inhalation, skin contact/absorption. **Acute Effects:** Headache, giddiness, stupor, irritability, fatigue, tingling in the limbs, and narcosis that is not usually fatal if the exposure is terminated before anesthetic death occurs. **Chronic Effects:** The ACGIH classification of this material as a suspected human carcinogen implies that cancer is a possible effect of chronic exposure to methylene chloride. **FIRST AID:** Eyes. Immediately flush eyes, including under the eyelids, gently but thoroughly with

SECTION 6. HEALTH HAZARD INFORMATION, cont.

flooding amounts of running water for at least 15 minutes. Skin. Rinse the affected area with flooding amounts of water and then wash it with soap and water. Inhalation. Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. Note to Attending Physician: Do not administer adrenalin. Ingestion. Unlikely. Should this type of exposure occur, do not induce vomiting because of the danger of aspiration. If spontaneous vomiting should occur, position the exposed person's head below his or her trunk to resist aspiration. Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid. Note to Physician: Absorbed methylene chloride is stored in body fat and metabolizes to carbon monoxide. This produced carbon monoxide increases and sustains carboxyhemoglobin levels in the blood, which concomitantly reduces the oxygen-carrying capacity of the blood. NIOSH advises preplacement and annual medical exams that emphasize liver, kidney, eye, skin, CNS, and respiratory system functions and a complete blood count. Simultaneous exposure to tobacco smoke, alcohol, and carbon monoxide, along with heavy manual labor, increases the body burden of a worker as well as the toxic hazards of the methylene chloride. In significant exposures, serum methylene chloride levels are of no clinical importance. Neurologic and hepatic status as well as carboxy hemoglobin should be monitored.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately, and provide adequate explosion-proof ventilation. Cleanup personnel need protection against this liquid's contact with the skin or eyes as well as inhalation of its vapor. Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways. Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, NO. U080

CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per the Clean Water Act (CWA), § 307 (a), and the Resource Conservation and Recovery Act (RCRA), § 3001.

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Use a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious neoprene, PVA, or Viton gloves, boots, aprons, and gauntlets, etc., to prevent any skin contact with liquid methylene chloride. **Ventilation:** Install and operate general and local maximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of acetone below the exposure limits cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. Floor or sump ventilation may be necessary. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment. **Other:** Because the health effects of carbon monoxide and methylene chloride are additive (see sect. 6), workplaces should be equipped with automatic sensing equipment that identifies workroom atmospheric levels of both of these materials. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale methylene chloride vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store methylene chloride in closed, moisture-proof containers in a cool, dry, well-ventilated area away from sources of ignition, strong oxidizers, caustics, and incompatible chemicals (see sect. 5). Protect containers from physical damage.

Special Handling/Storage: Prevent moist air from entering storage containers. Provide ventilation at the floor level in storage areas because methylene chloride vapor is denser than air. Installation of a dryer and a safety seal on each tank is recommended. Aluminum is not recommended for use as a storage material; appropriate storage materials include galvanized iron, black iron, or steel. **Engineering**

Controls: Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. Electrically ground and bond all containers and pipelines used in shipping, transferring, reacting, production, and sampling operations to prevent generating static sparks.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Dichloromethane or Methylene Chloride

DOT Hazard Class: ORM-A

ID No. UN1593

DOT Packaging Requirements: 49 CFR 173.605

DOT Packaging Exceptions: 49 CFR 173.505

IMO Shipping Name: Dichloromethane

IMO Hazard Class: 6.1

IMO Label: Saint Andrew's Cross (X)*

IMDG Packaging Group: III

*Harmful-Stow away from Foodstuffs.

References: 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

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Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD

METHYL PARATHION

MPT

Common Synonyms Mison, MPT Parath, Alkon Naran, Wolfaton O, O-Dimethyl O-p-Arophenyl Inphosphate Parathionmethyl		Solid crystals WH, a solid or brown and Rotten eggs or garlic odor
Solid and liquid are in water, solution floats on water. Melting (freezing) point is 85°F.		
AVOID CONTACT WITH LIQUID Keep people away Wear chemical protective suit with self-contained breathing apparatus. Stop discharge if possible. Call fire department. Soak and remove discharged material. Notify local health and pollution control agencies.		
Fire	Combustible POISONOUS GASES ARE PRODUCED IN FIRE AND WHEN HEATED Containers may explode in fire. Wear chemical protective suit with self-contained breathing apparatus. -Submerge tanks from safe distance or evacuated location. -Extinguish with water. -Cool exposed containers with water.	
Exposure	CALL FOR MEDICAL AID. LIQUID OR SOLID POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED. Irritating to eyes. Irritates contaminated clothing and skin's. Flush affected areas with plenty of water. If IN EYES, hold eyelids open and flush with plenty of water. If SWALLOWED and victim is UNCONSCIOUS, have victim drink water or milk and have victim induce vomiting. If SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.	
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Solution is toxic to animals. May be dangerous if it enters water intakes. Notify local health and waste officials. Notify operators of nearby water intakes.	
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-poster, water contaminants, restrict access. Should be removed. Chemical and physical treatment.		2. LABEL 2.1 Category: Poison 2.2 Class: 6
3. CHEMICAL DESIGNATIONS 3.1 CD Competency Class: Not listed 3.2 Formula: (CH ₃) ₂ PSOCC ₆ H ₄ NO ₂ p 3.3 MO/UN Designation: 6.1/2783 3.4 DOT ID No.: 2783 3.5 CAS Registry No.: 298-00-0		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Solid, liquid, or solution. 4.2 Color: Colorless solid or brownish liquid. 4.3 Odor: Characteristic: like rotten eggs or garlic.
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Approved mask or respirator; natural rubber gloves, overboots, protective clothing, goggles. 5.2 Symptoms Following Exposure: Exposure to fumes from a fire, or to the liquid, causes headache, blurred vision, constricted pupils of the eyes, weakness, nausea, cramps, diarrhea, and tightness in the chest. Muscle twitch and convulsions may follow. Symptoms may develop over a period of 8 hrs. 5.3 Treatment of Exposure: Speed is essential. INGESTION: call a doctor. If victim is not breathing, immediately institute artificial respiration by mouth-to-mouth, mouth-to-nose, or mouth-to-oropharyngeal method, when victim is conscious, give milk, water, or self-water and induce vomiting repeatedly. SKIN OR EYES: flood and wash exposed areas thoroughly with water, remove contaminated clothing under a shower. 5.4 Threshold Limit Value: 0.2 mg/m ³ 5.5 Short Term Inhalation Limit: Data not available 5.6 Toxicity by Ingestion: Grade 4, LD ₅₀ below 50 mg/kg (rat) 5.7 Lethal Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Not pertinent 5.9 Liquid or Solid Irritant Characteristics: Poisonous when absorbed through skin. 5.10 Odor Threshold: Data not available 5.11 IDLH Value: Data not available		

6. FIRE HAZARDS 6.1 Flash Point: 115°F O.C. 6.2 Flammable Limits in Air: Data not available 6.3 Fire Extinguishing Agents: Water 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion: Products: Toxic gases are produced in fire. 6.6 Behavior in Fire: Drums may rupture violently. 6.7 Ignition Temperature: Data not available 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Data not available 6.10 Autocatalytic Flame Temperature: Data not available 6.11 Self-heating Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-X-Y
7. CHEMICAL REACTIVITY 7.1 Reactivity with Water: Half decomposed in 8 days at 40°C. 7.2 Reactivity with Common Materials: Is absorbed in wood, etc., which must be replaced to eliminate poison hazard. 7.3 Stability During Transport: Decomposes above 50°C with possible explosive force. 7.4 Neutralizing Agents for Acids and Corrosives: Apply caustic at 5000 ton slurry and yellow starts disappear. 7.5 Polymerizability: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Resistant to Products): Data not available 7.8 Reactivity Group: Data not available	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Poison, B 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: Category Classification* Health Hazard (Blue) 4 4 Flammability (Red) 3 1 Reactivity (Yellow) 2 2 *First column for solution, second for solid.
8. WATER POLLUTION 8.1 Aquatic Toxicity: 1.8 ppm/96 hr/blugill/TL ₅₀ /fresh water 0.3 ppm/96 hr/fathead/TL ₅₀ /fresh water 8.2 Waterfowl Toxicity: LD ₅₀ = 10 mg/kg Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: Data not available	12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 263.2 12.3 Boiling Point at 1 atm: Very high 12.4 Freezing Point: 85°F = 15°C = 291°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.360 at 20°C (liquid) 12.8 Liquid Surface Tension: Data not available 12.9 Liquid Water Interfacial Tension: Data not available 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: Data not available 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.17 Heat of Fusion: Data not available 12.18 Limiting Value: Data not available 12.19 Reid Vapor Pressure: Data not available
9. SHIPPING INFORMATION 9.1 Grades of Purity: Pure (solid); technical (liquid); 90% or higher 9.2 Storage Temperature: Below 50°F 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-relief	NOTES

Material Safety Data Sheet

From Genium's Reference Collection
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No. 7

NITRIC ACID
 (Revision C)
 Issued: October 1980
 Revised: August 1988

SECTION 1. MATERIAL IDENTIFICATION 26

Material Name: NITRIC ACID

Description (Origin/Uses): Used to dissolve noble metals, for etching and cleaning metals, to make organic nitrates and nitrocompounds, to destroy residues of organic matter, and in explosives.



NFPA

Other Designations: Red Fuming Nitric Acid; HNO₃; CAS No. 7697-37-2

HMS
 H 3 R 1
 F 0 I 4
 R 1 S 4
 PPG* K 0
 *See sect. 8

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

SECTION 2. INGREDIENTS AND HAZARDS EXPOSURE LIMITS

Nitric Acid, CAS No. 7697-37-2

%

OSHA PEL
 8-Hr TWA: 2 ppm, 5 mg/m³

ACGIH TLVs, 1987-88
 TLV-TWA: 2 ppm, 5 mg/m³
 TLV-STEL: 4 ppm, 10 mg/m³

Toxicity Data**
 Mouse, Inhalation, LC₅₀: 67 ppm/4 Hrs

*Contact your supplier to determine the percent by weight of nitric acid in the purchased product. Water is the other component of the product.
 **See NIOSH, RTECS (QU5775000, QU5900000), for additional data with references to reproductive effects.

SECTION 3. PHYSICAL DATA

Boiling Point: Ca 251°F (122°C)*
Specific Gravity (H₂O = 1): 1.4*
pH: Very Acidic

Water Solubility (%): Complete
Molecular Weight: 63 Grams/Mole
Melting Point: Ca -30°F (-34°C)*

Appearance and Odor: A water white to slightly yellow liquid that darkens to a brownish color on aging and exposure to light; characteristic nitrogen dioxide (NO₂) odor.

*These properties are for the approximately 68%-by-weight nitric acid that is commercially available.

SECTION 4. FIRE AND EXPLOSION DATA LOWER UPPER

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
*	*	% by Volume	*	*

Extinguishing Media: *Nitric acid does not burn. Use extinguishing agents that will put out the surrounding fire. Use a water spray to dilute nitric acid during fires and to absorb liberated oxides of nitrogen.

Unusual Fire or Explosion Hazards: Although nitric acid does not burn, it is a strong oxidizing agent that can react with combustible materials to cause fires. Also, it can react with metals to liberate extremely flammable hydrogen gas. If this happens, direct fire-fighting procedures at this evolved hydrogen gas.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Choose protective equipment carefully (see sect. 5, Conditions to Avoid).

SECTION 5. REACTIVITY DATA

Nitric acid is stable in closed containers at room temperature under normal storage and handling conditions. It cannot undergo hazardous polymerization.

Chemical Incompatibilities: Nitric acid reacts explosively with metallic powders, carbides, hydrogen sulfide, and turpentine. Contact with organic materials such as wood, paper, sawdust, or alcohol, etc., may cause fires. Combustible materials can attain an increased flammability after being exposed to nitric acid even if they do not immediately catch fire.

Conditions to Avoid: Avoid any contact with incompatible chemicals. Because it is so reactive, always establish another material's compatibility with nitric acid before mixing the two materials. This applies to the selection of safety and handling equipment, because nitric acid can attack some forms of coatings, plastics, and rubber.

Hazardous Products of Decomposition: Various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), nitrous oxide (N₂O), as well as nitric acid mist or vapor, can be produced by the decomposition reactions that can affect the nitric acid during fires.

SECTION 6. HEALTH HAZARD INFORMATION

Nitric acid is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: This material is corrosive to any body tissue it contacts. Dental erosion is also reported.

Medical Conditions Aggravated by Long-Term Exposure: None reported. **Target Organs:** Skin, eyes, mucous membranes of the respiratory tract, teeth. **Primary Entry:** Inhalation, skin contact. **Acute Effects:** Irritation and/or corrosive burns of skin, eyes, and upper respiratory tract (URT), delayed pulmonary edema, pneumonitis, bronchitis, and dental erosion. **Chronic Effects:** None reported.

FIRST AID: **Eyes.** Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. Treat for eye burns. **Skin.** Immediately wash the affected area with soap and water. Watch for chemical skin burns and treat them accordingly. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. If the exposure is severe, hospitalization with careful monitoring by trained medical personnel to detect the delayed onset of severe pulmonary edema (lungs filled with fluid) is recommended for at least 72 hours. **Ingestion.** Call a poison control center. Never give anything by mouth to someone who is unconscious or convulsing. Do not induce vomiting. If the exposed person is responsive, give him or her one or two glasses of milk or water to drink as quickly as possible after exposure.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid. **NOTE TO PHYSICIAN:** Wash affected skin areas with a 5% solution of sodium bicarbonate (NaHCO₃). If ingested, the risk versus the benefit of the passage of a naso-gastric tube is debatable. Activated charcoal is of no value. Do not give the exposed person bicarbonate to neutralize the material.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all sources of ignition immediately in case contact with metals should produce highly flammable hydrogen gas. Cleanup personnel need protection against contact with and inhalation of nitric acid (see sect. 8). Contain large spills and collect waste. Use water sprays to direct nitric acid away from incompatible chemicals (see sect. 5). Neutralize the spilled nitric acid with soda ash or sodium bicarbonate. Use an absorbent such as sand, earth, or vermiculite on the resulting slurry and place the neutralized nitric acid material into containers suitable for eventual disposal, reclamation, or destruction.

Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z)

EPA Designations (40 CFR 302.4)

CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per Clean Water Act (CWA), Section 311 (b) (4)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of nitric acid solution is possible, wear a full face shield as a supplementary protective measure. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Consult the *NIOSH Pocket Guide to Chemical Hazards* (Genium ref. 88) for general recommendations on proper respiratory procedures. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine use (leaks or cleaning reactor vessels and storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will not protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, gauntlets, etc., to prevent skin contact with nitric acid. Choose protective equipment carefully (see sect. 5, Conditions to Avoid).

Ventilation: Install and operate both general and local exhaust-ventilation systems powerful enough to maintain airborne concentrations of nitric acid below the OSHA PEL standard cited in section 2. Construct exhaust ducts and systems with material such as fiberglass, which resists attack by nitric acid. **Safety Stations:** Make emergency eyewash stations, washing facilities, and safety/quickdrench showers available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do not wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean nitric acid from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do not eat, drink, or smoke in any work area. Provide preplacement and annual medical exams with emphasis on skin irritation to workers who are regularly exposed to nitric acid. Workers must receive training before handling this material in the workplace; even experienced workers should undergo refresher training periodically.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store nitric acid in a cool, dry, well-ventilated area away from incompatible chemicals (see sect. 5). Consider outside, isolated, or detached storage. Protect containers from direct sunlight.

Special Handling/Storage: Build all storage facilities of nonflammable materials that are resistant to chemical attack by nitric acid. Protect containers from physical damage. Preplan for routine use and emergency response.

Engineering Controls: Proper ventilation is essential in bulk storage areas; consider installing an automatic monitoring system to detect hazardous levels of nitrogen oxides that can develop from this material.

Comments: Separate nitric acid from hydrazine, diethylenetriamine, fluorides, and all other corrosives except sulfuric acid and sulfur trioxide when shipping or transferring it.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: (I) Nitric Acid, Fuming or (II) Nitric Acid, Over 40% or (III) Nitric Acid, 40% or Less

DOT Label: (I) Oxidizer and Poison or (II) Oxidizer and Corrosive or (III) Corrosive

DOT Hazard Class: (I) and (II) Oxidizer or (III) Corrosive Material

DOT ID Nos. (I) UN2032; (II) UN2031; (III) NA1760

IMO Class: 8 (All Types of Nitric Acid)

IMO Label: (I) Corrosive, Oxidizer, Poison; or (II) and (III) Corrosive

References: 1, 2, 26, 38, 84-94, 100, 112, 113, 114.

Judgments as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of such information, Genium Publishing Corp. extends no warranties, makes no representations and assumes no responsibility as to the accuracy or suitability of such information for application to purchaser's intended purposes or for consequences of its use.

Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD

NITROGEN TETROXIDE

NOX

<p>Common Synonyms</p> <p>Nitrogen peroxide Nitrogen dioxide Red oxide of nitrogen Dioxide of nitrogen Drown gas</p>	<p>Liquefied compressed gas Red-brown Sharp, unpleasant chemical odor</p> <p>Stinks and reacts with water. Poisonous brown vapor is produced.</p>
<p>AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Stop discharge if possible. Evacuate area in case of large discharge. Notify local health and pollution control agencies.</p>	
Fire	<p>Not flammable. May cause fire and explode on contact with combustibles. POISONOUS GASES ARE PRODUCED IN FIRE AND WHEN HEATED.</p> <p>Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Flood discharge area with water. Stop fire of gas or liquid. Cool exposed containers with water.</p>
Exposure	<p>CALL FOR MEDICAL AID. VAPOR POISONOUS IF INHALED. Irritating to eyes. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Will burn skin and eyes. POISONOUS IF SWALLOWED. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. If in EYES, hold eyelids open and flush with plenty of water. If SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.</p>
Water Pollution	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and welfare officials. Notify operators of nearby water intakes.</p>
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook)</p> <p>Use warning-poster, or signposts, water containment, dikes/bunds</p> <p>Respect dikes/bunds</p> <p>Evacuate area</p>	<p>2. LABEL</p> <p>2.1 Category: Poison gas; Oxidizer 2.2 Class: 2 and 5</p>
<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 DG Compatibility Class: Not listed 3.2 Formula: N₂O₄ 3.3 HSD/UN Designation: 2/1067 3.4 DOT ID No.: 1067 3.5 CAS Registry No.: 10102-44-0</p>	<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Red-brown at ambient temperature; colorless below about 14°F 4.3 Odor: Pungent, acid, mildly irritating</p>
<p>5. HEALTH HAZARDS</p>	
<p>5.1 Personal Protective Equipment: Rubber gloves; safety goggles and face shield; protective clothing; acid gas canister respirator or self-contained breathing apparatus.</p> <p>5.2 Symptoms Following Exposure: Very concentrated fumes produce coughing, choking, headache, nausea, pain in chest and abdomen; otherwise, few symptoms appear at time of exposure. After symptom-free period of 3-72 hours, pulmonary edema gradually develops, causing fatigue, restlessness, coughing, difficulty in breathing, frothy expectoration, mental confusion, lethargy, bluish skin, and weak, rapid pulse. Since NO₂ interferes with gas exchange in lungs, unconsciousness and death by asphyxiation can result, usually within a few hours after onset of pulmonary edema.</p> <p>5.3 Treatment of Exposure: INHALATION: remove patient to fresh air and have him breathe as deeply as possible; call a doctor; inhale complete rest for 24-48 hours; keep warm; give oxygen if coughing starts; physician may administer morphine (10 mg). EYES AND SKIN: Wash with water for at least 15 min.</p> <p>5.4 Threshold Limit Value: 3 ppm 5.5 Short Term Inhalation Limit: 25 ppm for 5 min. 5.6 Toxicity by Ingestion: Data not available 5.7 Lethal Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause severe irritation of eyes and throat and can cause eye and lung injury. They cannot be tolerated even at low concentrations. 5.9 Liquid or Solid Irritant Characteristics: Severe skin irritant. Causes second- and third-degree burns on short contact and is very injurious to the eyes. 5.10 Odor Threshold: 5 ppm 5.11 IDLH Value: 50 ppm</p>	

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: Not flammable 6.2 Flammable Limits in Air: Not flammable 6.3 Fire Extinguishing Agents: Stop flow of gas 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion: Products: Produces toxic gas when heated. 6.6 Behavior in Fire: Does not burn, but supports combustion of combustible materials such as wood. May cause fire or explode on contact with other materials. 6.7 Ignition Temperature: Not flammable 6.8 Electrical Hazard: Data not available 6.9 Burning Rate: Not flammable 6.10 Adiabatic Flame Temperature: Data not available (Continued)</p>	<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity With Water: Dissolves to form nitric acid and nitrous acid. Nitric acid reacts with air to form more nitrogen tetroxide. 7.2 Reactivity with Common Materials: Very corrosive to metals when wet. Reacts vigorously with combustible materials such as wood. 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Corrosives: Flush with water, then use soda ash or lime. 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Motor Fuels (Resistant to): Product: Data not available 7.8 Reactivity Groups: Data not available</p>
<p>8. WATER POLLUTION</p>	
<p>8.1 Aquatic Toxicity: 72 ppm/96 hr/massage fish/TL₅₀/fresh water 250-1000 ppm/96 hr/cattle/LC₅₀/sea water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): None 8.4 Food Chain Concentration Potential: None</p>	
<p>9. SHIPPING INFORMATION</p>	
<p>9.1 Grade of Purity: Data not available 9.2 Storage Temperature: Ambient. Storage and transfer structures shall be equipped with mechanical ventilation systems. 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure relief valves on containers.</p>	
<p>6. FIRE HAZARDS (Continued)</p>	
<p>6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>	

<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook)</p> <p style="text-align: center;">A-4-J-0</p>																																				
<p>11. HAZARD CLASSIFICATIONS</p>																																				
<p>11.1 Code of Federal Regulations: Poison, A</p> <p>11.2 HAS Hazard Rating for Bulk Water Transportation</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Rating</th> </tr> </thead> <tbody> <tr> <td>Fire.....</td> <td>0</td> </tr> <tr> <td>Health.....</td> <td>0</td> </tr> <tr> <td>Vapor Irritant.....</td> <td>4</td> </tr> <tr> <td>Liquid or Solid Irritant.....</td> <td>4</td> </tr> <tr> <td>Poisons.....</td> <td>4</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity.....</td> <td>3</td> </tr> <tr> <td>Aquatic Toxicity.....</td> <td>3</td> </tr> <tr> <td>Acute Effect.....</td> <td>4</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals.....</td> <td>2</td> </tr> <tr> <td>Water.....</td> <td>0</td> </tr> <tr> <td>Self Reaction.....</td> <td>0</td> </tr> </tbody> </table> <p>11.3 NFPA Hazard Classification</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue).....</td> <td>3</td> </tr> <tr> <td>Flammability (Red).....</td> <td>0</td> </tr> <tr> <td>Reactivity (Yellow).....</td> <td>0</td> </tr> </tbody> </table> <p style="text-align: right;">NF</p>	Category	Rating	Fire.....	0	Health.....	0	Vapor Irritant.....	4	Liquid or Solid Irritant.....	4	Poisons.....	4	Water Pollution		Human Toxicity.....	3	Aquatic Toxicity.....	3	Acute Effect.....	4	Reactivity		Other Chemicals.....	2	Water.....	0	Self Reaction.....	0	Category	Classification	Health Hazard (Blue).....	3	Flammability (Red).....	0	Reactivity (Yellow).....	0
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<p>12. PHYSICAL AND CHEMICAL PROPERTIES</p>																																				
<p>12.1 Physical State at 15°C and 1 atm: Soluble</p> <p>12.2 Molecular Weight: 92.02</p> <p>12.3 Boiling Point at 1 atm: 70.1°F = 21.2°C = 298°K</p> <p>12.4 Freezing Point: 11.2°F = -11.2°C = 282°K</p> <p>12.5 Critical Temperature: 317.5°F = 158.2°C = 431.4°K</p> <p>12.6 Critical Pressure: 1470 psia = 100 atm = 10.1 MN/m²</p> <p>12.7 Specific Gravity: 1.45 at 50°C (liq)</p> <p>12.8 Liquid Surface Tension: Not pertinent</p> <p>12.9 Liquid Water Interfacial Tension: Not pertinent</p> <p>12.10 Vapor (Gas) Specific Gravity: 3.2</p> <p>12.11 Ratio of Specific Heats of Vapor (Gas): (not) 1.292</p> <p>12.12 Latent Heat of Vaporization: 170 Btu/lb = 66.1 cal/g = 4.18 X 10⁴ J/kg</p> <p>12.13 Heat of Combustion: Not pertinent</p> <p>12.14 Heat of Decomposition: Not pertinent</p> <p>12.15 Heat of Solution: Data not available</p> <p>12.16 Heat of Polymerization: Not pertinent</p> <p>12.18 Heat of Fusion: 60.2 cal/g</p> <p>12.19 Limiting Value: Data not available</p> <p>12.20 Heat of Vaporization: 30 psia</p>																																				

Material Safety Data Sheet

From Genium's Reference Collection
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GENIUM PUBLISHING CORP.

No. 205

POTASSIUM NITRATE

Issued: January 1987

SECTION 1. MATERIAL IDENTIFICATION

22

MATERIAL NAME: POTASSIUM NITRATE

DESCRIPTION/USES: Used in pyrotechnics; explosives; matches; as a specialty fertilizer; reagent; to modify burning properties of tobacco; in glass manufacture; tempering steel; curing foods; as an oxidizer in solid rocket propellants.

OTHER DESIGNATIONS: Nitric Acid, Potassium Salt; Niter; Saltpeter; KNO₃; CAS #7757-79-1

MANUFACTURER/SUPPLIER: Available from several suppliers, including: Aldrich Chemical Co., Inc., PO Box 355, Milwaukee, WI 53201; Telephone: (414) 273-3850



HMIS

Nonfire

Fire

H 1

F 0

R 1

PPE*

*See Sect. 8

R 1

I -

S 2

K 0

SECTION 2. INGREDIENTS AND HAZARDS

%

HAZARD DATA

Potassium Nitrate, CAS #7757-79-1

>99%

ACGIH TLV:
None Established

OSHA PEL:
None Established

Oral, Rat,
LD₅₀: 3750 mg/kg

Oral, Rabbit,
LD₅₀: 1901 mg/kg

SECTION 3. PHYSICAL DATA

Melting Point ... 633°F (334°C)
 Boiling Point ... 400°C (Decomposes)
 Specific Gravity @ 16°C ... 2.11
 Vapor Pressure @ 20°C ... Negligible
 % Volatiles ... 0
 Evaporation Rate ... Not Found

Solubility in Water, at 0°C ... 13.3 g/100 cc
 at 100°C ... 247 g/100 cc
 pH of 5% Solution, at 25°C ... 4.5-7.0
 Molecular Weight ... 101.1

Appearance and odor: White crystalline powder or granules. No odor.

SECTION 4. FIRE AND EXPLOSION DATA

LOWER

UPPER

Flash Point and Method

Autoignition Temperature

Flammability Limits in Air

Not Found

Not Found

Not Found

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Potassium nitrate is not combustible. However, it is a strong oxidizer and can initiate and intensify combustion of flammable materials.

EXTINGUISHING AGENTS: Flood fires involving this material with water. Keep fire-exposed containers cool with water spray. Remove containers from the fire area if it can be done safely.

UNUSUAL FIRE/EXPLOSION HAZARDS: At high temperatures this material can fuse or melt; application of water when large quantities are involved can result in extensive scattering of molten material.

SPECIAL FIRE-FIGHTING PROCEDURES: Toxic fumes/gases can be evolved in a fire situation. Fire fighters should use self-contained breathing apparatus and wear full protective gear.

SECTION 5. REACTIVITY DATA

Potassium nitrate is stable at room temperature. It does not polymerize.

Violent reactions (including fire and explosion) may occur on its contact with organic materials, combustible materials, and reducing agents. Specific incompatibles under various conditions include aluminum, titanium, antimony, germanium, zinc, zirconium (and other metals), calcium disilicide, chromium nitride, metal sulfides, boron, carbon, sulfur, phosphorus, phosphides, sodium phosphinate, sodium thiosulfate, citric acid, tin chloride, sodium acetate, and thorium carbide.

Potassium nitrate decomposes at approximately 752°F (400°C) with the evolution of oxygen and oxides of nitrogen (toxic).

SECTION 6. HEALTH HAZARD INFORMATION

Potassium nitrate has not been identified as a known or suspected carcinogen by the NTP, IARC, or OSHA. This material can enter the body if it is inhaled or swallowed.

EFFECTS OF OVEREXPOSURE: Inhalation of excessive concentrations may be irritating to the nose, throat, and respiratory tract. Prolonged exposure may cause anemia, methemoglobinemia (the presence of methemoglobin, a soluble brown crystalline blood pigment that differs from hemoglobin in that it contains ferric iron and is unable to combine reversibly with molecular oxygen), and kidney injury (nephritis). Ingestion can cause severe gastrointestinal distress with abdominal pain, nausea, vomiting, and diarrhea. Eye contact may cause irritation.

FIRST AID: **EYE CONTACT:** Flush eyes, including under the eyelids, with a gentle flow of running water. Get medical help.* **SKIN CONTACT:** Wash affected area with mild soap and water. If irritation persists, prevent further contact and get medical help.* **INHALATION:** Remove victim from exposure. Get medical help if irritation or discomfort persists.* **INGESTION:** Give victim a large quantity of water to drink. Induce vomiting and get prompt medical help.* Keep him warm and at rest. **NOTE:** Never give anything by mouth or induce vomiting if the victim is unconscious.
* GET MEDICAL ASSISTANCE = In plant, community, paramedic. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Ventilate the potassium nitrate spill area. Prevent contact of spilled material with combustible and incompatible materials. Cleanup personnel should wear personal protective equipment as necessary to prevent skin/eye contact and dust inhalation. Carefully scoop spilled material into a suitable container for reclamation or disposal. Avoid generating dust during cleanup. Absorb small solution spills on inert (noncombustible) material such as dry sand or earth.
Disposal: Potassium nitrate requires disposal as a hazardous waste. Reclaim material when possible. Contact your supplier or a licensed chemical waste disposal contractor for treatment and disposal instructions. Follow all applicable Federal, state, and local regulations.

Reportable Spill Quantity: Not listed in 40 CFR 117.3, "Reportable Quantities of Hazardous Substances."
EPA Hazardous Waste Number: D001 (Ignitable, 40 CFR 261.21)

SECTION 8. SPECIAL PROTECTION INFORMATION

Use local exhaust ventilation to control airborne levels where potassium nitrate dust, mist, or fumes are generated.
Use an appropriate NIOSH-approved respirator for protection against potassium nitrate dust/mist where airborne levels are excessive. Respirator usage must be in accordance with OSHA requirements (29 CFR 1910.134).
Wear protective clothing (aprons, coveralls, etc.) where the possibility of skin or clothing contamination exist. Wear rubber gloves and safety goggles when handling this material.
Eyewash stations and washing facilities should be readily accessible to workers handling this material.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Particles may adhere to contact lenses and cause corneal damage.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store potassium nitrate in closed containers in a cool, dry location on a noncombustible surface. Store it away from flammable and combustible materials, reducing agents, and other incompatible materials (see sect. 5). Protect containers from physical damage.

Practice good housekeeping. Clean up spills promptly. Use procedures and techniques that minimize dust generation. Practice good personal hygiene. Wash thoroughly after handling this material and before eating, drinking, and smoking. Do not eat, drink, or smoke in the work area. Remove contaminated clothing promptly. Launder it before wearing it again. Do not take this material out of your work area or to your home on your clothing or equipment.

DOT Hazard Classification: Oxidizer (49 CFR 172.101) DOT ID No. UN1486 DOT Label: Oxidizer

Data Source(s) Code: 4, 5, 6, 9, 25, 49, 58, 77, 82, CV

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Approvals *J. P. Rice*

Indust. Hygiene/Safety *J. P. Rice 4/87*

Medical Review *J. P. Rice May 87*



SECTION 1. MATERIAL IDENTIFICATION 20

MATERIAL NAME: TOLUENE

OTHER DESIGNATIONS: Methyl Benzene, Methyl Benzol, Phenylmethane, Toluol, C₇H₈, CAS #0108-88-3

MANUFACTURER/SUPPLIER: Available from many suppliers, including:
 Allied Corp., PO Box 2064R, Morristown, NJ 07960; Telephone: (201) 453-4400
 Ashland Chemical Co., Industrial Chemicals & Solvents Div., PO Box 2219,
 Columbus, OH; Telephone: (614) 889-3844

HMIS

H: 2

F: 3

R: 0

PPE*

*See sect. 8



R 1
 I 3
 S 2
 K 4

SECTION 2. INGREDIENTS AND HAZARDS **HAZARD DATA**

<p>Toluene</p> <div style="text-align: center;"> <chem>CC1=CC=CC=C1</chem> </div> <ul style="list-style-type: none"> * Current (1985-86) ACGIH TLV. The OSHA PEL is 200 ppm with an acceptable ceiling concentration of 300 ppm and an acceptable maximum peak of 500 ppm/10 minutes. ** Skin designation indicates that toluene can be absorbed through intact skin and contribute to overall exposure. *** Affects the mind. 	<p>ca 100</p>	<p>8-hr TLV: 100 ppm, or 375 mg/m³* (Skin)**</p> <p>Man, Inhalation, TClO: 100 ppm: Psychotropic***</p> <hr/> <p>Rat, Oral, LD₅₀: 5000 mg/kg Rat, Inhalation, LCLo: 4000 ppm/4 hrs. Rabbit, Skin, LD₅₀: 14 gm/kg</p> <hr/> <p>Human, Eye: 300 ppm</p>
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SECTION 3. PHYSICAL DATA

<p>Boiling Point ... 231°F (111°C) Vapor Pressure @ 20°C, mm Hg ... 22 Water Solubility @ 20°C, wt. % ... 0.05 Vapor Density (Air = 1) ... 3.14</p>	<p>Evaporation Rate (BuAc = 1) ... 2.24 Specific Gravity (H₂O = 1) ... 0.866 Melting Point ... -139°F (-95°C) Percent Volatile by Volume ... ca 100 Molecular Weight ... 92.15</p>
<p>Appearance and odor: Clear, colorless liquid with a characteristic aromatic odor. The odor is detectable to most individuals in the range of 10 to 15 ppm. Because olfactory fatigue occurs rapidly upon exposure to toluene, odor is not a good warning property.</p>	

SECTION 4. FIRE AND EXPLOSION DATA **LOWER** | **UPPER**

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air		
40°F (4°C) CC	896°F (480°C)	% by Volume	1.27	7.1

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, alcohol foam. Do not use a solid stream of water because the stream will scatter and spread the fire. Use water spray to cool tanks/containers that are exposed to fire and to disperse vapors.

UNUSUAL FIRE/EXPLOSION HAZARDS: This OSHA class IB flammable liquid is a dangerous fire hazard. It is a moderate fire hazard when exposed to oxidizers, heat, sparks, or open flame. Vapors are heavier than air and may travel a considerable distance to an ignition source and flash back.

SPECIAL FIRE-FIGHTING PROCEDURES: Fire fighters should wear self-contained breathing apparatus with full facepiece operated in a positive-pressure mode when fighting fires involving toluene.

SECTION 5. REACTIVITY DATA

CHEMICAL INCOMPATIBILITIES: Toluene is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization. This material is incompatible with strong oxidizing agents, dinitrogen tetroxide, silver perchlorate, tetranitromethane, and uranium hexafluoride. Contact with these materials may cause fire or explosion. Nitric acid and toluene, especially in the presence of sulfuric acid, will produce nitrated compounds that are dangerously explosive.

CONDITIONS TO AVOID: Avoid exposure to sparks, open flame, hot surfaces, and all sources of heat and ignition. Toluene will attack some forms of plastics, rubber, and coatings. Thermal decomposition or burning produces carbon dioxide and/or carbon monoxide.

SECTION 6. HEALTH HAZARD INFORMATION | TLV

Toluene is not considered a carcinogen by the NTP, IARC, or OSHA. **SUMMARY OF RISKS:** Vapors of toluene may cause irritation of the eyes, nose, upper respiratory tract, and skin. Exposure to 200 ppm for 8 hours causes mild fatigue, weakness, confusion, lacrimation (tearing) and paresthesia (a sensation of prickling, tingling, or creeping on the skin that has no objective cause). Exposure to higher concentrations may cause headache, nausea, dizziness, dilated pupils, and euphoria, and, in severe cases, may cause unconsciousness and death. The liquid is irritating to the eyes and skin. Contact with the eyes may cause transient corneal damage, conjunctival irritation, and burns if not promptly removed. Repeated and/or prolonged contact with the skin may cause drying and cracking. It may be absorbed through the skin in toxic amounts. Ingestion causes irritation of the gastrointestinal tract and may cause effects resembling those from inhalation of the vapor. Chronic overexposure to toluene may cause reversible kidney and liver injury. **FIRST AID: EYE CONTACT:** Immediately flush eyes, including under eyelids, with running water for at least 15 minutes. Get medical attention if irritation persists.* **SKIN CONTACT:** Immediately flush skin (for at least 15 minutes) while removing contaminated shoes and clothing. Wash exposed area with soap and water. Get medical attention if irritation persists or if a large area has been exposed.* **INHALATION:** Remove victim to fresh air. Restore and/or support breathing as required. Keep victim warm and quiet. Get medical help.* **INGESTION:** Give victim 1 to 2 glasses of water or milk. Contact a poison control center. Do not induce vomiting unless directed to do so. Transport victim to a medical facility. Never give anything by mouth to a person who is unconscious or convulsing. * **GET MEDICAL ASSISTANCE** = In plant, paramedic, community. Get medical help for further treatment, observation, and support after first aid, if indicated.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Notify safety personnel of large spills or leaks. Remove all sources of heat and ignition. Provide maximum explosion-proof ventilation. Limit access to spill area to necessary personnel only. Remove leaking containers to safe place if feasible. Cleanup personnel need protection against contact with liquid and inhalation of vapor (see sect. 8). **WASTE DISPOSAL:** Absorb small spills with paper towel or vermiculite. Contain large spills and collect if feasible, or absorb with vermiculite or sand. Place waste solvent or absorbent into closed containers for disposal using nonsparking tools. Liquid can be flushed with water to an open holding area for handling. Do not flush to sewer, watershed, or waterway. **COMMENTS:** Place in suitable container for disposal by a licensed contractor or burn in an approved incinerator. Consider reclaiming by distillation. Contaminated absorbent can be buried in a sanitary landfill. Follow all Federal, state, and local regulations. TLm 96: 100-10 ppm. Toluene is designated as a hazardous waste by the EPA. The EPA (RCRA) HW No. is U220 (40 CFR 261). The reportable quantity (RQ) is 1000 lbs/454 kg (40 CFR 117).

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV requirements. Ventilation fans and other electrical service must be nonsparking and have an explosion-proof design. Exhaust hoods should have a face velocity of at least 100 lfpm (linear feet per minute) and be designed to capture heavy vapor. For emergency or nonroutine exposures where the TLV may be exceeded, use an organic chemical cartridge respirator if concentration is less than 200 ppm and an approved canister gas mask or self-contained breathing apparatus with full facepiece if concentration is greater than 200 ppm. Safety glasses or splash goggles should be worn in all work areas. Neoprene gloves, apron, face shield, boots, and other appropriate protective clothing and equipment should be available and worn as necessary to prevent skin and eye contact. Remove contaminated clothing immediately and do not wear it until it has been properly laundered.

Eyewash stations and safety showers should be readily available in use and handling areas.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

STORAGE/SEGREGATION: Store in a cool, dry, well-ventilated area away from oxidizing agents, heat, sparks, or open flame. Storage areas must meet OSHA requirements for class IB flammable liquids. Use metal safety cans for handling small amounts. Protect containers from physical damage. Use only with adequate ventilation. Avoid contact with eyes, skin, or clothing. Do not inhale or ingest. Use caution when handling this compound because it can be absorbed through intact skin in toxic amounts. **SPECIAL HANDLING/STORAGE:** Ground and bond metal containers and equipment to prevent static sparks when making transfers. Do not smoke in use or storage areas. Use nonsparking tools. **ENGINEERING CONTROLS:** Preplacement and periodic medical exams emphasizing the liver, kidneys, nervous system, lungs, heart, and blood should be provided. Workers exposed to concentrations greater than the action level (50 ppm) should be examined at least once a year. Use of alcohol can aggravate the toxic effects of toluene. **COMMENTS:** Emptied containers contain product residues. Handle accordingly! Toluene is designated as a hazardous substance by the EPA (40 CFR 116). DOT Classification: Flammable liquid. UN1294. Data Source(s) Code: 1-9, 12, 16, 20, 21, 24, 26, 34, 81, 82. CR

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Approvals *J. P. Accardo, 11/86*

Indust. Hygiene/Safety *JW 10-86*

Medical Review *[Signature]*

TOXAPHENE

TXP

<p>Common Synonyms Dibenzodioxaphene</p> <p>Waxy solid or in solution Amber</p> <p>Solid sinks in water, solution floats on water.</p>	
<p>Stop discharge if possible. Keep people away. Call fire department. Avoid contact with solid and solution. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>	
<p>Fire</p>	<p>Solid not flammable, but readily dissolved in combustible liquid. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles, self-contained breathing apparatus, and water overclothing (including gloves). Extinguish with foam, dry chemical or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p> <p>C</p>
<p>Exposure</p>	<p>CALL FOR MEDICAL AID.</p> <p>SOLID OR SOLUTION POISONOUS IF SWALLOWED. Wash mouth with water and spit. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim quiet and warm.</p>
<p>Water Pollution</p>	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Solution is toxic to shrimps. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-pond, water equipment Should be removed Chemical and physical treatment</p>	<p>2. LABEL 2.1 Category: None 2.2 Class: Not pertinent</p>
<p>3. CHEMICAL DESIGNATIONS 3.1 OQ Compatibility Class: Not listed 3.2 Formula: C₁₂H₁₀Cl₆ 3.3 RQ/UN Designation: Not listed 3.4 DOT ID No.: 2761 3.5 CAS Registry No.: 8001-35-2</p>	<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Waxy solid 4.2 Color: Amber 4.3 Odor: Mild turpentine odor</p>
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Chemical-type respirator; rubber gloves; chemical goggles or face shield. 5.2 Symptoms Following Exposure: May be absorbed through skin, lungs, or mucous tract. Symptoms include edema, leg and back muscle spasms, nausea, vomiting, hyperreflexia, tremors, shivering, clonic convulsions, then tetanic contractions of all skeletal muscles. Lethal doses cause respiratory failure. Respiration, affected as a result of the exertion from vomiting or convulsions, is first arrested because of tetanic muscular contractions, then increased in both amplitude and rate as the muscles relax. 5.3 Treatment of Exposure: If symptoms of poisoning appear, promptly remove the unabsorbed pesticide from the stomach by inducing vomiting with warm salty or soapy water (if the patient is conscious) or from the skin with soap and water. Keep patient warm and quiet. Call a physician. 5.4 Threshold Limit Value: 0.5 mg/m³ 5.5 Short Term Inhalation Limit: Not pertinent 5.6 Toxicity by Ingestion: Grade 4; LD₅₀ below 50 mg/kg (dog) 5.7 Lethal Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: The solid is non-volatile. For solutions, see meta-xylene. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause eming and reddening of the skin. 5.10 Odor Threshold: Not pertinent 5.11 IDLH Value: 200 mg/m³</p>	

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 64°F C.C. (solution) 6.2 Flammable Limits in Air: 1.1%-6.4% (solvent only) 6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective. 6.5 Special Hazards of Combustion Products: Toxic vapors are generated when heated. 6.6 Behavior in Fire: Solution in xylene may produce corrosive products when heated. 6.7 Ignition Temperature: 665°F (solution) 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: 5.8 mm/min. 6.10 Autoxidative Flame Temperature: Data not available</p> <p>(Continued)</p>	<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) N-A-T-U</p>
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Bases: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Oxidation (Resistant to Products): Data not available 7.8 Reactivity Group: Data not available</p>	<p>11. HAZARD CLASSIFICATIONS</p> <p>11.1 Code of Federal Regulations (CFR): 11.2 NAB Hazard Rating for Bulk Water Transportation: Not listed 11.3 MFPA Hazard Classification: Not listed</p>
<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: 0.05 ppm/20 days/goldfish/100% ml/fresh water 0.02 ppm*/fishkill/100% ml/fresh water 0.002 ppm/24 hr/spot/100% ml/cold water *Time period not specified. 8.2 Waterfowl Toxicity: 30.8 mg/kg 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: None</p>	<p>12. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>12.1 Physical State at 25°C and 1 atm: Waxy solid 12.2 Molecular Weight: 414 (avg.) 12.3 Boiling Point at 1 atm: Decomposes 12.4 Freezing Point: 140-154°F = 65-60°C = 328-322°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.8 at 15°C (solid) 12.8 Liquid Surface Tension: Not pertinent 12.9 Liquid Water Interfacial Tension: Not pertinent 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.18 Heat of Fusion: Data not available 12.20 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available</p>
<p>9. SHIPPING INFORMATION</p> <p>9.1 Grade of Purity: Technical: 40% dust concentrate; 60% solution in xylene 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Sealed containers in well-ventilated area</p>	<p>6. FIRE HAZARDS (Continued)</p> <p>6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>

Material Safety Data Sheet

From Genium's Reference Collection
 Genium Publishing Corporation
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 Schenectady, NY 12303-1836 USA
 (518) 377-8855



No. 318

XYLENE (Mixed Isomers)
 (Revision D)
 Issued: November 1980
 Revised: August 1988

SECTION 1. MATERIAL IDENTIFICATION

Material Name: XYLENE (Mixed Isomers)
Description (Origin/Uses): Used as a raw material for the production of benzoic acid, phthalic anhydride, isophthalic and terephthalic acids and their dimethyl esters in the manufacture of polyester fibers; in sterilizing catgut; with Canadian balsam as oil-immersion in microscopy; and as a cleaning agent in microscopic techniques.
Other Designations: Dimethylbenzene; Xylo; C₈H₁₀; CAS No. 1330-20-7
Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.
Comments: Although there are three different isomers of xylene (*ortho*, *meta*, and *para*), the health and physical hazards of all three isomers are very similar. This MSDS is written for a xylene mixture of all three isomers, which is usually commercial xylene.



HMIS		
H	2	R 1
F	3	I 3
R	0	S 2
PPG*		K 3
*See sect. 8		

SECTION 2. INGREDIENTS AND HAZARDS

Xylene (Mixed Isomers), CAS No. 1330-20-7*

*o-Xylene, CAS No. 0095-47-6
 m-Xylene, CAS No. 0108-38-3
 p-Xylene, CAS No. 0106-42-3

**Check with your supplier to determine if there are additions, contaminants, or impurities (such as benzene) that are present in reportable quantities per 29 CFR 1910.

***Immediately dangerous to life and health.

**** See NIOSH, *ATECS* (No. ZE2100000), for additional data with references to reproductive, irritative, and mutagenic effects.

EXPOSURE LIMITS

IDLH*** Level: 1000 ppm

OSHA PEL
 8-Hr TWA: 100 ppm, 435 mg/m³
 ACGIH TLVs, 1987-88
 TLV-TWA: 100 ppm, 435 mg/m³
 TLV-STEL: 150 ppm, 655 mg/m³

Toxicity Data****
 Human, Inhalation, TC₀₁: 200 ppm
 Man, Inhalation, LC₅₀: 10000 ppm/6 Hrs
 Rat, Oral, LD₅₀: 4300 mg/kg

SECTION 3. PHYSICAL DATA

Boiling Point: 225°F to 293°F (135°C to 145°C)*
Melting Point: -33°F (-25°C)
Evaporation Rate: 0.6 Relative to BuAc = 1
Specific Gravity (H₂O = 1): 0.86

Water Solubility (%): Insoluble
Molecular Weight: 106 Grams/Mole
% Volatile by Volume: Ca 100
Vapor Pressure: 7 to 9 Torrs at 68°F (20°C)
Vapor Density (Air = 1): 3.7

Appearance and Odor: A clear liquid; aromatic hydrocarbon odor.

*Materials with wider and narrower boiling ranges are commercially available.

SECTION 4. FIRE AND EXPLOSION DATA

			LOWER	UPPER
Flash Point and Method	Autoignition Temperature	Flammability Limits in Air		
81°F to 90°F (27°C to 32°C)	867°F (464°C)	% by Volume	1%	7%

Extinguishing Media: Use foam, dry chemical, or carbon dioxide. Use water sprays to reduce the rate of burning and to cool containers.

Unusual Fire or Explosion Hazards: Xylene vapor is heavier than air and may travel a considerable distance to a low-lying source of ignition and flashback.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive pressure mode.

SECTION 5. REACTIVITY DATA

Xylene is stable in closed containers during routine operations. It does not undergo hazardous polymerization.

Chemical Incompatibilities: This material may react dangerously with strong oxidizers.

Conditions to Avoid: Avoid any exposure to sources of ignition and to strong oxidizers.

Hazardous Products of Decomposition: Carbon monoxide (CO) may be evolved during xylene fires.

SECTION 6. HEALTH HAZARD INFORMATION

Xylene is not listed as a carcinogen by the IARC, NTP, or OSHA.

Summary of Risks: Liquid xylene is a skin irritant and causes erythema, dryness, and defatting; prolonged contact may cause blistering. Inhaling xylene can depress the central nervous system (CNS), and ingesting it can result in gastrointestinal disturbance; and possibly hematemesis (vomiting blood). Effects on the eyes, kidneys, liver, lungs, and the CNS are also reported. **Medical Conditions Aggravated by Long-Term Exposure:** Problems with eyes, skin, central nervous system, kidneys, and liver may be worsened by exposure to xylene. **Target Organs:** CNS, eyes, gastrointestinal tract, blood, liver, kidneys, skin. **Primary Entry:** Inhalation, skin contact/absorption. **Acute Effects:** Dizziness; excitement; drowsiness; incoordination; staggering gait; irritation of eyes, nose, and throat; corneal vacuolization; anorexia; nausea; vomiting; abdominal pain; and dermatitis. **Chronic Effects:** Reversible eye damage, headache, loss of appetite, nervousness, pale skin, and skin rash.

FIRST AID: Eyes. Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin.** Immediately wash the affected area with soap and water. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have a trained person administer oxygen. **Ingestion.** Never give anything by mouth to someone who is unconscious or convulsing. Vomiting may occur spontaneously, but do not induce it. If vomiting should occur, keep exposed person's head below his or her hips to prevent aspiration (breathing the liquid xylene into the lungs). Severe hemorrhagic pneumonitis with grave, possibly fatal, pulmonary injury can occur from aspirating very small quantities of xylene.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid. If exposure is severe, hospitalization for at least 72 hours with careful monitoring for delayed onset of pulmonary edema is recommended.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all sources of ignition immediately. Cleanup personnel need protection against contact with and inhalation of xylene vapor (see sect. 8). Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.

Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z)

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. U239

CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per the Clean Water Act (CWA), section 311 (b) (9)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield as a supplementary protective measure. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine use (leaks or cleaning reactor vessels and storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specifics of the work operation to prevent prolonged or repeated skin contact with xylene. **Ventilation:** Install and operate general and local maximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of xylene below the OSHA PEL standard cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of xylene into general work areas by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. **Safety Stations:** Make eyewash stations, safety/quick-drench showers, and washing facilities available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean xylene from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale xylene vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store xylene in a cool, dry, well-ventilated area away from sources of ignition and strong oxidizers. Protect containers from physical damage.

Special Handling/Storage: Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. Ground and bond all containers, pipelines, etc., used in shipping, transferring, reacting, producing, and sampling operations.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Xylene

DOT ID No. UN1307

DOT Label: Flammable Liquid

DOT Hazard Class: Flammable Liquid

IMO Label: Flammable Liquid

IMO Class: 3.2 or 3.3

References: 1, 2, 12, 73, 84-94, 100, 103.

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Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD

APPENDIX D OF APPENDIX B

INCIDENT REPORT FORM

**APPENDIX D
FORM HS-502
HAZARDOUS WASTE INCIDENT REPORT**

DATE PROJECT/LOCATION BUSINESS UNIT

DESCRIPTION OF INCIDENT, INCLUDING INJURIES, PROPERTY DAMAGE
AND EMERGENCY ACTION TAKEN AND PERSONNEL INVOLVED (use
additional sheets if needed):

WITNESSES OF INCIDENT:

POSSIBLE OR KNOWN CAUSES:

WHAT ACTIONS ARE NEEDED TO PREVENT A SIMILAR INCIDENT?

REPORTER

BUSINESS UNIT SAFETY OFFICER

PROJECT MANAGER

CORPORATE HEALTH AND SAFETY
OFFICER

APPENDIX E OF APPENDIX B

HNU PHOTOIONIZATION DETECTOR

APPENDIX E

HNU PHOTOIONIZATION DETECTOR (MODEL PI 101)

The instrument is turned to the battery check position first. Assuming proper charge, the main control switch is set to the standby position using the zero knob. The instrument is then allowed to warm up for above five minutes in the standby mode. The calibration gas (usually isobutylene from the HNU factory) is attached. The proper range setting is selected (usually 0-200 ppm) and the calibration gas turned on.

The gas flows through a critical orifice which reduces its flow rate to the proper rate for calibration purposes. The normal factory calibration of this instrument is for benzene in air. Isobutylene is used for normal calibration because it is less toxic. The relative response of isobutylene as compared to benzene is about 70 percent with the 10.2 eV and 11.7 eV lamps (there is a slight difference between the relative response of the two different energy probes, but it is not considered significant for most field calibration purposes). Accordingly, a bottle of isobutylene calibration gas that contains 100 ppm isobutylene will read out as about 70 ppm on a factory calibrated instrument. A bottle of factory calibration gas will state the proper readout on the instrument "as benzene".

If the instrument does not calibrate exactly, the span pot knob is normally adjusted to bring the instrument into calibration. The normal "factory" settings are 9.8 for the 10.2 eV lamp and 5.90 for the 11.7 eV lamp. If the instrument cannot be brought into calibration by using the span pot, the lamp may need to be cleaned or other maintenance items performed so that the unit will calibrate accurately.

APPENDIX C

COMMUNITY RELATIONS PLAN

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Schedule of Community Relations Activities

OVERVIEW OF COMMUNITY RELATIONS PLAN

This Community Relations Plan (CRP) for the Cedar Site in Vicksburg, Mississippi, has been prepared in response to a Consent Decree negotiated and approved by Cedar in December, 1990 and entered April 17, 1992. The Community Relations Plan presented herein describes the mechanism for the dissemination of information to the public regarding RCRA Facility Investigation (RFI) activities and results. The CRP describes the history of the site, the affected community, and community concerns about the site. It also describes community relations objectives and techniques for implementing the community relations program. The community relations program will provide the public an opportunity to participate in the decision-making process regarding remedial actions at the site and inform the public of current and future site activities.

This CRP is a working document that serves as a guide for communicating with the affected community. Activities and schedules may be altered according to future circumstances.

The information in this CRP was obtained from EPA and MSDEQ files and interviews with Cedar concerning their interaction with local residents and government officials. Interviews were conducted to determine the general level of awareness and concerns of the community regarding the site.

SITE OPERATIONAL, OWNERSHIP AND PERTINENT REGULATORY HISTORY

2.1 OPERATIONAL AND OWNERSHIP HISTORY

The Vicksburg Chemical Division of Cedar Chemical Corporation is located in Warren County, Mississippi along the Mississippi River immediately on the south limits of Vicksburg. About 70 acres border on the Mississippi River, however, none of the plant production facilities is located along the river. The address is:

Cedar Chemical Corporation
Vicksburg Chemical Division
Post Office Box 821003
Rifle Range Road
Vicksburg, Mississippi 39182-1007

The facility is a manufacturer of chemicals. The 650 acre plant site is divided into two separate and distinct operations known as the North Plant and the South Plant. Active operations are conducted or have been conducted on about 130 acres.

In operation since 1961, the North Plant produces potassium nitrate, liquid chlorine and liquid nitrogen tetroxide. The raw materials for the North Plant include potassium chloride and nitric acid. The potassium nitrate is sold in varying grades as a chemical fertilizer and for industrial uses. The chlorine is sold for various industrial uses. Most nitrogen tetroxide is sold to the government as an oxidizer for rocket fuels.

The South Plant, in operation since 1953, formerly manufactured chlorinated pesticides, nitrogen based herbicides, and other agricultural chemicals. The active operations at the South Plant are a modern (plant constructed in 1986) nitric acid unit and a new IRFNA plant. The manufactured nitric acid is used primarily in the North Plant as a raw material. During various periods prior to 1987, the South Plant produced dinitro butyl phenol (dinoseb or DNBP), monosodium methane arsonate (MSMA), diethylhexylphosphoric acid (DEHPA), 1-hydroxy-ethylidene-1,1-diphosphonic acid

Woodward-Clyde Consultants

(UNIHIB), toxaphene, methyl parathion, cyanazine (bladex), and atrazine. Toxaphene and methyl parathion are insecticides, while atrazine, dinoseb, and MSMA are herbicides. Raw materials for these formerly operating processes included chlorine, camphene, ortho secondary butyl phenol (OSBP), sodium arsenite, sodium hydroxide, methyl chloride, sulfuric acid, paranitrophenol, and phosphoric trichloride.

Originally, the two plants were completely separate, owned and operated by two different companies. The South Plant was originally constructed by Spencer Chemical in 1953 to produce agricultural chemicals: ammonia, nitric acid, urea, and ammonium nitrate. After purchasing the facility in 1964, Gulf Chemical added a formaldehyde unit in 1966. American Metal Climax Corporation (Amax) constructed the North Plant in 1961 to produce chloride-free potassium nitrate for selected crops in the southeast United States, such as tobacco, tomatoes, and certain vegetables. The main reason the potassium nitrate plant was built at Vicksburg, Mississippi was the availability of nitric acid from the adjacent Gulf Oil installation. The Amax plant was also referred to as the Southwest Potash Division.

Vicksburg Chemical Company was formed in early 1972 and purchased both the Gulf Oil and Amax Chemical facilities except the formaldehyde plant on July 12, 1972. Production, under the new management, began in October of the same year. Vicksburg Chemical then operated the nitric acid, potassium nitrate, and nitrate solutions plants about 2 1/2 years. By September, 1974, five more facilities were built for atrazine, methyl parathion, dinoseb, toxaphene, and UDMH (Unsymmetrical Dimethyl Hydrazine) production. The UDMH facility process was experimental and not well defined. Consequently, the UDMH process was eliminated due to production problems and economic reasons.

In 1978, Vicksburg Chemical Company was merged into Vertac, Inc. Effective September 1, 1979 Vertac, Inc. was merged into Vertac Chemical Corporation (VCC). In February, 1986, Cedar Chemical Corporation acquired the Vicksburg Chemical plant from VCC. Fermenta A.B. of Sweden acquired Cedar Chemical Corporation in June, 1986 and Nine West Corporation (Trans Resources, Inc.) acquired Cedar Chemical Corporation in January, 1988.

2.2 PERTINENT REGULATORY HISTORY

Vertac Chemical Corporation (VCC) first registered the Vicksburg plant as a pesticide producing site on July 2, 1979. A Notification of Hazardous Waste Activity was submitted on June 23, 1980. On November 18, 1980 a Resource Conservation and Recovery Act (RCRA) Part A permit application was filed to gain interim status to store and handle hazardous waste. VCC registered as producing potassium nitrate, dinoseb and toxaphene at the Vicksburg facility.

VCC submitted a RCRA Part B permit application on August 10, 1983 along with a modified Part A permit application. The original Part A application had included an 80 foot by 80 foot "greater than 90 day" hazardous Drum Storage Area and the Surface Impoundment both located at the South Plant. The drummed wastes stored in the Drum Storage Area contained hazardous constituents; therefore, to ensure proper disposal, the wastes were manifested by VCC as hazardous wastes and the RCRA permit for storage was requested from the regulatory agency. After the drums of waste were sent offsite for disposal, the RCRA permit application for the Drum Storage Area became unnecessary and hence the modification to the Part A consisting of removing the "greater than 90 day" hazardous Drum Storage Area from the RCRA application was submitted.

A second Part B application was filed on June 18, 1985 even though Cedar was attempting to reach agreement that a RCRA permit was not necessary on the basis that the Surface Impoundment did not qualify as a RCRA-regulated unit.

The Vicksburg facility was contracted to be sold to Cedar in 1985. The new ownership continued the negotiations with the regulatory agencies in an attempt to come an agreement on the regulatory status of the Surface Impoundment at the plant. A hearing on the issue was scheduled for July 22, 1986 before the Mississippi Commission on Natural Resources. Cedar's position regarding the surface impoundment was based on the de minimis exemption to the mixture rule contained in 40 CFR Part 261.3. De minimis losses are defined to include losses from minor spills, leaks from pipes and valves, minor leaks from process equipment, and leaks from well-maintained pump packings and seals which would occur during normal manufacturing operations.

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In December 1986 and again on August 5, 1987, MSDNR ruled that the Surface Impoundment was not required to be RCRA regulated.

Additionally, Cedar requested a meeting with the EPA to discuss regulatory issues. On December 17, 1987 representatives from Cedar, MSDNR, and EPA met to further discuss the Surface Impoundment. Cedar proposed to consolidate the contaminated sediment into a Solid Waste Containment Area, solidify it, and cap it in such a way as to continue to be able to use the rest of the impoundment for the accumulation of rainwater runoff prior to treatment. Cedar also proposed to line the impoundment with a double synthetic liner and to continue to use the surface impoundment after containment of the existing sediment.

Cedar submitted an engineered closure plans to the MSDNR on August 4, 1988. The MSDNR suggested some modifications to the plan for meeting RCRA requirements and Cedar agreed to go forward with the modified plan unless EPA voiced an objection. On January 27, 1989 Cedar reported to the MSDNR that a contract to implement the closure plan had been entered into and that the contractor had moved on site to begin closure of the impoundments. The construction has been completed.

In June of 1988 an Administrative Order for Interim Measures was drafted by EPA Region IV. The Order called for Cedar to conduct a RCRA Facility Investigation to determine the extent of any contamination; and for a Corrective Measures Study to evaluate the best solution for containment and/or clean-up of the facility as required. Based on previous inspections and a February, 1989 Sampling Investigation, the Director of Waste management, Region IV, issued a Determination of Release for Cedar on October 12, 1989. By October 20, 1989 a draft Endangerment Assessment was completed regarding contamination at the Vicksburg Facility of Cedar. Negotiations for a Consent Decree began in January of 1990 and were completed in December of 1990. The Consent Decree was entered in the form previously negotiated on April 17, 1992.

COMMUNITY BACKGROUND

The following subsection describes the Vicksburg Community, past community involvement with the site, and major concerns expressed by local officials and residents during community interviews.

3.1 COMMUNITY PROFILE

A blend of tradition and progress has established Vicksburg as a modern city, yet one which retains the charm of the "Old South". Vicksburg has an interesting and diverse history. First claimed by the French in 1680, along with every foot of land drained by the Mississippi River, the area was later transferred to Spain by King Louis XV. Spain in turn sold the land to the United States in 1795.

Georgia organized the County of Bourbon in southwest Mississippi and in 1795 sold huge tracts of land to syndicates for speculation. In 1798 Congress bought the Georgia claims and created the territory of Mississippi. Warren County was organized in 1817. Vicksburg "America's River port City", was founded in 1812 on the plantation of William Vick and John Lane, and by 1825, was a thriving frontier settlement. From this time until the Civil War, the community continued to grow and by 1861, was a well-ordered and prosperous city.

Vicksburg's role during the days when *civil strife* scarred the nation is historic. Modern writers have called it "The Gibraltar of the Confederacy", for whichever force held the bluffs controlled the vital Mississippi River and the country to the west. The Confederates, surrounded, with few supplies, little ammunition, and no prospects of reinforcement, were finally starved out and forced to surrender the city to Union General U.S. Grant on July 4, 1863.

In 1899, by act of Congress, the Vicksburg National Military Park was created. This park, now a part of the National Park System, was established to preserve the field of

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In 1899, by act of Congress, the Vicksburg National Military Park was created. This park, now a part of the National Park System, was established to preserve the field of

battle and the scenic and historic heritage of Vicksburg. It is considered by many as one of the country's most beautiful national memorials.

Reconstruction was a trying period for the city, as it was for the entire South. Civic progress was slow. Only because this was the era of the packet boat, coupled with Vicksburg's location which made her a center for the steamboat trade, was it possible for the community to prosper.

However, on April 27, 1876, the Mississippi River cut itself off from Vicksburg, south of the city, leaving the city's wharf high and dry. The U.S. Army Corps of Engineers began work in 1892, to divert the Yazoo River into the old Mississippi River bed thus restoring a harbor on the river. Work on the new canal was completed in January, 1903.

Now a city with a sound basic economy, Vicksburg can look to the future with confidence that her strategic location will lead to a commercial prominence. Cedar Chemical Corporation provides employment for a large number of residents in the Vicksburg area.

3.2 CHRONOLOGY OF COMMUNITY INVOLVEMENT

Cedar has conducted its own community relations activities to keep the community informed through dissemination of information.

Cedar has:

- Retained the Rutland Simmons Group to inform and educate several target audiences.
- Issued news releases on the Corrective Action Program.
- Conducted information on site briefings with Cedar production supervisors most of whom are residents of the community.

- Set up a speakers bureau and offered to meet with groups or organizations when requested.
- Published information booklets and distributed them to government and Elected Officials in Vicksburg, selected State Officials and business and opinion leaders in Vicksburg.

3.3 KEY ISSUES AND CONCERNS

The citizens of Vicksburg indicate an interest in site activities, but have few significant concerns about the site. This is in part due to Cedar's community relations with the town. The citizens of Vicksburg seem to feel that Cedar will continue to take care of any problems that arise from the site.

COMMUNITY RELATIONS OBJECTIVES

The community relations program for the site is designed to inform and educate the local government officials and residents of current site conditions and remedial alternatives. The community relations program will present the community with a clear description of the Corrective Action Process and will encourage the community to voice opinions on present and future site activities.

Currently, concern among local officials and the community residents is low. Because community interest may change as more information on the site becomes available, the community relations program should be flexible to respond to changing interests and concerns. Objectives for the community relations program are:

- Encourage the support and interest of local government officials in community relations activities.
- Inform local residents of all site activities to ensure that the public receives accurate information on site findings and developments as they occur, solicit comments on a continuing basis, and increase public awareness of the site activities.
- Encourage and facilitate positive interaction among government agencies, local officials, and concerned citizens to foster trusting relationships among the parties involved and provide open lines of communication.
- Provide opportunities for community involvement, and solicit input on remedial activities to address community concerns. Local residents should be encouraged to contact EPA officials if new or additional concerns arise during remedial activities.

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- Inform the local media of major site activities to increase public awareness and knowledge of the site.

COMMUNITY RELATIONS ACTIVITIES

The following community relations activities have been selected to inform the public of site activities and to meet the community relations objectives outlined in Section 4.0:

- **Information Repository** - Establish an information repository to include information on the Corrective Action Program and various site documents. The information repository will be updated as information becomes available. All items will be available for public inspection and copying. The local repository is the Cedar Plant site. The contact person is the Plant Manager.
- **Notifications and Briefings** - Periodically contact local government officials and residents to update them on the site status. Contact can be made by telephone, letters, public notices, and briefing meetings. Contact will be made at the completion of the RFI/CMS, and as needed during remedial activities.

Two summary papers will be sent to local government officials about the site. The first paper will be sent at the completion of the RFI to present information on sampling results and to address local officials' questions and concerns regarding the RFI and the upcoming CMS. The second paper will present information on CMS results and the proposed plan.

- **Public Comment Period** - A 30-day period will be provided to give the public an opportunity to review and comment on the CMS and proposed plan for the site.
- **Prepare Public Notices** - A public notice that will be published at least 2 weeks before the start of the 30-day comment period. This public

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Public notice may take the form of a display advertisement in the local newspapers and flyers to be displayed at local businesses. This public notice may also be broadcast through local radio and television public service announcements. Local media may be informed of site events through mailings of fact sheets and public notices.

- **Fact Sheets** - Three fact sheets will be prepared to keep the public informed of site activities.

The first fact sheet has been issued, and included information on the following:

- The Cedar Corporation/Vicksburg Plant Site;
- The Corrective Action Process
- Initiation of the RFI/CMS and
- Opportunities for public involvement

The second fact sheet will describe RFI results and upcoming CMS activities. This fact sheet should be prepared and distributed after completion of the final RFI report.

The third fact sheet will address the proposed plan, describe the CMS results and the preferred alternative, and the Agency's rationale for this preference. This fact sheet should be prepared and distributed, after the CMS is complete and a preferred alternative has been selected, to solicit comments during a 30-day comment period.

The fact sheets will include the name, address and telephone numbers of Federal and state contacts directly involved with site activities.

- **Media Interviews** - Cedar will conduct other community relations activities, such as interviews with media to insure information is provided to the public, or other events to provide information or obtain

community input if the community indicates sufficient interest or concern.

- **Review of CRP - Cedar will review this plan periodically, particularly after a remedy is selected, to determine if changes are needed to insure an effective community relations effort for the Cedar Site.**

SCHEDULE OF ACTIVITIES

Table 1 presents a schedule of community relations activities for the site. Each community relations activity described in Section 5.0 is coordinated with the technical milestones of the RFI/CMS process. An "X" in Table 1 designates the appropriate time to conduct the community relations activity.

CEDAR CHEMICAL CORPORATION/VICKSBURG PLANT

SCHEDULE OF COMMUNITY RELATIONS ACTIVITIES

Community Relations Activity	During IM and RFI	Completion of RFI	During CMS	Proposed Plan Announced	Corrective Action Activities
(1) Establish Information Repository	X		update as needed		X
(2) Contact Local Officials	as needed	X	as needed	X	as needed
(3) Publish Public Notice				X	as needed
(4) Contact Local Officials	X		as needed		X
(5) Distribute Fact Sheets	X	X		X	
(6) Conduct Comment Period				X	30-days
(7) Additional Activities			as needed		
(8) Review of CRP					as needed

Cedar Chemical Corporation

APPENDIX D

CEDAR HEALTH AND SAFETY PLAN

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INTRODUCTION

The Health and Safety Plan sets guidelines and requirements for the safety of all Cedar Chemical Corporation (CCC) personnel during the conduct of Hazardous Waste Clean-up activities at the Cedar Chemical, Vicksburg Plant site location. Specific sites and activities are defined later in this plan. All employees of Cedar Chemical involved in this project will be required to read the plan and sign the attached compliance agreement.

Cedar Chemical will administer a Health and Safety program which meets all the applicable regulations and requirements of these specifications. The implementation and enforcement of these health and safety requirements is the company's responsibility. The company (CCC) shall take all necessary precautions for the safety of and provide the necessary plant protection to prevent injury, damage, or loss to:

- A. All employees on the plant sites and other persons who may be affected thereby.
- B. All the work and materials or equipment to be incorporated in the work site.

This plan may be modified by the project director and/or the Cedar Chemical Plant Health and Safety Officer in response to additional information obtained regarding the potential hazards to CCC field personnel.

1.1 KEY PERSONNEL

Project management will be handled out of the Cedar Chemical South administration office, Vicksburg, MS. The following is a description of job responsibilities and authorities:

1.1.1 Project Director: Steve Boswell

Responsibilities:

- A. To see that all work performed is consistent with the CCC Health and Safety Plan.
- B. To have an approved Health and Safety Plan prepared and properly implemented for this project.
- C. To provide the Health and Safety Officer with information related to health and safety matters and development of the Health and Safety Plan.
- D. To implement the Health and Safety Plan.
- E. To insure compliance with the Health and Safety Plan by CCC and contractor personnel.
- F. To coordinate with the CCC Health and Safety Officer on health and safety matters.

The Project Director has the authority to take the following actions:

- A. To determine matters relating to schedule, cost, and personnel assignments on hazardous waste management projects.
- B. To temporarily suspend field activities, if the health and safety of personnel are endangered, pending further consideration by the CCC Health and Safety Officer.

- C. To temporarily suspend an individual from field activities for infractions of Health and Safety Plan, pending further consideration by the CCC Health and Safety Officer.

1.1.2 Health and Safety Officer: Roger Holdiness

The Health and Safety Officer has the following responsibilities:

- A. To interface with the Project Director as may be required in matters of health and safety.
- B. To approve a Health and Safety Plan for the project.
- C. To appoint or approve a Site Safety Officer to assist in implementing the Health and Safety Plan.
- D. To monitor compliance with the approved Health and Safety Plan.
- E. To assist the Project Director in seeing that proper health and safety equipment is available for the project.
- F. To approve personnel to work on this site with regard to medical examinations and health and safety training.

The Health and Safety Officer has the authority to take the following actions:

- A. To suspend work or otherwise limit exposures to personnel, if a Health and Safety Plan appears to be unsuitable or inadequate.
- B. To direct personnel to change work practices, if they are deemed to be hazardous to health and safety of personnel.

- C. To remove personnel from the project, if their actions or condition endangers their health and safety or the health and safety of co-workers.

1.1.3 CCC Site Safety Officer: Otto Logue

The Site Safety Officer (SSO) has the following responsibilities:

- A. To direct health and safety activities onsite.
- B. To report safety-related incidents or accidents to the Project Director and CCC Health and Safety Officer.
- C. To assist the Project Director in all aspects of implementing the Health and Safety Plan.
- D. To maintain health and safety equipment onsite, as specified in Health and Safety Plan.
- E. To perform health and safety activities onsite, as specified in the Health and Safety Plan, and report results to the Project Director and the CCC Health and Safety Officer.

The SSO has the authority to take the following actions:

- A. To temporarily suspend field activities, if the health and safety of personnel are endangered, pending further consideration by the CCC Health and Safety Officer.
- B. To temporarily suspend an individual from field activities for infractions of the Health and Safety Plan, pending further consideration by the CCC Health and Safety Officer.

PRINCIPAL WORK ITEMS

Principal work items for the Health and Safety Program include, but are not limited to, the following:

- A. Development and implementation of a specific site Health and Safety Plan which includes, but is not limited to, the following:
 - 1. Site description
 - 2. Objectives
 - 3. Description of field activities
 - 4. Medical surveillance
 - 5. Description of personnel protection levels
 - 6. Organization
 - 7. List of key personnel and their responsibilities
 - 8. Hazard analysis
 - 9. Site control
 - 10. Air monitoring program
 - 11. Action level for response procedures, emergency procedures air releases
 - 12. Employee training program
 - 13. Standard operating procedures

- B. Provide facilities for personnel decontamination.

- C. Provide personnel and equipment decontamination facilities sufficient to prevent the spread of contaminants to the environment.

- D. Provide equipment, personnel and facilities for personnel protection and first aid during work.

- E. Provide equipment, personnel and facilities for air monitoring and for control of air releases.
- F. Provide safety audits, documents, inspections and reports for health and safety activities and air monitoring.

2.1 REFERENCES

- A. Requirements for Worker Health and Safety included in the National Oil and Hazardous Substances Contingency Plan, (40 CFR 300.38).
- B. EPA's Occupation Health and Safety Manual.
- C. EPA Order 1440.2 - Health and Safety Requirements for Employees Engaged in Field Activities.
- D. EPA Order 1440.3 - Respiratory Protection.
- E. EPA Standard Operating Safety Guides (November 1984)
- F. Title 29 Code of Federal Regulations
- G. All applicable OSHA requirements under 29 U.S.C. 651 et. seq. including, but not limited to:
 - 1. General Industry Standards (20CFR Part 1910)
 - 2. Construction Standards (29 CFR Part 1926)
 - 3. OSHA Recordkeeping and Reporting Regulations
 - 4. OSHA General Duty Requirement (29 U.S.C. 654(A) (1).
- H. All applicable state and local regulations.

2.2 SITE DESCRIPTION

Cedar Chemical Corporation, Vicksburg Plant, is located in Warren County, Mississippi, along the Mississippi River, on a 600-acre site immediately south of the City of Vicksburg. The plant site is divided physically and functionally into a "north plant" and "south plant". The south plant operation includes areas for the production of nitric acid (65%), receiving and storage of anhydrous ammonia (NH_3), sodium hydroxide (NaOH), sulfuric acid (H_2SO_4) and boiler water treatment chemicals. Other areas in the south plant are used for storage of chemicals not currently being used. Nitric acid is normally shipped via pipeline to the north plant as a raw material.

The "north plant" includes the potassium nitrate (KNO_3) process and areas for storage of raw materials (muriate of potash and nitric acid), product, potassium nitrate, chlorine and nitrogen tetroxide. Potassium hydroxide, sodium hydroxide and Petro-ag are used to treat the different grades of potassium nitrate. Sulfuric acid is stored and used in the treatment of boiler feedwater and pH control of wastewater.

The work sites concerning this plan are associated with the south and north plants (Figure 1) and include several Solid Waste Management Units (SWMUs) and Other Areas of Concern (OACs)

2.3 OBJECTIVE

To provide a comprehensive health and safety plan that includes initial and continued training of all in-plant employees who are required to either participate as a responder to a chemical spill, explosion or gas release, etc. and/or clean-up and disposal of hazardous waste.

2.4 SITE HISTORY

In the past, Cedar Chemical Corporation produced various types of pesticides and herbicides such as dinoseb, toxaphene, atrazine and monosodium methane arsonate. All of these chemicals have been detected in the soil and water by Cedar Chemical

Corporation and the state of Mississippi. Concentrations range from less than detectable on hazardous wastes to an average of about 5 parts per million (ppm). Chlorinated solvents have been detected in sludge sediments in the ppm range for carbon tetrachloride, methylene chloride, chloroform, and 1,1-dichloroethylene. The source of the chlorinated solvents is unknown as well as the source of xylene, toluene, and ethylbenzene, which have been detected in the range of 2-15 ppm.

2.5 DESCRIPTION OF FIELD ACTIVITIES

CCC will perform work as required in the Consent Decree. This Decree requires interim measure activities, sampling of soil, ground water, and air, and where necessary cleaning and dismantling of old abandoned organic process facilities, excavation of contaminated soil and any other activities that may be required after a RCRA investigation.

2.6 RECORDS OF FILE

- A. Employee training records including, but not limited to, the employee's name, date of training session, topics, equipment demonstration, equipment practice for each employee, buddy-system explanation, etc.
- B. Employee compliance agreement signed and dated by the trainee stating that he or she has read, understands, and will abide by all provisions of Health and Safety Plan.
- C. Employee respiratory fit test records including, but not limited to, the employee's name, social security number, examination date, respiratory equipment, manufacturer's name, type and model/size, test results, employee training on principles of respiratory protection devices, a signature and date, employee's name (printed), a signature and date.
- D. Medical certificates including, but not limited to, the employee's name, date of physical, name of physician, physician's statement on results of

the physical completed on the subject employee, whether the employee is approved or not for hazardous waste site work, limitations, etc., physician's signature and date of signature.

E. Logs and Reports (as required):

1. Safety Inspection Log including, but not limited to the date, area (specified zone) checked, activities being performed, equipment being utilized by employees, protective devices being worn by employees, monitoring results, and Site Safety Officer's signature and date.
2. Inspection Logs to be filled out routinely by Site Safety Officer to include, but not limited to summary sheet covering range of work being done, incidents, violations and observations, reports of any job-related injuries and illness.

F. Qualifications of Health and Safety Officer:

1. Name - Roger Holdiness
2. Relevant experience and training (see Appendix A).

G. Qualifications of Plant Site Safety Officer:

1. Name - Otto Logue
2. Relevant experience and training (see Appendix A).

2.7 DEFINITIONS

- A. OSHA Permissible Exposure Limits (PEL) - Time weighted average (TWA) concentrations to which most workers can be exposed for 40 hours per week on a permanent basis with no significant health effects.**

These concentrations are enforceable OSHA standards. (Source: NIOSH/OSHA Pocket Guide to Chemical Hazards, August, 1980).

- B. **Immediately Dangerous to Life & Health (IDLH) - Concentrations representing a maximum level from which one could escape within 30 minutes without any escape impairing symptoms or irreversible health effects. (Source: NIOSH/OSHA Pocket Guide to Chemical Hazards, August, 1980).**

- C. **Threshold Limit Values/Time weighted Average (TLV-TWA) - Time weighted average concentrations to which most workers can be exposed for 40 hours per week on a permanent basis with no significant health effects. They are similar to PELS except that they are not enforceable standards and are updated annually. (Source: ACGIH Threshold Limit Values and Biological Exposure Indices for 1985-86).**

- D. **Health and Safety Officer (HSO) - Representative responsible for development and implementation of the Health and Safety Plan.**

- E. **Site Safety Officer (SSO) - Representative responsible for development and implementation of the Health and Safety Plan.**

- F. **Level of Protection - The four (4) levels of protection, as described in the U.S. EPA's Interim Standard Operating Safety Guide are briefly described as follows:**
 - 1. **Level A - The highest level of protection to be utilized when respirator, dermal, and eye exposure is possible.**

 - 2. **Level B - Provides the highest level of respiratory protection but a lesser degree of dermal protection. To be used when cutaneous or percutaneous exposure risks are minor.**

3. **Level C - To be used when the types and concentrations of respirable contaminants are known and are not greater than the protection limitations of the air purifying respirators and cartridges.**
4. **Level D - Cloth work uniform including boots, hard hat, and facial protection. An air purifying respirator or an escape mask is readily available in the event of an unexpected air release.**

2.8 PLANT SITE SAFETY REGULATIONS

- A. **Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of any material is prohibited in any area designated contaminated.**
- B. **No facial hair which interferes with a satisfactory fit of the mask-to-face-seal is allowed on personnel required to wear respirators.**
- C. **Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, there will be no walking through puddles, discolored surfaces, kneeling on ground, leaning, sitting or placing equipment on drums, containers or the ground.**
- D. **Medicine and alcohol can potentiate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on remedial operations where the potential for adsorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Alcoholic beverages and/or illegal drugs will not be allowed on the plant sites.**
- E. **Wind socks visible to all personnel are strategically located on each plant site.**

- F. Personnel and equipment in any contaminated area(s) will be minimized, consistent with effective site operations.
- G. Work areas for various operational activities are established.
- H. Procedures for leaving a contaminated area must be planned and implemented prior to going on site. Work areas and decontamination procedures must be established based on expected site conditions.
- I. The site Health and Safety Plan must be made available to all personnel.
- J. All personnel must be familiar with standard operating safety procedures and any additional instructions and information contained in the site Health and Safety Plan.
- K. All personnel must adhere to the information contained in the site Health and Safety Plan.
- L. All personnel going on site must be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures and communications.
- M. Any required respiratory protective devices and clothing must be worn by all personnel going into areas designed for wearing protective equipment.
- N. During response and hazardous clean-up operations on site, workers act as safety back-up to each other.
- O. Personnel should practice unfamiliar operations prior to doing the actual procedure.

- P. Warning signals for site evacuation are contained in the Cedar Chemical Contingency Plan.
- Q. Communications using radios, hand signals, signs, or other means must be maintained between initial entry members at all times. Emergency communications should be prearranged in case of radio failure, necessity for evacuation off site, or other reasons.

2.9 PERMISSIBLE EXPOSURE LIMITS

Results of industrial hygiene monitoring and surveillance shall be compared to the U.S. Department of Labor occupational Safety and Health Administration (OSHA).

MEDICAL CARE

Medical care is divided into routine health care and emergency medical care treatment.

1. **Routine Health Care**

Routine health care and maintenance consists of:

- a. Pre-employment medical examinations to establish the individual's state of health, baseline physiological data, and ability to wear personnel protective equipment.

2. **Emergency Medical Care and Treatment**

- a. The following local emergency organizations and facilities will be utilized. Call 911 for an emergency.

636-1603 Ambulance - Vicksburg Fire Department
636-2611 Hospital - Vicksburg Medical Center
636-2131 Hospital - Parkview Medical Center
636-1761 Sheriff - Warren County Sheriff's Dpt.
636-2511 Police - Vicksburg Police Department
636-7271 Doctor - Dr. Randy Easterling (office)
636-2561 Registered Nurse - Cleo Donovan

- b. Emergency showers, eye wash fountains, and first aid kits are available at the site area.
- c. First aid stations are located in both north and south plants.

- d. Both plants have personnel qualified in first aid and CPR during all site work activity.
- e. Material Safety Data Sheets are available at the plant site and will be given to Medical Emergency Personnel when exposure has been determined.

3.1 MEDICAL MONITORING PROGRAM

- A. General: Cedar Chemical utilizes the services of a physician experienced in occupational medicine and the effects of toxic industrial substances.
- B. Pre-work Assignment Physical Exam: The initial medical examination shall include, at a minimum:
 - 1. Medical history which includes, but is not limited to:
 - a. Job-related illnesses or injuries.
 - b. Personnel habits, e.g., smoking, alcohol, and drug consumption.
 - c. Medical history.
 - d. Allergies.
 - 2. A full physical examination, with particular attention to the following:
 - a. Cardiopulmonary system
 - b. Skin
 - c. Blood forming system
 - d. Liver
 - e. Renal system
 - f. Nervous system

6. Calcium
7. Phosphorus
8. Uric acid
9. Creatinine
10. Urea nitrogen
11. Cholesterol
12. Glucose
13. Total protein

9. Urinalysis, including:

- a. Specific gravity
- b. pH
- c. Microscopic examination
- d. Proteins
- e. Acetone
- f. Glucose

10. Other special tests as deemed necessary by the company physician.

C. Exit Exam: Exit exams shall include the following items:

1. A physical examination, as specified under the Pre-Work Assignment Physical Exam
2. Vital systems check, as specified under the Pre-Work Assignment Physical Exam
3. Screening audiometric test with otoscopic exam for wax
4. Visual acuity measurement, including color perception
5. Pulmonary function test
6. Blood tests, as specified for Pre-Work Assignment Physical Exam

7. Urinalysis, as specified for Pre-Work Assignment Physical Exam

D. Medical Support Services: Cedar's physician will provide medical consultation services to advise on medical and health questions as they arise, and evaluation and care of individuals with work-related exposures, injuries, or illness.

3.2 TRAINING REQUIREMENTS

A. Cedar Chemical shall provide training to all of its employees who will be assigned to the plant sites which complies with the requirements of 29 CFR 1910.120.

Any person assigned to work on a hazardous material site will complete a required 40-hour training course as required by 29 CFR 1910.120 (OSHA) and Section 125 of SARA, plus three days of actual field experience under the direct supervision of a trained and experienced supervisor.

Manager and supervisors directly responsible for hazardous waste site operations will receive a minimum of eight additional hours of specialized training on managing hazardous waste operations.

Training will cover the following outline, but is not limited to:

1. Names of personnel and alternates responsible for site safety and health
2. Safety, health and other hazards present on site
3. Personal protective equipment, use, care, and limitations
4. Work practices that minimize risks from hazards
5. Safe use of engineering controls and equipment on site
6. Medical surveillance program requirement

7. **Right to know program**
 - a. **Where to find information on chemicals (MSDS)**
 - b. **Recognition of symptoms and signs which might indicate overexposure to hazard**
8. **Site control measures**
9. **Decontamination procedures**
10. **Site standard operating procedure**
11. **Contingency plan**
12. **Confined space entry procedures**
13. **There is an implied training requirement for handling drums and other containers/packages**

In addition, employees who are responsible for responding to hazardous emergency situations are trained in how to respond to any anticipated emergency conditions.

First aid and CPR training - CFR 29 1910.151 OSHA requires that a person or persons be trained in first aid and CPR.

- B. **Initial Training: Cedar Chemical provides initial training to all employees assigned to the sites. Training shall be a minimum of eight hours and includes as a minimum.**
 1. **Acute and chronic effects of the toxic chemicals at the sites**
 2. **Routes of exposure (Skin penetration, inhalation, and ingestions and field activities, which could result in exposure).**
 3. **Need for personal protection (effectiveness and limitations).**

4. **Proper use and fitting of respirator (to include drills in donning emergency respirator)**
5. **Medical surveillance program review.**
6. **Prohibitions (outside support zone), including:**
 - a. **Glasses or facial hair, such as bears and long sideburns which interfere with respirator fit**
 - b. **Contact lenses**
 - c. **Eating, drinking, smoking, chewing**
 - d. **Personal articles, e.g., watches, rings, etc.**
 - e. **Working when ill**
 - f. **Work zones established at the site**
 - g. **Engineering controls and safe work practices associated with employee's work assignment, including dust control measure and use of buddy system.**
 - h. **Personnel and equipment decontamination procedures**
 - i. **Emergency response**
 - j. **Basic operational safety, emphasizing hazards expected onsite**

C. Emergency Response Training:

1. **First Aid and CPR Training: The HSO and SSO shall have current first aid and CPR certification via an established American Red Cross Program.**
2. **Fire Extinguisher Training: At least one member of each work crew shall receive training in the use of portable fire extinguisher in accordance with OSHA 1910.157G.**

- D. **Visitor Training:** Cedar Chemical will provide safety orientation training for visitors to the site in order to make them aware of the hazards associated with the site; explain emergency procedures and the use, limitations, and fit of protective gear required during the visit.

3.3 STANDARD OPERATING PROCEDURES

- A. Cedar Chemical has standard operating procedures in accordance with EPA standard operating safety guides (November 1984). At a minimum, the following standard operating procedures cover the following:

1. Heat Stress Prevention Plan which at a minimum cover the following:
 - a. Identification of symptoms
 - b. Treatment
 - c. Prevention
 - d. Heat stress monitoring
2. A Respiratory Protection Program in accordance with OSHA regulation 1910.134 and at a minimum includes the following areas:
 - a. Selection and use of respiratory protection equipment
 - b. Respirator fit testing
 - c. Respirator inspection, care, maintenance and storage
3. Personal protective equipment selection and use procedures for each type of equipment.
4. Personnel and equipment decontamination procedures in accordance with the provisions of Article 3.06.

5. Incident/accident reporting procedures
6. Plant site control procedures
7. Emergency Preparedness outlined in the Contingency Plan

3.4 PLANT SITE CONTROL

The Cedar Chemical plant SWMU's are controlled to reduce the possibility of (1) exposure to any chemical present, and (2) their transport by personnel or equipment from the process sites as detailed below:

- A. Only those personnel that have been previously approved for work in these sites will be utilized.
- B. All employees approved and assigned to perform interim measures remedial work in the site (SWMU's) must enter and exit through a decontamination area. Such work and decontamination procedures will be monitored by the site work supervisor and/or site Health and Safety Officer.
- C. Unless previously approved and protected by required personnel equipment visitors will not be permitted into site exclusion zone (areas of contamination clean-up activity).

3.5 EMERGENCY MEDICAL TREATMENT AND ACCIDENT NOTIFICATION

Should site personnel suffer an injury or illness, the following resources will be utilized, as appropriate:

- A. At least one person on site will be qualified to render first aid and cardiopulmonary resuscitation.

- B. Fire Department Rescue Squad, Vicksburg Fire Department - 911
- C. Ambulance Service, Vicksburg Fire Department - 911
- D. Sheriff's Office, Warren County - 636-1761
- E. Hospital Emergency Room, Vicksburg Medical Center - 634-2611
- F. Hospital Emergency Room, Parkview Medical Center - 631-2131

These numbers are posted at the plant first aid stations and change house.

If an injury/illness is the result of a site specific material exposure, this information will be provided to the treating physician.

Any injury/illness not limited to a first aid case will require that the Cedar Health and Safety Officer be notified immediately.

3.6 RESPONSES TO SPECIFIC SITUATIONS

- A. Worker injury: If an employee working on the property is physically injured, Red Cross First Aid procedures will be followed. Depending on the severity of the injury, emergency medical response may be sought. If the employee can be moved, he will be taken to the First Aid Station for treatment and, if necessary, transported to the Vicksburg or Parkview Medical Center.

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

- a. Eye exposure: If liquids get into the eyes, wash eyes immediately with the emergency eyewash using large amounts of water and lifting the lower and the upper lids occasionally.

Wash for at least 15 minutes. Obtain medical attention immediately.

- b. **Skin exposure:** If liquids get on the skin, promptly wash the affected skin using soap or mild detergent and water for at least 15 minutes. Obtain medical attention immediately. Wash face and hands prior to eating or leaving the site.
- c. **Inhalation exposure:** Remove to fresh air. Support breathing if needed. Obtain medical attention.

3.7 NOTIFICATION

- A. **Checklist:** The names and phone numbers of all personnel and agencies that could be involved in emergency response are posted on the work site.
- B. **Procedures:** In the event of an onsite emergency requiring notification of off site personnel, the Emergency Coordinator is responsible for immediately notifying the appropriate agencies and personnel.
- C. **Evacuation Plan:** Although very unlikely, it is possible that a site emergency could necessitate evacuating all personnel from the work site. If such a situation arises, the Emergency Coordinator will notify all personnel for site evacuation. Evacuation will be upwind or across-wind, whichever gives the most direct and safest path of escape.

All available vehicles located outside process area will be used in the evacuation.

The Emergency Coordinator for Hazardous Waste Management Activities will be as follows: (The EC list below is for this plan only).

- a. **Site work supervisor - Mike Lockett**
- b. **Site Health and Safety Officer - Otto Logue**
- c. **Cedar Health and Safety Officer - Roger Holdiness**

PERSONNEL PROTECTIVE EQUIPMENT

Personal Protective Equipment (PPE) required to prevent contact with known or anticipated chemical hazards has been divided into four categories by the USEPA, Levels A, B, C and D, according to the degree of protection afforded. The following personnel protective equipment will be provided to CCC personnel involved in site activities.

Mobilization - Level D Protection

- Boots, steel toe and shank
- Hard hat
- Safety glasses with side shields
- Coveralls - cloth

Modified Level D Protection

- Gloves (outer), chemical resistant, Polyvinyl Alcohol (PVAL)
- Gloves (inner), chemical resistant, latex
- Boots, chemical resistant (or bottie covers), steel toe and shank
- Safety glasses with side shields
- Hard hat (with faceshield if splash hazard exists)

Modified Level C Protection

- To include Modified Level D; PPE mentioned above
- Full-face air purifying respirators with combination organic vapor/ammonia filter cartridges.

Tyvek coveralls will be discarded after each use or when they become worn or punctured. Suit materials are resistant to all known or anticipated chemicals at the site. If the disposable protective suits appear to be deteriorating under chemical action, the Site Safety Officer should be notified.

In addition to the personal protective equipment listed above, general safety equipment available for use will include a first aid kit, portable eye wash and fire extinguisher.

4.1 WORK ZONES

During activities conducted in Modified Level D PPE the setup of work zones as defined by the United States Environmental Protection Agency (U.S. EPA) will not be required. Management of this project shall be conducted in such a manner which will restrict access to the job site by unauthorized personnel. If Level D action levels are exceeded resulting in an upgrade to Level C PPE, work zones as described in the following paragraphs shall be implemented.

To minimize the movement of contaminants from the site to uncontaminated areas, three work zones will be set up during activities conducted under Level C PPE. The three work zones will include the following:

- Zone 1: Exclusion Zone (Work Zone)
- Zone 2: Contamination Reduction Zone (Decon Area)
- Zone 3: Support Zone

The exclusion zone is the zone where contamination does or could occur. Observations by the Site Safety Officer will determine the extent of the zones. All persons entering this zone must wear at a minimum the level of protection (Level C PPE).

Between the exclusion zone and support zone is the personnel decontamination zone which provides a transition zone between the contaminated and clean areas of the site. This zone will be located directly outside of the exclusion zone and will be defined as 10-foot zone directly outside the exclusion zone.

The support zone will be an uncontaminated area from which operations will be directed. It is essential that contamination from the site be kept out of this area. Included in this area will be a storage area for decontaminated clothing, additional personal protective equipment, etc.

One additional work zone will be set up for decontaminating equipment.

4.2 DECONTAMINATION PROCEDURES

Cedar Chemical Corporation will have a minimum of the personal decontamination station, strategically located in the work area or in the contamination reduction zone if applicable. The decontamination station will have at least the following items:

- An adequate-sized plastic sheet for flooring
- Boot wash equipment
 - Water/alconox solution container
 - Rinse water container
 - Long-handled plastic brush
- Waste container (disposable PPE, tape, etc.)
- Hand wash equipment
 - Water/alconox solution container
 - Rinse water container
 - Paper towels

4.3 EQUIPMENT DECONTAMINATION

Decontamination equipment will be accomplished by the following procedure:

1. Washing in a detergent solution
2. Rinsing with clean water
3. Equipment must pass a non-transferrable wipe test

Decontamination of equipment shall be conducted in Modified Level D PPE.

4.4 PERSONNEL DECONTAMINATION

Decontamination of personnel will be performed at a designated location at the perimeter of the work area. Decontamination will consist primarily of soap and water washings and water rinse of exterior protective gear to remove contaminants, followed by doffing of the gear.

Coveralls should be removed by turning the clothing inside out. A general sequence of doffing procedures is outlined below. The extent of washing required, or modifications to the sequence, may be specified as appropriate.

Personnel will be decontaminated by the following procedure:

- Wash and rinse outer protective coverall
- Wash work gloves and boots
- Remove outer protective clothing
- Rinse respirator if worn
- Wash hands and face

Contaminated disposable PPE and all decontamination fluids shall be containerized on site for subsequent disposal by the direction of Cedar Chemical Corporation.

5.0

SAFETY TRAINING DOCUMENTATION

Prior to commencing any of the field activities, all CC personnel performing interim measure remedial work on site will supply certificate or equivalent, attesting to completing 40 hours of training as required by OSHA, in 29 CFR 1910.120, to the SSO. Site supervisors will be required to supply documentation indicating that an additional 8 hours of training has been completed. Escorted visitors may be allowed in a defined area without 40 hours training at the discretion of the CCC SSO and the CCC site supervisor.

Documentation concerning respirator fit testing, in accordance with OSHA, 20 CFR 1910.134 shall be required of any CCC employee wearing a respirator.

5.1 COMPLIANCE AGREEMENT

The Project Director and the Cedar Health and Safety Officer shall hold meetings with all CCC field personnel before work commences. During the meeting, all personnel shall be provided with a copy of this safety plan; the plan shall be reviewed and discussed and questions answered. Signed Compliance Agreement Forms shall be collected by the Project Director and filed by the Cedar Health and Safety Officer. Individuals refusing to sign the form will not be allowed to work on the site.

5.2 PROJECT DIRECTOR NOTIFICATION

All field personnel must inform the Project Director or his designated representative before entering the site. The "buddy system" will be employed during all project work. This means at least two members of the field crew must be on site whenever work is performed. Personnel must be in visual contact with each other or carry two-way radios at all times.

5.3 PROJECT SAFETY LOG

A Project safety log will be used to record the names, entry and exit dates and times of all CCC and subcontractor personnel and of project site visitors; accidents, injuries, and illnesses; incidence of safety infractions by field personnel; air quality and personal exposure monitoring data; and other information related to safety matters. All accidents, illnesses or other incidence shall be reported immediately to the CCC Project Director and the Cedar Health and Safety Officer and subsequently documented for filing on the Incident Report Form attached as Attachment 4.

5.4 PROHIBITIONS

- Smoking, eating, drinking, chewing gum or tobacco, storing food or food containers shall not be permitted on the work site. Good personal hygiene should be practiced by field personnel to avoid ingestion of contaminants or spread of contaminated materials.
- Ignition of flammable liquids within, on or through improvised heating devises or space heaters.
- Approach or entry into areas or spaces where toxic or explosive concentrations of gases or dust may exist without proper equipment available to enable safety entry.
- Conduct of onsite operations without off site back up personnel.

5.5 SITE SAFETY MEETINGS

During all site activities, daily safety meetings will be held by the Site Safety Officer and/or Site Field Supervisor to review and plan the specific health and safety aspects of scheduled work for that day.

5.6 LABORATORY CONSIDERATIONS

The laboratory manager will be informed of any obvious contaminant level in the samples that would require special handling procedures to prevent risk to the health and safety of laboratory personnel.

PERSONNEL PROTECTIVE EQUIPMENT

This section outlines the general usage guidelines for personal protective equipment.

6.1 HEAD PROTECTION

Hard hats must be worn by all personnel working on site.

6.2 EYE PROTECTION

Safety glasses with side shields or goggles must be worn by all personnel performing activities where potential for eye or face exposure exists due to splash, dust, or vapor, etc. An eyewash station will be set up by the site safety officer prior to commencing field activities and should be placed so that it could be used quickly in an emergency.

6.3 SKIN PROTECTION

Due to the potential for skin absorption and carcinogenic properties chemical resistant gloves and coveralls shall be worn by all personnel during waste handling activities. These will be disposed of in a designated sealable drum after each use or when they become worn or punctured.

6.4 FOOTWEAR

Steel toed chemical resistant boots will be worn by field personnel engaged in the field activities at the site. Chemical resistant booties can be substituted for chemical resistant boots.

6.5 RESPIRATORY PROTECTION

For respiratory protection against possible volatile organic, full-face air purifying respirators (APR) will be required if Level D air monitoring action levels are exceeded. Specific cartridges to be utilized with the APRs will be combination organic vapor/ammonia filter cartridges. All personnel must be properly fit-tested for the specific brand and size respirator to be used. Documentation of fit testing is to be provided to CCC SSO prior to commencement of work. A respirator which has not been successfully fit-tested cannot be used by an individual on the project. To ensure a proper fit, no facial hair will be allowed that will interfere with mask operation. The site safety officer will determine if facial hair represents such as interference. Air purifying respirators will only be used if the following conditions are met:

- The oxygen content of the air is greater than 19.5 percent
- Concentration of air contaminants are known and monitored
- The contaminants of concern all have good warning properties (i.e., odor threshold below PEL value)
- The protection factor is adequate and PELs are not exceeded
- If concentrations of air contaminants exceed IDLH value, personnel must immediately evacuate
- Cartridges are changed daily or whenever breakthrough occurs, whichever even occurs first
- Each person has been fit-tested for the specific brand and size of respirator used
- The respirator is MSHA and/or NIOSH approved.

AIR QUALITY MONITORING

The primary goal of onsite air quality monitoring will be compliance with the specified contaminant action levels. The secondary goal will be documentation of personal exposures as required by OSHA 1920.120.

7.1 AIR QUALITY SURVEY

During modified Level D field activities at the site, an air quality survey will be performed utilizing an Teco 5.80 B photoionization detector (PID) equipped with a 10.6 ev probe, or equivalent instrument to characterize volatile organic and ammonia concentrations on site. Standard operating procedures for this instrument are attached as Appendix E. During Level C field activities, additional sampling utilizing colorimetric tubes specific for detecting chloroform, methylene chloride, and carbon tetrachloride will be used along with the HNu for total organic vapors. At least two sampling events utilizing each of these tubes will be conducted in the breathing zone of personnel closest to the field activities at the site. Table 2 lists air monitoring action levels for Level D and C work.

8.0

SAFETY TRAINING DOCUMENTATION

Prior to commencing any of the field activities, all CCC personnel working on site will supply certificate or equivalent, attesting to completing 40 hours of training as required by OSHA, in 29 CFR 1910.120, to the SSO. Site supervisors will be required to supply documentation indicating that an additional 8 hours of training has been completed. Escorted visitors may be allowed in a defined area without 40 hours training at the discretion of the CCC SSO and the CCC site supervisor.

EMERGENCIES/ACCIDENTS

A site map and direction to Vicksburg Hospital are included in Figure 1. Illnesses, injuries, and accidents occurring on site must be attended to immediately in the following manner:

- Remove the injured or exposed person(s) from immediate danger.
- Render FIRST AID if necessary. Decontaminate affected personnel, if necessary.
- Call ambulance for transport to local. This procedure should be followed even if there is no apparent serious injury. Emergency numbers are listed on the following section.
- Evacuate other personnel onsite to a safe place until the field supervisor (assisted by the Site Safety Officer) determines that it is safe for work to resume.
- Report the accident to the Health and Safety Officer immediately.
- Develop procedures, in accordance with the Health and Safety Officer, Site Safety Officer, and Project Manager to prevent a recurrence.

In the event that an emergency site evacuation should be necessary for any reason, the Site Safety Officer will render an alarm using a horn and all personnel shall leave the site. The assembly point will be designated in the field. Personnel will not return to the site until an all-clear has been received from the Site Safety Officer.

9.1 EMERGENCY NUMBERS

For any on site Emergency dial 911.

Emergency Service

Telephone

Fire Department	636-1121
Ambulance	911
Sheriff	636-1761
Vicksburg Police Department	636-2511
National Response Center (NRC)	1-800 424-8802
Poison Control Center	1-800 535-0525
Vicksburg Medical Center	636-2611
Parkview Medical Center	631-2131

10.0

I, _____ (print name), have received a copy of the Safety Plan for the Hazardous Waste Management Workplans for Cedar Chemical Corporation, Vicksburg, Mississippi. I have read the plan, understand it, and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the safety requirements specified in the plan.

Signed:

Signature

Date

Firm: _____

TABLE 1
EXPOSURE LIMITS FOR POTENTIAL AIRBORNE CONTAMINANTS

Contaminant	ACGIH TWA	OSHA PEL-TWA	STEL	IDLH
+Toxaphene	0.5 mg/m ³	0.5 mg/m ³	1 mg/m ³	200 mg/m ³
Atrazine	5 mg/m ³	5 mg/m ³	-	-
+Carbon Tetrachloride	5 ppm	2 ppm	-	Ca
Methylene Chloride	50 ppm	500 ppm	-	Ca
Chloroform	10 ppm	2 ppm	-	Ca
Xylene	100 ppm	100 ppm	150 ppm	1000 ppm
Toluene	100 ppm	100 ppm	150 ppm	2000 ppm
Ethylbenzene	100 ppm	100 ppm	125 ppm	2000 ppm
Lime Kiln Dust	10 mg/m ³	10 mg/m ³	-	-
Ammonia	25 ppm	50 ppm	35 ppm	500 ppm

+ Potential Skin Irritant

Ca Potential Human Carcinogen (Cancer Causing);

No IDLH level established.

TABLE 2
AIR MONITORING ACTION LEVELS FOR LEVEL C AND D WORK

Contaminant	Instrument*	Reading	Action Taken
Volatile Organic	HNu or equivalent	<5 ppm	Continued Work in Modified D Level
		5 - 25 ppm	Upgrade to Level C and Expand Work Zones; Commence additional colorimetric tube sampling
		>25 ppm	Evacuate Area

• Sustained reading above background (for 15 minutes continuous) which shall not be exceeded within worker breathing zones or exclusion zones.

APPENDIX A
HEALTH AND SAFETY PERSONNEL

APPENDIX A

HEALTH AND SAFETY PERSONNEL

- A. Cedar Health and Safety Officer (HSO) - Roger Holdiness. Roger Holdiness is the Cedar's representative responsible for the development and implementation of the Health and Safety Plan for Consent Decree activities. Roger has been the plant Safety Director for the past ten (10) years and another ten (10) years experience in all phases of chemical plant health and safety activities. During the past 10 years numerous safety goals have been achieved. The most recent is the record of one million manhours worked without a lost time. The record of four years and eight months without a lost time continues to the present.

Fire brigades, emergency response teams, safety committee and employee training programs have all been developed or improved under Roger Holdiness's leadership. He is the present Chairman of Warren County Sara Title III Committee - Right to Know. Organized and assisted in training the Warren County Hazardous Material Emergency Response Team.

- B. Site Health and Safety Officer (SSO) - Otto Logue. Otto Logue is directly responsible for the daily implementation of the site Health and Safety Plan. Logue started his career in the chemical industry with Spencer Chemical, now Cedar's south plant. He served a production supervisor and Operations Supt. for Amax and Vicksburg Chemical from 1965-1974 and as Personnel and Safety Director 1974-1978. Prior to his present assignment, Logue worked on special projects in the Engineering, Production and Safety Departments.

APPENDIX B
HAZARD ASSESSMENT

APPENDIX B

HAZARD ASSESSMENT

An assessment of hazards has been made for each activity group specified in the previous section. The following hazards have been identified and will be protected against:

- Heat stress
- Biological hazardous
- Physical hazards
- Skin contact with organic contaminants

BIOLOGICAL HAZARDS

If biological hazards develop during work activities, practical guidelines for prevention of exposure to pests will be implemented.

HEAT STRESS HAZARDS

If heat stress becomes a concern, the heat stress casualty prevention plan, presented in Appendix A shall be implemented.

PHYSICAL HAZARDS

Personnel should be cognizant of the fact that when protective equipment such as respirators, gloves, and protective clothing are worn, visibility and manual dexterity are impaired. In addition, personnel should be alert to physical hazards such as slipping, tripping/falling potentially associated with dismantled process equipment and piping remnants/ladders/stairways in various stages of disrepair, and uneven ground surface due to foundation fragments distributed throughout the site. Backhoe and crane operating should abide by standard safety guidelines applicable to such operations.

CHEMICAL HAZARDS

Due to past production activities at the facility, pesticides, herbicides, chlorinated solvents, and volatile organic solvents have been detected on site during site characterization efforts conducted by Cedar Chemical Corporation and the state of Mississippi. The constituents detected included dinoseb, toxaphene, atrazine, carbon tetrachloride, methylene chloride, chloroform, 1,1-dichloroethylene, xylene, toluene, and ethylbenzene at concentration report in the part per million range. On the constituents detected onsite, carbon tetrachloride, methylene chloride, and chloroform are classified by OSHA and/or ACGIH as known or suspected human carcinogens.

The constituents detected on site are present in low concentrations. However, exposure to these chemicals may potentially occur through inhalation, ingestion, and/or direct contact. Chemical exposure via multiple exposure pathways is cumulative, therefore it is important to recognize potential exposure situations and to take precautions to minimize exposure to chemical hazards by all routes.

The following potential exposure routes and associated health hazards have been identified.

Inhalation: Chemical hazards associated with inhalation exposures may include irritation of the mucous membranes and respiratory tract or with more severe exposures, may include systemic effects. Table 1 represents recommended exposure limits for potential airborne constituents.

Ingestion: Ingestion of chemical will be controlled on site by prohibiting eating, smoking, or drinking in the Exclusion Zone and by requiring all field personnel to conduct decontamination procedures prior to leaving the Exclusion Zone.

Direct Contact: Skin and eye contact with chemical hazards may potentially result in irritation, rashes, or burns. If a person should exhibit symptoms of eye or skin irritation, he/she should report to the SSO for immediate medical attention.

Potential hazards may be minimized by utilizing appropriate personal equipment designed to protect the body against contact with known or anticipated chemical hazards. Personal protective equipment is classified by the EPA by the level of protection afforded and is divided into four categories designated as Level A, B, C, and D with Level A providing the most extensive level of protection.

The level of protection required for the field activities specified by the work scope are presented in Section 5.1.

Chemical information sheets for each constituent known to be present at the site are presented in Appendix C. These sheets provide important information concerning physical/chemical properties, chemical/reactive hazards, exposure potentials, health hazards and symptoms of exposures, and appropriate treatment following exposure.

HEAT STRESS CASUALTY PREVENTION PLAN

Heat Stroke

- a) **Symptoms:** This is the most serious of heat casualties due to the fact that the body excessively overheats. Body temperatures often are between 107 degrees to 110 degrees Fahrenheit. First there is often pain in the head, dizziness, nausea, oppression, and the skin is dry, red and hot. Unconsciousness follows quickly and death is imminent if exposure continues. The attack will usually occur suddenly.
- b) **First Aid:** Immediately evacuate the victim to a cool and shady area in the Personnel Decontamination Reduction Zone. Remove all protective outer wear and all personal clothing. Lay him on his back with his head and shoulders slightly elevated. It is imperative that the body temperature be lowered immediately. This can be accomplished by applying cold wet towels, ice bags, etc., to the head. Sponge off bare skin with cool water or rubbing alcohol, if available, or even place him in a tub of cool water. The main objective is to cool him without chilling him. Give no stimulants. Transport the victim to a medical facility as soon as possible.

B. PREVENTION OF HEAT STRESS

- 1) One of the major causes of heat casualties is the depletion of body fluids. On the site there will be plenty of fluids available. Personnel should replace water and salt loss from sweating. Salts can be replaced by either 0.1 percent solution, more heavily salted foods, or commercial mixes such as Gatorade. The commercial mixes are advised for personnel on low sodium diets.

- 2) A work schedule should be established so that the majority of the work day will be during the morning hours of the day before ambient air temperature levels reach their highs.
- 3) A work/rest guideline will be implemented for personnel required to wear Level B or Level C protection. This guideline is as follows:

<u>Ambient Temperatures</u>	<u>Maximum Wearing Time</u>
Above 90 F	½ hour
80-90F	1 hour
70-80F	2 hours
60-70F	3 hours
50-60F	4 hours
40-50F	5 hours
30-40F	6 hours
Below 30 F	8 hours

A sufficient period will be allowed for personnel to "cool down". This may require shifts of workers during operation.

C. HEAT STRESS MONITORING

For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism. Monitoring of personnel wearing protective clothing should commence when the ambient temperature is 70 degrees Fahrenheit or above. Frequency of monitoring should increase as the ambient temperature increases or if slow recovery rates are indicated. When temperatures exceed 80 degrees Fahrenheit, workers must be monitored for heat stress after every work period.

Heart rate should be measured at the radial pulse for 30 seconds as early as possible in the resting period. The heart rate at the beginning of the rest period should not exceed 110 beats per minute. If the heart rate is higher, the next work period should be shortened by 10 minutes (or 33 percent), while the length

of the rest period stays the same. If the pulse rate is 100 beats per minute at the beginning of the next rest period, the following work cycle should be shortened by 33 percent.

Body temperatures should be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature at the beginning of the rest period should not exceed 99 degrees Fahrenheit. If it does, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. However, if the oral temperature exceeds 99.7 degrees Fahrenheit at the beginning of the next period, the following work cycle should be further shortened by 33 percent. Oral temperature should be measured again at the end of the rest period to make sure that it has dropped below 99 degrees Fahrenheit.

Body water loss due to sweating should be measured by weighing the worker in the morning and in the evening. The clothing worn should be similar at both weighings; preferably, the worker should be weighed nude. The scale should be accurate to plus or minus one-quarter pound. Body water loss should not exceed 1.5 percent of the total body weight. If it does, workers should be instructed to increase their daily intake of fluids by the weight lost.

Ideally, body fluids should be maintained at a constant level during the work day. This requires replacement of salt lost in sweat as well.

Good hygiene standards must be maintained by frequent changes of clothing and daily showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

APPENDIX C

CHEMICAL INFORMATION SHEETS

The chemical information sheets are presented in alphabetical order for quick reference:

Ammonia

Atrazine

Calcium oxide

Carbon tetrachloride

Chlorine

Chloroform

Dinoseb

Ethylbenzene

Methanearsonic acid, sodium salt (MSMA)

Methylene chloride

Methyl parathion

Tric acid

Nitrogen tetroxide

Potassium nitrate

Toluene

Toxaphene

Xylene

AMMONIA

• Hazardous substance (EPA)

Description: NH_3 , ammonia is a colorless, strongly alkaline, and extremely soluble gas with a characteristic pungent odor.

Code Numbers: CAS 7664-41-7 RTECS BO0875000 UN 1005

DOT Designation: Nonflammable gas.

Synonyms: Anhydrous ammonia.

Potential Exposures: Ammonia is used as a nitrogen source for many nitrogen-containing compounds. It is used in the production of ammonium sulfate and ammonium nitrate for fertilizers and in the manufacture of nitric acid, soda, synthetic urea, synthetic fibers, dyes, and plastics. It is also utilized as a refrigerant and in the petroleum refining and chemical industries. It is used in the production of many drugs (A-41) and pesticides (A-32).

Other sources of occupational exposure include the silvering of mirrors, glue-making, tanning of leather, and around nitriding furnaces. Ammonia is produced as a by-product in coal distillation and by the action of steam on calcium cyanamide, and from the decomposition of nitrogenous materials.

Incompatibilities: Strong oxidizers, calcium, hypochlorite bleaches, gold, mercury, silver, halogens.

Permissible Exposure Limits in Air: The Federal standard for ammonia is an 8-hour time-weighted average of 50 ppm (35 mg/m^3). NIOSH has recommended 50 ppm expressed as a ceiling and determined by a 5-minute sampling period. ACGIH as of 1983/84 has set TWA values of 25 ppm (18 mg/m^3). The tentative STEL value is 35 ppm (27 mg/m^3). The IDLH level is 500 ppm.

Determination in Air: Collection by midget impinger and colorimetric analysis using Nessler's reagent (A-10). Ammonia may also be determined using long-duration detector tubes (A-11).

Permissible Concentration in Water: EPA in 1976 (A-3) proposed a limit of 0.02 mg/l (as unionized ammonia) for the protection of freshwater aquatic life. As of 1980, EPA (2) first proposed adding ammonia to the list of priority toxic pollutants and developing criteria for it, but then withdrew the proposal. NAS/NRC proposed (A-2) a limit of 0.5 mg/l for drinking water.

Routes of Entry: Inhalation of gas, ingestion, skin and eye contact.

Harmful Effects and Symptoms: *Local* — Contact with anhydrous liquid ammonia or with aqueous solutions is intensely irritating to the mucous membranes, eyes, and skin. Eye symptoms range from lacrimation, blepharospasm, and palpebral edema to a rise of intraocular pressure, and other signs resembling acute-angle closure glaucoma, corneal ulceration, and blindness. There may be corrosive burns of skin or blister formation. Ammonia gas is also irritating to the eyes and to moist skin.

Systemic — Mild to moderate exposure to the gas can produce headache, salivation, burning of throat, anosmia, perspiration, nausea, vomiting, and substernal pain. Irritation of ammonia gas in eyes and nose may be sufficiently intense to compel workers to leave the area. If escape is not possible, there may be severe irritation of the respiratory tract with the production of cough, glottal edema, bronchospasm, pulmonary edema, or respiratory arrest. Bronchitis or pneumonia may follow a severe exposure if patient survives. Urticaria is a rare allergic manifestation from inhalation of the gas.

Points of Attack: Lungs, respiratory system, eyes.

Medical Surveillance: Preemployment physical examinations for workers in ammonia exposure areas should be directed toward significant changes in the skin, eyes, and respiratory system. Persons with corneal disease, and glaucoma, or chronic respiratory diseases may suffer increased risk. Periodic examinations should include evaluation of skin, eyes, and respiratory system, and pulmonary function tests to compare with baselines established at preemployment examination.

First Aid: If this chemical gets into the eyes, irrigate immediately. If this chemical contacts the skin, flush with water immediately. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Do not induce vomiting.

Personal Protective Methods: Where ammonia hazards exist in concentrations above the standard, respiratory, eye, and skin protection should be provided. Fullface gas masks with ammonia canister or supplied air respirators, both with full facepieces, afford good protection. In areas where exposure to liquid ammonia occurs, goggles or face shields, as well as protective clothing impervious to ammonia and including gloves, aprons, and boots should be required. Where ammonia gas or concentrated ammonia solution is splashed in eyes, immediate flooding of the eyes with large quantities of water for 15 minutes or longer is advised, followed at once by medical examination.

In heavy concentrations of ammonia gas, workers should be outfitted with complete self-contained protective suits impervious to ammonia, with supplied air source, and full headpiece and facepiece. Appropriate clothing should be worn to prevent any possible skin contact with liquids of >10% content or reasonable probability of contact with liquids of <10% content. Wear eye protection to prevent any possibility of eye contact with liquids of >10% NH₃ content. Employees should wash immediately when skin is wet or contaminated with liquids of >10% content. Remove nonimpervious clothing immediately if wet or contaminated with liquids containing >10% and promptly remove if liquid contains <10% NH₃. Provide emergency showers and eyewash if liquids containing >10% NH₃ are involved.

Respirator Selection:

- 100 ppm: CCRS/SA/SCBA
- 300 ppm: CCRSF
- 500 ppm: GMS/SAF/SCBAF
- Escape: GMS/SCBA

Disposal Method Suggested: Dilute with water, neutralize with HCl and discharge to sewer (A-38). Recovery is an option to disposal which should be considered for paper manufacture, textile treating, fertilizer manufacture and chemical process wastes (A-57).

References

- (1) National Institute for Occupational Safety and Health, *Criteria for a Recommended Standard: Occupational Exposure to Ammonia*, NIOSH Doc. No. 74-136, Washington, DC (1974).
- (2) U.S. Environmental Protection Agency, "Toxic Pollutant List: Proposal to Add Ammonia," *Federal Register*, 45, No. 2, 803-806 (January 3, 1980) Rescinded by *Federal Register*, 45, No. 232, 79692-79693 (December 1, 1980).
- (3) National Research Council, Committee on Medical and Biologic Effects of Environmental Pollutants, *Ammonia*, Baltimore, MD, University Park Press (1979).
- (4) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report*, 2, No. 1, 65-68, New York, Van Nostrand Reinhold Co. (1982).
- (5) See Reference (A-61).
- (6) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report*, 3, No. 3, 49-53, New York, Van Nostrand Reinhold Co. (1983).
- (7) See Reference (A-60).
- (8) Parmeggiani, L., Ed., *Encyclopedia of Occupational Health & Safety*, Third Edition, Vol. 1, pp 148-150, Geneva, International Labour Office (1983).

ATZ	ATRAZINE
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12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour- square foot-F	Temperature (degrees F)	Centipoise
	N O T P E R T I N E N T		N O T P E R T I N E N T		N O T P E R T I N E N T		N O T P E R T I N E N T

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	I N S O L U B L E		N O T P E R T I N E N T		N O T P E R T I N E N T		N O T P E R T I N E N T

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
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NO. 410

CARBON TETRACHLORIDE

Revisor A

Date December 1980

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: CARBON TETRACHLORIDE
OTHER DESIGNATIONS: Tetrachlormethane, Perchlormethane, Methane Tetrachloride, CCl₄, GE Material D5B50, CAS #000 056 235
MANUFACTURER: Available from several suppliers, including:
Linden Chemicals & Plastics
PO Drawer J, Phone: (314) 843-1310
Moundsville, WV 26041

SECTION II. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Carbon Tetrachloride	ca 100	8-hr TWA 5 ppm (skin) or 30 mg/m ³ * Human, oral LDLo 43 mg/kg Human, inhalation LCLo 1000 ppm TCLo 20 ppm (CNS) Hamsters and mice have developed cancer on long term feeding.
*ACGIH (1980 Intended Changes List). OSHA 8-hr TWA is 10 ppm. NIOSH has proposed a 10-hr TWA of 2 ppm. ACGIH and NIOSH recommend labeling as a suspected human carcinogen. (skin) notation indicates absorption through the skin can contribute significantly to overall exposure.		

SECTION III. PHYSICAL DATA

Boiling point at 1 atm, deg C	--- 76.7	Specific gravity, 25/4 C	--- 1.585
Vapor pressure @ 20 C, mm Hg	---- ca 91	Melting point, deg C	----- -23
Vapor density (Air=1)	----- 5.3	Volatiles, %	----- ca 100
Solubility in water @ 20 C, wt %	- 0.08	Molecular weight	----- 153.8

Appearance & Odor: A clear, colorless liquid with a characteristic sweetish odor. Odor recognition threshold (100% of test panel): 21.4 ppm in air when prepared from CS₂; 100 ppm in air when prepared from CH₄. Odor may not be objectionable at acutely toxic levels.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	LOWER	UPPER

Extinguishing Media: It is nonflammable. Use that which is appropriate for the surrounding fire. Use water spray to cool fire-exposed containers. When involved in a fire situation, this material will emit highly toxic and irritating fumes and gases. Metals, such as aluminum and magnesium, can react violently with carbon tetrachloride when hot or burning. Firefighters must wear self-contained breathing apparatus and full protective gear to fight fires involving this material.

SECTION V. REACTIVITY DATA

This material is stable under normal conditions of handling and use. It does not polymerize. Thermal-oxidative decomposition will produce toxic, corrosive fumes, including phosgene and hydrogen chloride. Violent reactions or explosions can occur with incompatible materials, such as barium, lithium, sodium, and potassium metal, powdered aluminum, magnesium, dimethylformamide (above 65 C), fluorine, etc. (See NFPA, "Manual of Hazardous Chemical Reactions".)

SECTION VI. HEALTH HAZARD INFORMATION

TLV 5 ppm (skin) (See Sect. II)

Carbon tetrachloride is highly toxic and irritating by inhalation and ingestion (mean lethal dose is 5-10 ml). It is toxic by skin absorption. Excessive exposure may result in CNS depression and/or gastrointestinal symptoms.* It is irritating to skin and eyes. Eye contact or systemic effects can produce visual disturbances (haze, blind spots, narrowing of visual field, etc.). Skin contacts can cause defatting & dermatitis.

Kidney & liver damage can occur from severe acute or chronic exposure. It is a suspected carcinogen in humans.

FIRST AID:

Eye Contact: Flush eyes with running water for 15 minutes, including under the eyelids. Get medical help if irritation persists or when visual disturbances occur.

Skin Contact: Remove contaminated clothing promptly. Wash exposed skin with soap and water. Get medical help for repeated or gross exposures.

Inhalation: Remove to fresh air. Restore and/or support breathing; have qualified person administer oxygen if needed. Get medical help.

Ingestion: Contact physician for gastric lavage. (If medical help and advice is not readily available, give water to drink and induce vomiting.)

*Also cardiac arrhythmias.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel when large spills occur. Evacuate area. Provide maximum exhaust ventilation. Clean-up personnel must use protection against contact and inhalation (see Sect. VIII). Contain spill; pick up liquid for disposal. Small spills and residues can be absorbed on paper, vermiculite, etc. and allowed to evaporate in a hood. Prevent release of CCl₄ to surface water or sewers. Spills or discharges in 24 hours of 5000 lb or more (proposed RQ* is 1000 lb) must be reported to U.S. Government.

DISPOSAL: Consider recovery and reuse, if feasible. Scrap may be burned in approved, high temperature incinerator with scrubber or it may be disposed of as hazardous waste (EPA number U211 or F001 as a spent degreasing solvent under RCRA). Follow Federal, State and Local regulations.

*Reportable Quantity.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV. Exhaust hoods need 100 fpm min. face velocity. Ventilate sumps and low lying areas. Use air-supplied or self-contained respirators above TLV, with full face piece above 100 ppm. PVA or neoprene gloves and protective clothing needed to prevent skin contact. Wear safety goggles and/or face shield for eye protection.

An eyewash station and chemical safety shower should be readily accessible.

Provide preplacement and twice a year medical exams. Workers with obesity, diabetes, alcoholism or pulmonary problems should have a physician's approval before working with CCl₄. Retain medical records for 30 years after termination of employment.

Provide training to those exposed to CCl₄ in the workplace. Monitor vapor levels in the workplace.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, dry, well-ventilated, low fire-risk area. Protect containers against physical damage. Keep away from sources of heat, direct sunlight, and incompatible materials (see Sect. V). Prevent exposure of vapors to high temperature to prevent decomposition to toxic and corrosive gases and vapors. No smoking in areas where vapors may be present.

Prevent contact with the skin or eyes. Avoid exposure to vapors. Use good personal hygiene.

CCl₄ toxicity is markedly increased by the synergistic effects of alcohol. When possible, substitute a less hazardous solvent for CCl₄. DOT Classification - ORM-A

DATA SOURCE(S) CODE: 1-12,15,16,21-26,31,37,38,43

APPROVALS: MIS
CRD

Industrial Hygiene
and Safety

MEDICAL REVIEW: 16 Dec. 1980

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Material Safety Data Sheet

From Genium's Reference Collection
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No. 53

CHLORINE
 (Revision B)
 Issued: July 1979
 Revised: April 1988

SECTION 1. MATERIAL IDENTIFICATION

25

Material Name: CHLORINE

Description (Origin/Uses): Used mainly to manufacture chlorinated lime for bleaching fabrics; as a versatile reagent in organic chemistry; in water purification; and as a military poison gas (bertholite).



Other Designations: Bertholite; Molecular Chlorine; Cl₂; NIOSH RTECS No. FO2100000;
 CAS No. 7782-50-5

HMIS
 H 3
 F 0 R 1
 R 1 I 4
 PPG* S 4
 *See sect. 8 K 0

Manufacturers: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek* *Bayers' Guide* (Genium ref. 73) for a list of suppliers.

SECTION 2. INGREDIENTS AND HAZARDS

%

EXPOSURE LIMITS

Chlorine, CAS No. 7782-50-5

ca 100

IDLH* Level: 30 ppm
 OSHA PEL
 Ceiling: 1 ppm, 3 mg/m³
 TLV-STEL: 3 ppm, 9 mg/m³
 NIOSH REL
 15-Min Ceiling: 0.5 ppm, 1.45 mg/m³
 Toxicity Data**
 Rat, Inhalation, LC₅₀: 293 ppm (1 Hr)
 Mouse, Inhalation, LC₅₀: 137 ppm (1 Hr)

*Immediately dangerous to life and health

**See NIOSH, RTECS, for additional data with references to irritative and mutagenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: ca -29°F (-34°C)

Vapor Pressure: >760 Torrs (Normal Atmospheric Pressure)

Vapor Density (Air = 1): 1.4085 at 68°F (20°C)

Melting Point: ca -150°F (-101°C)

Molecular Weight: 71 Grams/Mole

Water Solubility: Slight

Appearance and Odor: A greenish yellow, noncombustible gas; pungent, suffocating, nauseating odor. Its odor-recognition threshold is reported to be ca 0.3 ppm.

SECTION 4. FIRE AND EXPLOSION DATA

LOWER UPPER

Flash Point and Method

Autoignition Temperature

Flammability Limits in Air

% by Volume

Extinguishing Media: *Chlorine will not burn, but it supports combustion of materials already involved in a fire. Use agents that will extinguish the surrounding fire. Use a water spray to cool fire-exposed tanks and to protect personnel attempting to stop a chlorine leak.
Unusual Fire or Explosion Hazards: Chlorine is a reactive/explosive gas. Fight fires involving it from the maximum possible distance; this gas greatly increases the flammability hazards of other combustibles that are present. Warning: Flammable gases, vapors, and mists form dangerously explosive mixtures with chlorine gas.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Fire fighters must use the maximum personal protective equipment available. If possible, have specially trained personnel remove intact cylinders of chlorine from the fire area and protect them with any available resource such as directed water spray.

SECTION 5. REACTIVITY DATA

Chlorine is stable in closed, pressurized containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Chemical Incompatibilities: Chlorine reacts dangerously with acetylene, ammonia, hydrogen, ether, fuel gas, hydrocarbons, turpentine, finely divided metals, diborane, benzene, and acetaldehyde (see Genium ref. 84, pp. 49-28 and 491M-53 to 491M-56).

Conditions to Avoid: Do not allow open flame, unprotected heaters, lighted tobacco products, electric sparks, or excessive heat in work areas because chlorine gas can form explosive mixtures with other gases. Do not heat pressurized storage tanks or cylinders containing chlorine because they may explode. Do not allow chlorine to be directly exposed to incompatible chemicals (see above).

Hazardous Products of Decomposition: Toxic gases such as carbon monoxide, phosgene, and hydrogen chloride (Genium Industrial MSDs 35, 66, 30) can be produced in fires involving chlorine and other combustibles.

SECTION 6. HEALTH HAZARD INFORMATION

Chlorine is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks, Warning: This material is a powerful respiratory irritant. The most important acute health effect of exposure is lung damage from hydrochloric acid (HCl) caused by the reaction of chlorine with the moisture in the upper respiratory tract (URT). Fatal pulmonary edema (lungs filled with fluid) may be delayed from 24 to 48 hours after exposure. Erosion of teeth, decreased lung capacity, and increased susceptibility to tuberculosis are chronic effects in workers who handle this gas. **Medical Conditions Aggravated by Long-Term Exposure:** Cardiac, pulmonary, or respiratory problems. Administer preplacement and periodic medical exams emphasizing the respiratory system to workers who regularly handle chlorine. **Target Organs:** Respiratory system. **Primary Entry:** Inhalation, skin contact. **Acute Effects:** Burning and severe irritation of the eyes, skin, and URT; wheezing, shortness of breath; nausea; vomiting; headache; dizziness; and (delayed) pulmonary edema. **Chronic Effects:** Reduced respiratory capacity may result from chronic low-level exposure to chlorine.

FIRST AID: **Eyes.** Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin.** Skin contact with chlorine causes severe damage from frostbite (cryogenic injury) as well as chemical burns. Irrigate the area with water and treat the exposed person accordingly. **Inhalation.** Remove exposed person to fresh air; restore and/or support his or her breathing as needed. Recommended treatment includes administering pure oxygen gas (O₂) as soon as symptoms of exposure develop (Genium ref. 39, p. 1975). Observe exposed person for respiratory effects. **Ingestion.** This type of exposure to chlorine is highly unlikely because it is a gas.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Preplan and carefully explain proper emergency procedures to relevant personnel. Notify safety personnel, evacuate all non-essential personnel, provide maximum explosion-proof ventilation, and eliminate all sources of ignition immediately. Cleanup personnel must wear protection against contact with and inhalation of vapor (see sect. 8). Try to shut off the flow of chlorine gas. Use a water spray to protect personnel attempting to stop the leak.

Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z): Not Listed

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste: Listed without Number

CERCLA Hazardous Substance, Reportable Quantity: 10 lbs (4.54 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines in 29 CFR 1910.133. **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. For emergency or nonroutine use (e.g., cleaning reactor vessels or storage tanks) wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will not protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves; boots; aprons; and clean, impervious, body-covering clothing to prevent any possibility of skin contact. **Ventilation:** Install and operate general and local ventilation systems powerful enough to maintain airborne levels of chlorine gas strictly below the OSHA PEL standard cited in section 2. Make all ventilation systems of maximum explosion-proof design, e.g., nonsparking, electrically grounded and bonded, etc. **Safety Stations:** Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do not wear contact lenses in any work area. **Other:** Use enclosed-containment processing operations; otherwise, the ventilation systems may not be able to keep airborne levels of chlorine below the legal ceiling limit of 1 ppm (3 mg/m³) set by OSHA. **Automatic air-monitoring sensing equipment** connected to an alarm system is recommended for continual-use operations. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do not eat, drink, or smoke in any work area. Avoid prolonged skin contact with this material.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store chlorine in a cool, dry, well-ventilated area away from organics, sources of ignition, any flammable or explosive materials, cylinders containing oxygen, and incompatible chemicals (see sect. 5). Use outside or detached storage. Store cylinders upright and secure them tightly. **Special Handling/Storage:** Chlorine is shipped/stored as a pressurized gas in cylinders or tank cars. Protect them against physical damage and regularly inspect them for cracks, leaks, or faulty valves. Follow standard safety procedures for handling compressed, corrosive gases. Electrically ground and bond all containers used in shipping and transferral operations to prevent static sparks. Do not drag or slide cylinders containing chlorine; move them in a carefully supervised manner with a suitable hand truck. Do not smoke in use or storage areas. **Engineering Controls:** All engineering systems (ventilation, production, etc.) must be of maximum explosion-proof design. Use chlorine in closed engineering systems to prevent dispersion of this gas into general work areas. Monitor all piping systems, reactor vessels, and holding tanks for unwanted moisture contamination or buildup. Liquid chlorine levels should be less than 85% of a tank's or cylinder's capacity. **Comments:** Perform all operations with chlorine carefully to prevent accidental ignition of explosive mixtures. Prevent any contact with incompatible chemicals (see sect. 5). Keep the valve-protection cap in place until immediately before using chlorine. Insert a check valve or trap into the transferral line to prevent a dangerous backflow into the original container. Use a pressure-reducing regulator when connecting a storage vessel to a lower-pressure piping system. A trained chemist or safety specialist familiar with the physical and chemical properties of this gas should be present during all work operations.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Chlorine

DOT Class: Nonflammable Gas

References: 1, 2, 12, 73, 84-94, 100, 103.

DOT Label: Nonflammable Gas and Poison

DOT ID No. UN1017

IMO Label: Poison Gas

IMO Class: 2.3

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Material Safety Data Sheet

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No. 315

CHLOROFORM
(Revision D)
Issued: August 1979
Revised: April 1988

SECTION 1. MATERIAL IDENTIFICATION

25

Material Name: CHLOROFORM

Description (Origin/Uses): Used as a solvent for fats, oils, rubber, alkaloids, waxes, and resins; as a cleansing agent.

Other Designations: Trichloromethane; CHCl₃; NIOSH RTECS No. FS9100000; CAS No. 0067-66-3

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

HMIS
H 2
F 0 R 1
R 0 I 3
PPG* S 2
*See sect. 8 K 0



SECTION 2. INGREDIENTS AND HAZARDS

%

EXPOSURE LIMITS

Chloroform, CAS No. 0067-66-3

Ca 100

OSHA PEL
Ceiling: 50 ppm, 240 mg/m³

ACGIH TLV, 1987-88
TLV-TWA: 10 ppm, 50 mg/m³

NIOSH REL
Ceiling: 2 ppm, 9.78 mg/m³

*See NIOSH, RTECS, for additional toxicity data with references to mutagenic, reproductive, tumorigenic, and irritative effects.

Toxicity Data*
Human, Oral, LD₅₀: 140 mg/kg
Rat, Oral, LD₅₀: 908 mg/kg

SECTION 3. PHYSICAL DATA

Bolling Point: 142°F (61°C)
Melting Point: -82.3°F (-63.5°C)
Vapor Pressure: 158.4 Torr at 68°F (20°C)
Vapor Density (Air = 1): 4.13

Water Solubility (%): 0.822 ml of CHCl₃ per 100 ml of H₂O at 68°F (20°C)
% Volatile by Volume: 100
Molecular Weight: 119 Grams/Mole
Specific Gravity (H₂O = 1): 1.484 at 68°F (20°C)

Appearance and Odor: A heavy, colorless, clear, volatile liquid; characteristic, pleasant, ethereal, sweet odor (recognition threshold: 0.3 mg/m³); sweet taste.

SECTION 4. FIRE AND EXPLOSION DATA

LOWER

UPPER

Flash Point and Method

Autoignition Temperature

Flammability Limits in Air

% by Volume

Extinguishing Media: *Chloroform does not burn. Use an agent that will put out the surrounding fire.

Unusual Fire or Explosion Hazards: None reported.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Chloroform is stable if kept in closed containers and protected from air and sunlight. It does not undergo hazardous polymerization; however, even when stabilized with ethanol, this material develops acidity from prolonged exposure to air and light.

Chemical Incompatibilities: This material is incompatible with strong alkalis.

Conditions to Avoid: Avoid prolonged exposure to air and light and to strong alkalis.

Hazardous Products of Decomposition: Toxic and corrosive gases like hydrochloric acid (HCl), chlorine (Cl₂), carbon monoxide (CO), and oxides of chlorine (ClO_x) can be produced during fires.

SECTION 6. HEALTH HAZARD INFORMATION

Chloroform is listed as a suspected human carcinogen by ACGIH.

Summary of Risks: Exposure to this material affects the central nervous system (anesthesia); heart (arrhythmia, ventricular tachycardia, bradycardia); liver (necrosis, hepatoma); kidney (necrosis); and it is an embryonic toxin. Fatalities are associated with cardiovascular depression and ventricular fibrillation.

Medical Conditions Aggravated by Long-Term Exposure: Ailments of the heart, liver, and kidneys may be worsened by exposure to chloroform. **Target Organs:** Liver, kidneys, heart, skin, eyes. **Primary Entry:** Skin contact, inhalation.

Acute Effects: Dizziness, mental dullness, nausea, headache, fatigue, and anesthesia. **Chronic Effects:** Possible cancer.

FIRST AID

Eyes: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes.

Skin: Immediately wash the affected area with soap and water. **Inhalation:** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed.

Ingestion: Never give anything by mouth to someone who is unconscious or convulsing. If the exposed person is responsive, give him or her several glasses of milk or water to drink and induce vomiting. Repeat if large quantities were ingested.

Comments: Workers who are regularly exposed to chloroform require preplacement and periodic medical exams emphasizing kidney, liver, skin, and central nervous system functions. Carefully evaluate each exposure that produces a noticeable effect to determine the extent to which factors like alcohol or drugs have affected it.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel of a chloroform spill or leak. Provide ventilation. Cleanup personnel need protection against contact with and inhalation of vapor (see sect. 8). Chloroform vapor is heavier than air and will collect in low-lying areas. Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.

Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z)

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. U044

CERCLA Hazardous Substance, Reportable Quantity: 5000 lbs (2270 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield as a supplementary protective measure. Follow the eye- and face-protection guidelines in 29 CFR 1910.133. **Respirator:** Wear a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. For emergency or nonroutine use (e.g., cleaning reactor vessels or storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** To prevent contact with skin, wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specific work environment. **Ventilation:** Install and operate general and local ventilation systems that are powerful enough to maintain airborne levels of chloroform below the OSHA PEL standard cited in section 2.

Safety Stations: Make eyewash stations, washing facilities, and safety showers available in use and handling areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Avoid inhalation of vapor!

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store chloroform in closed containers away from light and alkalis.

Special Handling/Storage: Protect containers from physical damage. Do not transfer chloroform through plastic or rubber hoses or pipes.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Chloroform

DOT Class: ORM-A

DOT Label: None

DOT ID No. UN1888

IMO Label: Poison

IMO Class: 6.1

References: 1, 2, 12, 73, 84-94, 100, 103.

Judgments as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of such information, Genium Publishing Company extends no warranties, makes no representations and assumes no responsibility as to the accuracy or suitability of such information for application to purchaser's intended purposes or for consequences of its use.

Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

PRODUCT NAME: TECHNICAL DINOSEB DATE: 08/15/86 PAGE 1
EPA REG. NO.: 56077-3

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137
Emergency Phone Number: 1-800-434-9300
Information Phone Number: 1-601-636-1231
Prepared by: M. S. Bernard

SECTION II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

INGREDIENT OSHA PEL ACGIH TLV PERCENT
Dinoseb n/d 0.3mg/m³ 95.00
Dinoseb (2-sec-butyl-4,6-dinitrophenol)
CAS = 88-85-7
Impurities n/d n/d 5.00

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F) above 212 Specific Gravity 1.258
Vapor Pressure(mm Hg.) below 1 Melting Point(°F) 90
Vapor Density(Air=1) n/a Evaporation Rate n/d
Solubility in Water: 0.0052g/100ml
Appearance and Odor: Brown solid, organic acid odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 350.6°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO₂, and Dry Chemical

CONTINUED ON PAGE 2

Special Fire Fighting Procedures:

Self-contained air supply. Confine water used in fire fighting.

Unusual Fire and Explosion Hazards:

Noxious fumes may form. Material undergoes rapid exothermic decomposition at 190°C. Vapors may ignite.

SECTION V REACTIVITY DATA

Stability: Stable in normal use and storage.

Conditions to Avoid: Heating above 100°C. Product undergoes rapid exothermic decomposition at 190°C. Avoid ignition sources.

Incompatibility: Strong Bases and Strong Oxidizers

Hazardous Decomposition or Byproducts: Oxides of Nitrogen

Hazardous Polymerization: Will not occur. No known conditions to avoid.

SECTION VI HEALTH HAZARD DATA

Route(s) of Entry: Inhalation: Moderate Toxicity
 Skin: Readily Absorbed
 Ingestion: Highly Toxic

Health Hazards (Acute and Chronic):

Oral Ingestion: High Single Dose Oral Toxicity.
 LD₅₀ for Rats 25 mg/kg.
 May be fatal if swallowed.

Eye Contact: May cause severe irritation and corneal injury. Corneal injury should heal in 1-2 weeks.

Skin Contact: May cause slight irritation or mild burn. Colors the skin yellow.

Skin Absorption: Readily absorbed through skin. High toxicity. LD₅₀ rabbits 80mg/kg.

Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m³.

Carcinogenicity: NTP: Negative
 IARC Monographs: Negative
 OSHA Regulated: Negative.

Signs and Symptoms of Exposure: Fatigue, sweating, thirst, and fever. Increased metabolic rate.

Medical Conditions Generally Aggravated by Exposure: Liver and kidney problems may be aggravated by extreme exposure.

Emergency and First Aid Procedures:

Oral Ingestion: Toxic by ingestion. Induce vomiting and seek medical help immediately.

Eye Contact: Flush immediately with continuous irrigation with flowing water for at least thirty minutes. Seek medical consultation immediately.

Skin Contact: Immediately flush skin with plenty of water for at least fifteen minutes while removing contaminated clothing. Consult physician. Wash clothing before reuse.

Inhalation: Remove to fresh air if effects occur. Consult physician.

Note to Physician:

Eyes: Stain for evidence of corneal injury. If cornea is burned, instill antibiotic steroid preparation frequently. Consult ophthalmologist. May cause temporary injury.
Overexposure: Treat for symptoms. No specific antidote.
 Human effects not established.

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to Be Taken in Case Material Is Released or Spilled:

Use proper safety equipment. Absorb spill with absorbant inert material such as oil-dry. Dike area for large spills. Keep out of streams and water supplies.

Waste Disposal Method:

Dispose of in non-crop area away from water supplies or in an approved landfill in accordance with State, Federal, and local regulations.

Precautions to Be Taken in Handling and Storing:

Do not get on skin, on clothing, or in eyes. Keep out of reach of children.

Other Precautions:

Do not breathe spray mists. Keep away from heat or flame.

SECTION VIII CONTROL MEASURES

Respiratory Protection:

None normally needed. During spraying use organic vapor respirator.

Ventilation: Required to control level of dinoseb.

Protective Gloves: Impervious rubber gloves

Eye Protection: Chemical workers' goggles

Other Protective Clothing or Equipment: Rubber boots and apron and body-covering clothing.

Work/Hygenic Practices: Shower after handling.

THE INFORMATION HEREIN IS SUPPLIED IN GOOD FAITH.
 BUT NO WARRANTY, EXPLICITE OR IMPLIED, IS MADE.

Material Safety Data Sheet

from Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855



No. 385

ETHYL BENZENE
(Revision A)
Issued: August 1978
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION

27

Material Name: ETHYL BENZENE

Description (Origin/Uses): Used as a solvent and as an intermediate in the production of styrene monomer.

Other Designations: Phenylethane; Ethylbenzol; $C_2H_5C_6H_5$; CAS No. 0100-41-4

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.



NFPA

HMIS		
H	2	R 1
F	3	I 3
R	0	S 2
PPG*		K 4

*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

%

EXPOSURE LIMITS

Ethyl Benzene, CAS No. 0100-41-4

Ca 100

OSHA PELs
8-Hr TWA: 100 ppm, 435 mg/m³
15-Min STEL: 125 ppm, 545 mg/m³
ACGIH TLVs, 1988-89
TLV-TWA: 100 ppm, 435 mg/m³
TLV-STEL: 125 ppm, 545 mg/m³

*See NIOSH, RTECS (DA0700000), for additional data with references to reproductive, irritative, and mutagenic effects.

Toxicity Data*
Human, Inhalation, TC_{50} : 100 ppm (8 Hrs)
Rat, Oral, LD_{50} : 3500 mg/kg

SECTION 3. PHYSICAL DATA

Boiling Point: 277°F (136°C)

Melting Point: -139°F (-95°C)

Vapor Pressure: 7.1 Torr at 68°F (20°C)

Vapor Density (Air = 1): 3.7

% Volatile by Volume: Ca 100

Molecular Weight: 106 Grams/Mole

Solubility in Water (%): Slight

Specific Gravity ($H_2O = 1$): 0.86258 at 77°F (25°C)

Appearance and Odor: A clear, colorless, flammable liquid; characteristic aromatic hydrocarbon odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method: 64°F (18°C) CC

Autoignition Temperature: 810°F (432.22°C)

LEL: 1% v/v

UEL: 6.7% v/v

Extinguishing Media: Use foam, dry chemical, or carbon dioxide to put out ethyl benzene fires. A water spray may be ineffective in extinguishing the fire, because it can scatter and spread the burning liquid. Use water spray to cool fire-exposed containers of ethyl benzene, to disperse ethyl benzene vapor, and to protect personnel attempting to stop an ethyl benzene leak. Unusual Fire or Explosion Hazards: This liquid can readily form explosive vapor-air mixtures, especially when heated. Ethyl benzene vapor is heavier than air and may travel a considerable distance to a low-lying source of ignition and flash back to its origin. Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Ethyl benzene is stable in closed containers during routine operations. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Hazardous chemical reactions can occur between ethyl benzene and strong oxidizing agents, acids, ammonia, and bases. Conditions to Avoid: Avoid any exposure to sources of ignition such as heat, sparks, open flame, and lighted tobacco products, etc., and to incompatible chemicals. Use caution when entering confined spaces, particularly low-lying areas where explosive concentrations of ethyl benzene vapor may be present. Provide good ventilation to such areas to prevent the concentration of this vapor. Hazardous Products of Decomposition: Thermal-oxidative degradation can include toxic gases such as carbon monoxide and/or aromatic hydrocarbon gases.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Ethyl benzene is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: Ethyl benzene vapor is severely irritating to the eyes and to the mucous membranes of the respiratory system. Sustained inhalation of excessive levels can cause depression of the central nervous system (CNS) characterized by dizziness, headache, narcosis, and coma. Skin contact with liquid ethyl benzene causes irritation; dermatitis and defatting can also develop. The acute oral toxicity of ethyl benzene is low; however, ingestion of it presents a serious aspiration hazard. Aspirating even a small amount into the lungs can result in extensive edema (lungs filled with fluid) and hemorrhaging of the lung tissue. No systemic effects are expected at the levels that produce pronounced, unignorable, disagreeable skin and eye irritation. The TLVs cited in section 2 are set to prevent this intolerable irritation. Medical Conditions Aggravated by Long-Term Exposure: None reported. Target Organs: Skin, eyes, respiratory system, and CNS. Primary Entry: Inhalation, skin contact. Acute Effects: Irritation of the skin, eyes, and respiratory system. Also, cardiac-rhythm disturbance due to sensitization; acute bronchitis, bronchospasm, pulmonary and laryngeal edema; euphoria; headache; giddiness; dizziness;

SECTION 6. HEALTH HAZARD INFORMATION, cont.

flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes. Skin. Rinse the affected area with plenty of water, then wash it with soap and water. Inhalation. Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. Ingestion. Unlikely. Should this type of exposure occur, the aspiration hazard must be considered. Do not induce vomiting unless directed to do so by a physician. To prevent aspiration by spontaneous vomiting, keep the victim's head low (between his or her knees). Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid. Note to Physician: Professional judgment is required as to whether or not to induce vomiting because of the possibility of aspiration. A gastric lavage may be administered, followed by saline catharsis, if this procedure is appropriate to the specific incident. Monitor cardiac and pulmonary functions.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately, and provide adequate explosion-proof ventilation. Cleanup personnel need protection against skin or eye contact with this liquid as well as inhalation of its vapor (see sect. 8). Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways. Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).

EPA Designations (40 CFR 302.4)

CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per the Clean Water Act (CWA), §§ 311 (b) (4) and 307 (a).

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Wear a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will not protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, and gauntlets, etc., to prevent prolonged or repeated skin contact with this material. **Ventilation:** Install and operate general and local maximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of this material below the OSHA PEL standard cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do not wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do not eat, drink, or smoke in any work area. Do not inhale ethyl benzene vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store ethyl benzene in closed containers in a cool, dry, well-ventilated area away from sources of ignition and strong oxidizers. Protect containers from physical damage. **Special Handling/Storage:** Outside, isolated, detached, or remote storage is recommended for large quantities of ethyl benzene. Isolate bulk storage areas from acute fire hazards. **Engineering Controls:** Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. To prevent static sparks, electrically ground and bond all containers, pipelines, etc., used in shipping, transferring, reacting, production, and sampling operations. **Other:** Use safety cans for transferring small amounts of ethyl benzene.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Ethyl Benzene

DOT Hazard Class: Flammable Liquid

ID No. UN1175

DOT Label: Flammable Liquid

DOT Packaging Exceptions: 49 CFR 173.118

DOT Packaging Requirements: 49 CFR 173.119

IMO Shipping Name: Ethylbenzene

IMO Hazard Class: 3.2

IMO Label: Flammable Liquid

IMDG Packaging Group: II

References: 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

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Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: W Silverman, MD



VERTAC CHEMICAL CORPORATION

MATERIAL SAFETY DATA SHEET

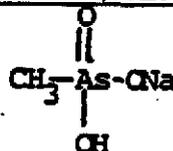
Section 1

NAME & PRODUCT

MANUFACTURER'S NAME Vertac Chemical Corporation		IN CASE OF EMERGENCY TELEPHONE 1-800-424-9300
STREET ADDRESS 5100 Poplar Avenue	<small>For latest data, consult manufacturer</small>	
CITY, STATE, ZIP CODE Memphis, TN 38137	Prepared by: M. S. Bernard	Date: 10/17/84

CHEMICAL NAME, TRADE NAME AND SYNONYMS
Vertac MSMA 800, 8#/gal Monosodium Acid Methane arsonate, MSMA

FORMULA OF PRIMARY COMPONENTS (STRUCTURAL)



Section 2

INGREDIENTS

	%	TLV (units)
Monosodium Acid Methane Arsonate	58.5	
Inert Ingredients	41.5	

Section 3

PHYSICAL DATA

2 BOILING POINT (°F)		4 SPECIFIC GRAVITY (H₂O = 1)	1.648
3 VAPOR PRESSURE (mmHg at 20° C) *	Low	7 % VOLATILE BY VOLUME	40.7
4 VAPOR DENSITY (air = 1)	N/A	8 COLOR AND ODOR	Very light yellow
5 SOLUBILITY IN WATER	Miscible	9 PHYSICAL STATE	Clear Liquid

Section 4

FIRE AND EXPLOSION HAZARD DATA

10 FLASH POINT (METHOD USED) Aqueous Solution - No Flash	11 FLAMMABLE LIMITS STP L.F.L. U.F.L.
--	---

12 EXTINGUISHING MEDIA:	<input checked="" type="checkbox"/> WATER FOG	<input checked="" type="checkbox"/> FOAM	<input checked="" type="checkbox"/> ALCOHOL FOAM	<input checked="" type="checkbox"/> CO ₂	<input checked="" type="checkbox"/> DRY CHEMICAL	<input type="checkbox"/> OTHER
--------------------------------	---	--	--	---	--	--------------------------------

13 SPECIAL FIRE FIGHTING PROTECTIVE EQUIPMENT
Self-contained breathing apparatus, chemical gloves and boots

14 UNUSUAL FIRE AND EXPLOSION HAZARDS
Under EXTREME conditions such as strong acidic environment and strong heat, arsine gas (a poisonous gas) may be produced.

Section 5

REACTIVITY DATA

15 STABILITY	16 CONDITIONS TO AVOID Extreme heat and strong acid
	FIRE CONDITIONS

17 COMPATIBILITY (Materials to avoid)	<input type="checkbox"/> WATER	<input type="checkbox"/> ACID	<input type="checkbox"/> BASE	<input type="checkbox"/> CORROSIVE*	<input type="checkbox"/> OXIDIZING MATERIAL
	<input type="checkbox"/> OTHER				

18 HAZARDOUS DECOMPOSITION PRODUCTS

19 **20 CONDITIONS TO AVOID**

Section 6

HEALTH HAZARD DATA

21 ORAL INGESTION

Acute Oral ID50 Rats 1359mg/kg

22 EYE CONTACT

Mild Irritant

23 SKIN CONTACT

Mild to none irritation, depending on individual's sensitivity.

24 SKIN ABSORPTION

Not absorbed

25 INHALATION (TLV OR SUGGESTED CONTROL FIGURE)

Not normally a problem

26 EFFECTS OF OVEREXPOSURE

Subacute: salty taste, burning in throat, colicky stomach pains.

Acute: headache, vomiting, diarrhea, stupor, convulsions

27 FIRST AID PROCEDURES

Eyes: flush with water. Consult physician if irritation persists.

Skin: Wash with soap and water. Oral Ingestion: empty stomach by vomiting or

intubation. Lavage with 3 liters isotonic saline. BAL (Dimercaprol) is antidotal;

administer in 3mg/kg body weight every 4 hours.

Section 7

SPILL OR LEAK PROCEDURES

28 STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Contain spill and transfer to suitable container. Absorb remaining free liquid with adsorbant.

29 DISPOSAL METHOD

Consult local pollution control authorities or EPA office.

Section 8

SPECIAL PROTECTION INFORMATION

30 VENTILATION

LOCAL EXHAUST

Not normally required

SPECIAL

MECHANICAL (General)

OTHER

31 RESPIRATORY PROTECTION (Specify Type)

Not normally required

PROTECTIVE CLOTHING

Rubber gloves, boots, chemical goggles

32 EYE PROTECTION

 NOT NORMALLY NECESSARY SAFETY GLASSES WITHOUT SIDE SHIELDS SAFETY GLASSES WITH SIDE SHIELDS OR CHEMICAL WORKERS GOGGLES GAS TIGHT GOGGLES OR EQUIVALENT OTHER:

34 OTHER PROTECTIVE EQUIPMENT

Not required

Section 9

SPECIAL PRECAUTIONS OR OTHER COMMENTS

35 PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Use standard procedures for chemical handling

36 OTHER PRECAUTIONS

away from foods, feeds, seeds, fertilizers, insecticides, and fungicides.

METHYL CHLORIDE

MTC

Common Synonyms Chloromethane Arlic		Gas Colorless Odorless or sweet odor
Floats and boils on water. Flammable, visible vapor cloud is formed.		
Avoid contact with liquid and vapor. Keep people away. Avoid goggles and self-contained breathing apparatus. Stop activities if possible. Shut off ignition sources and call fire department. Stay upwind and use water spray to knock down vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.		
Fire	FLAMMABLE POISONOUS GASES ARE PRODUCED IN FIRE Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Stop activities if possible. Do not expose containers and protect men affecting spillage with water. DO NOT RUB AFFECTED AREAS.	
Exposure	CALL FOR MEDICAL AID VAPOR Not irritating to eyes, nose or throat. If inhaled, will cause nausea, vomiting, headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Will cause frostbite. Flush affected areas with plenty of water. DO NOT RUB AFFECTED AREAS.	
Water Pollution	Not harmful to aquatic life.	
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability, or contaminant. Restrict access. Evacuate area.	2. LABEL 2.1 Category: Flammable gas 2.2 Class: 2	
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Halogenated hydrocarbon. 3.2 Formula: CH ₂ Cl 3.3 IMO/IUN Designation: 2.0/1063 3.4 DOT ID No.: 1063 3.5 CAS Registry No.: 74-87-3	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquefied gas. 4.2 Color: Colorless. 4.3 Odor: Faint, sweet, non-irritating, ether-like.	
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Approved canister mask; leather or vinyl gloves; goggles or face shield. 5.2 Symptoms Following Exposure: Inhalation causes nausea, vomiting, weakness, headache, emotional disturbances; high concentrations cause mental confusion, eye disturbances, muscular tremors, cyanosis, convulsions. Contact of liquid with skin may cause frostbite. 5.3 Treatment of Exposure: Remove to fresh air. Call a doctor and have patient hospitalized for observation of slowly developing symptoms. 5.4 Threshold Limit Value: 50 ppm. 5.5 Short Term Inhalation Limit: 100 ppm for 5 min. 5.6 Toxicity by Ingestion: Not pertinent. 5.7 Lethal Toxicity: None. 5.8 Vapor (Gas) Irritant Characteristics: Vapors are nonirritating to the eyes and throat. 5.9 Liquid or Solid Irritant Characteristics: No appreciable hazard. Practically harmless to the skin because it evaporates quickly. May cause frostbite. 5.10 Odor Threshold: Data not available. 5.11 IDLH Value: 10,000 ppm.		

6. FIRE HAZARDS

6.1 Flash Point: < 32°F C.C.
 6.2 Flammable Limits in Air: 8.1%-17.2%
 6.3 Fire Extinguishing Agents: Dry chemical or carbon dioxide. Stop flow of gas.
 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent.
 6.5 Special Hazards of Combustion: Products: Toxic and irritating gases are generated in fire.
 6.6 Behavior in Fire: Containers may explode.
 6.7 Ignition Temperature: 1170°F
 6.8 Electrical Hazard: Not pertinent.
 6.9 Burning Rate: 2.2 mm/min.
 6.10 Adiabatic Flame Temperature: Data not available.
 6.11 Stoichiometric Air to Fuel Ratio: 4.078 (Est.)
 6.12 Flame Temperature: Data not available.

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction.
 7.2 Reactivity with Common Materials: Reacts with zinc, aluminum, magnesium, and their alloys; reaction is not violent.
 7.3 Stability During Transport: Stable.
 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent.
 7.5 Polymerization: Not pertinent.
 7.6 Inhibitor of Polymerization: Not pertinent.
 7.7 Water Reactions (Reactions to Products): Data not available.
 7.8 Reactivity Group: 30.

8. WATER POLLUTION

8.1 Aquatic Toxicity: None.
 8.2 Waterfowl Toxicity: None.
 8.3 Biological Oxygen Demand (BOD): None.
 8.4 Food Chain Concentration Potential: None.

9. SHIPPING INFORMATION

9.1 Grade or Purity: Technical grade; "Arlic" refrigerant grade.
 9.2 Storage Temperature: Ambient.
 9.3 Inert Atmosphere: No requirement.
 9.4 Venting: Safety relief.

10. HAZARD ASSESSMENT CODE
 (See Hazard Assessment Handbook)
A-B-C-D-E-F-G

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable gas.

11.2 HAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	4
Health	0
Vapor Irritant	0
Liquid or Solid Irritant	0
Poison	2
Water Pollution	0
Human Toxicity	0
Aquatic Toxicity	1
Anesthetic Effect	0
Reactivity	1
Other Chemicals	1
Water	0
Salt Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	4
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Gas.
 12.2 Molecular Weight: 50.49
 12.3 Boiling Point at 1 atm: -11.6°F = -24.2°C = 249°K
 12.4 Freezing Point: -143.9°F = 87.7°C = 175.5°K
 12.5 Critical Temperature: 290.5°F = 143.5°C = 416.8°K
 12.6 Critical Pressure: 900 psia = 65.9 atm = 6.69 MN/m²
 12.7 Specific Gravity: 0.987 at -24°C (liquid)
 12.8 Liquid Surface Tension: 18.2 dynes/cm = 0.0162 N/m at 20°C
 12.9 Liquid Water Interfacial Tension: (est.) 50 dynes/cm = 0.05 N/m at -24°C
 12.10 Vapor (Gas) Specific Gravity: 1.7
 12.11 Ratio of Specific Heats of Vapor (Gas): 1.250
 12.12 Latent Heat of Vaporization: 182.3 Btu/lb = 101.3 cal/g = 4.241 X 10⁴ J/kg
 12.13 Heat of Combustion: -6280 Btu/lb = -2908 cal/g = -123.1 X 10⁴ J/kg
 12.14 Heat of Decomposition: Not pertinent.
 12.15 Heat of Solution: Not pertinent.
 12.16 Heat of Polymerization: Not pertinent.
 12.17 Heat of Fusion: Data not available.
 12.18 Limiting Value: Data not available.
 12.19 Reid Vapor Pressure: 116.7 psia.

NOTES

METHYL PARATHION

MPT

Common Synonyms Malon, MPT Pandol, Atron Naph, Wolfen O, O-Dimethyl O-p-nitrophenyl Phosphorothioate Parathion-methyl	Solid crystals Solid and liquid form in water, solution boils on water. Melting (freezing) point is 65°F	White solid or brown liquid Rusty eggs or garlic odor
--	---	---

AVOID CONTACT WITH SKIN. DO NOT PROBE EYES.
 Wear chemical protective suit with self-contained breathing apparatus.
 E100 discharge if possible.
 Call fire department.
 Isolate and remove discharged material.
 Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE AND WHEN HEATED.
 Containers may explode in fire.
 Wear chemical protective suit with self-contained breathing apparatus.
 Combat fires from safe distance or protected location.
 Extinguish with water.
 Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.
LIQUID OR SOLID POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.
 Irritating to eyes.
 Remove contaminated clothing and shoes.
 Flush affected areas with plenty of water.
 IF IN EYES: keep eyelids open and flush with plenty of water.
 IF SWALLOWED and victim is CONSCIOUS: have victim drink water or milk and have victim induce vomiting.
 IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS: do nothing except keep victim warm.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
 Solution is toxic to invertebrates.
 May be dangerous if it enters water intakes.
 Notify local health and wildlife officials.
 Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-poison. water contaminant Restrict access. Should be removed. Chemical and physical treatment.	2. LABEL 2.1 Category: Poison 2.2 Class: 6
3. CHEMICAL DESIGNATIONS 3.1 CO Compatibility Class: Not listed 3.2 Formula: $C_8H_{19}NO_3PS$ 3.3 IMO/UN Designation: 6.1/2783 3.4 DOT ID No.: 2783 3.5 CAS Registry No.: 298-00-0	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Solid, liquid, or solution 4.2 Color: Colorless solid or brownish liquid 4.3 Odor: Characteristic like rotten eggs or garlic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved mask or respirator, natural rubber gloves, overalls, protective clothing, goggles.
 5.2 Symptoms Following Exposure: Exposure to fumes from a fire, or to the liquid, causes headache, blurred vision, constricted pupils of the eyes, weakness, nausea, cramps, diarrhea, and tightness in the chest. Muscle twitch and convulsions may follow. Symptoms may develop over a period of 8 hrs.
 5.3 Treatment of Exposure: Speed is essential. **INGESTION:** call a doctor. If victim is not breathing, immediately resuscitate artificial respiration by mouth-to-mouth, mouth-to-nose, or mouth-to-oropharyngeal method when victim is conscious, give milk, water, or soft-water and induce vomiting repeatedly. **SKIN OR EYES:** flood and wash exposed areas thoroughly with water; remove contaminated clothing under a shower.
 5.4 Threshold Limit Value: 0.2 mg/m³
 5.5 Short Term Inhalation Limit: Data not available
 5.6 Toxicity by Ingestion: Grade 4; LD₅₀ below 50 mg/kg (rat)
 5.7 Lethal Toxicity: Data not available
 5.8 Vapor (Gas) Irritant Characteristics: Not permanent
 5.9 Liquid or Solid Irritant Characteristics: Poisonous when absorbed through skin.
 5.10 Odor Threshold: Data not available
 5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 115°F O.C.
 6.2 Flammable Limits in Air: Data not available
 6.3 Fire Extinguishing Agents: Water
 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
 6.5 Special Hazards of Combustion: Products: Toxic gases are produced in fire.
 6.6 Behavior in Fire: Burns may rupture containers.
 6.7 Ignition Temperature: Data not available
 6.8 Electrical Hazard: Not pertinent
 6.9 Burning Rate: Data not available
 6.10 Adiabatic Flame Temperature: Data not available
 6.11 Stoichiometric Air to Fuel Ratio: Data not available
 6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Half decomposed in 8 days at 40°C
 7.2 Reactivity with Common Materials: Is absorbed in wood, etc., which must be replaced to eliminate poison hazard.
 7.3 Stability During Transport: Decomposes above 30°C with possible explosive force.
 7.4 Neutralizing Agents for Acids and Caustics: Apply caustic or acids with caution until yellow stains disappear.
 7.5 Polymerization: Not pertinent
 7.6 Inhibitor of Polymerization: Not pertinent
 7.7 Motor Fuels (Resistant to): Products: Data not available
 7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
 1.0 ppm/96 hr/biostat/TL₅₀/fresh water
 0.2 ppm/96 hr/biostat/TL₅₀/fresh water
 8.2 Waterway Toxicity: LD₅₀ = 10 mg/kg
 8.3 Biological Oxygen Demand (BOD): Data not available
 8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Pure (solid); technical (solid); 80% in xylene
 9.2 Storage Temperature: Below 50°C
 9.3 Inert Atmosphere: No requirement
 9.4 Venting: Pressure-relief

10. HAZARD ASSESSMENT CODE
 (See Hazard Assessment Handbook)
A-Z-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Poison, B
 11.2 NAS Hazard Rating for Bulk Water Transport: Not listed
 11.3 MFPA Hazard Classification:

Category	Classification*
Health Hazard (Blue)	4 4
Flammability (Red)	3 1
Reactivity (Yellow)	2 2

 *First column for solution, second for solid.

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
 12.2 Molecular Weight: 263.2
 12.3 Boiling Point at 1 atm: Very high
 12.4 Freezing Point: 65°F = 18°C = 291°K
 12.5 Critical Temperature: Not pertinent
 12.6 Critical Pressure: Not pertinent
 12.7 Specific Gravity: 1.380 at 20°C (solid)
 12.8 Liquid Surface Tension: Data not available
 12.9 Liquid Water Interfacial Tension: Data not available
 12.10 Vapor (liq) Specific Gravity: Not pertinent
 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
 12.12 Latent Heat of Vaporization: Not pertinent
 12.13 Heat of Combustion: Data not available
 12.14 Heat of Decomposition: Not pertinent
 12.15 Heat of Solution: Not pertinent
 12.16 Heat of Polymerization: Not pertinent
 12.17 Heat of Fusion: Data not available
 12.18 Limiting Value: Data not available
 12.19 Reid Vapor Pressure: Data not available

NOTES

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855



No. 7

NITRIC ACID
(Revision C)
Issued: October 1980
Revised: August 1988

SECTION 1. MATERIAL IDENTIFICATION

26

Material Name: NITRIC ACID

Description (Origin/Uses): Used to dissolve noble metals, for etching and cleaning metals, to make organic nitrates and nitrocompounds, to destroy residues of organic matter, and in explosives.

Other Designations: Red Fuming Nitric Acid; HNO₃; CAS No. 7697-37-2

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.



NFPA

H	3	R	1
F	0	I	4
R	1	S	4
PPG*		K	0

*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

%

EXPOSURE LIMITS

Nitric Acid, CAS No. 7697-37-2

OSHA PEL
8-Hr TWA: 2 ppm, 5 mg/m³

ACGIH TLVs, 1987-88
TLV-TWA: 2 ppm, 5 mg/m³
TLV-STEL: 4 ppm, 10 mg/m³

Toxicity Data**
Mouse, Inhalation, LC₅₀: 67 ppm/4 Hrs

*Contact your supplier to determine the percent by weight of nitric acid in the purchased product. Water is the other component of the product.
**See NIOSH, RTECS (QU5775000, QU5900000), for additional data with references to reproductive effects.

SECTION 3. PHYSICAL DATA

Boiling Point: Ca 251°F (122°C)*
Specific Gravity (H₂O = 1): 1.4*
pH: Very Acidic

Water Solubility (%): Complete
Molecular Weight: 63 Grams/Mole
Melting Point: Ca -30°F (-34°C)*

Appearance and Odor: A water white to slightly yellow liquid that darkens to a brownish color on aging and exposure to light; characteristic nitrogen dioxide (NO₂) odor.

*These properties are for the approximately 68%-by-weight nitric acid that is commercially available.

SECTION 4. FIRE AND EXPLOSION DATA

LOWER

UPPER

Flash Point and Method

Autoignition Temperature

Flammability Limits in Air

% by Volume

Extinguishing Media: *Nitric acid does not burn. Use extinguishing agents that will put out the surrounding fire. Use a water spray to dilute nitric acid during fires and to absorb liberated oxides of nitrogen.

Unusual Fire or Explosion Hazards: Although nitric acid does not burn, it is a strong oxidizing agent that can react with combustible materials to cause fires. Also, it can react with metals to liberate extremely flammable hydrogen gas. If this happens, direct fire-fighting procedures at this evolved hydrogen gas.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Choose protective equipment carefully (see sect. 5, Conditions to Avoid).

SECTION 5. REACTIVITY DATA

Nitric acid is stable in closed containers at room temperature under normal storage and handling conditions. It cannot undergo hazardous polymerization.

Chemical Incompatibilities: Nitric acid reacts explosively with metallic powders, carbides, hydrogen sulfide, and turpentine. Contact with organic materials such as wood, paper, sawdust, or alcohol, etc., may cause fires. Combustible materials can attain an increased flammability after being exposed to nitric acid even if they do not immediately catch fire.

Conditions to Avoid: Avoid any contact with incompatible chemicals. Because it is so reactive, always establish another material's compatibility with nitric acid before mixing the two materials. This applies to the selection of safety and handling equipment, because nitric acid can attack some forms of coatings, plastics, and rubber.

Hazardous Products of Decomposition: Various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), nitrous oxide (N₂O), as well as nitric acid mist or vapor, can be produced by the decomposition reactions that can affect the nitric acid during fires.

SECTION 6. HEALTH HAZARD INFORMATION

Nitric acid is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: This material is corrosive to any body tissue it contacts. Dental erosion is also reported.

Medical Conditions Aggravated by Long-Term Exposure: None reported. **Target Organs:** Skin, eyes, mucous membranes of the respiratory tract, teeth. **Primary Entry:** Inhalation, skin contact. **Acute Effects:** Irritation and/or corrosive burns of skin, eyes, and upper respiratory tract (URT), delayed pulmonary edema, pneumonitis, bronchitis, and dental erosion. **Chronic Effects:** None reported.

FIRST AID: **Eyes.** Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. Treat for eye burns. **Skin.** Immediately wash the affected area with soap and water. Watch for chemical skin burns and treat them accordingly. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. If the exposure is severe, hospitalization with careful monitoring by trained medical personnel to detect the delayed onset of severe pulmonary edema (lungs filled with fluid) is recommended for at least 72 hours. **Ingestion.** Call a poison control center. Never give anything by mouth to someone who is unconscious or convulsing. Do not induce vomiting. If the exposed person is responsive, give him or her one or two glasses of milk or water to drink as quickly as possible after exposure.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid. **NOTE TO PHYSICIAN:** Wash affected skin areas with a 5% solution of sodium bicarbonate (NaHCO₃). If ingested, the risk versus the benefit of the passage of a naso-gastric tube is debatable. Activated charcoal is of no value. Do not give the exposed person bicarbonate to neutralize the material.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all sources of ignition immediately in case contact with metals should produce highly flammable hydrogen gas. Cleanup personnel need protection against contact with and inhalation of nitric acid (see sect. 8). Contain large spills and collect waste. Use water sprays to direct nitric acid away from incompatible chemicals (see sect. 5). Neutralize the spilled nitric acid with soda ash or sodium bicarbonate. Use an absorbent such as sand, earth, or vermiculite on the resulting slurry and place the neutralized nitric acid material into containers suitable for eventual disposal, reclamation, or destruction.

Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z)

EPA Designations (40 CFR 302.4)

CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per Clean Water Act (CWA), Section 311 (b) (4)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of nitric acid solution is possible, wear a full face shield as a supplementary protective measure. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Consult the *NIOSH Pocket Guide to Chemical Hazards* (Genium ref. 88) for general recommendations on proper respiratory procedures. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine use (leaks or cleaning reactor vessels and storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will not protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, gauntlets, etc., to prevent skin contact with nitric acid. Choose protective equipment carefully (see sect. 5, *Conditions to Avoid*).

Ventilation: Install and operate both general and local exhaust-ventilation systems powerful enough to maintain airborne concentrations of nitric acid below the OSHA PEL standard cited in section 2. Construct exhaust ducts and systems with material such as fiberglass, which resists attack by nitric acid. **Safety Stations:** Make emergency eyewash stations, washing facilities, and safety/quickdrench showers available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do not wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean nitric acid from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do not eat, drink, or smoke in any work area. Provide preplacement and annual medical exams with emphasis on skin irritation to workers who are regularly exposed to nitric acid. Workers must receive training before handling this material in the workplace; even experienced workers should undergo refresher training periodically.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store nitric acid in a cool, dry, well-ventilated area away from incompatible chemicals (see sect. 5). Consider outside, isolated, or detached storage. Protect containers from direct sunlight.

Special Handling/Storage: Build all storage facilities of nonflammable materials that are resistant to chemical attack by nitric acid.

Protect containers from physical damage. Preplan for routine use and emergency response.

Engineering Controls: Proper ventilation is essential in bulk storage areas; consider installing an automatic monitoring system to detect hazardous levels of nitrogen oxides that can develop from this material.

Comments: Separate nitric acid from hydrazine, diethylenetriamine, fluorides, and all other corrosives except sulfuric acid and sulfur trioxide when shipping or transferring it.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: (I) Nitric Acid, Fuming or (II) Nitric Acid, Over 40% or (III) Nitric Acid, 40% or Less

DOT Label: (I) Oxidizer and Poison or (II) Oxidizer and Corrosive or (III) Corrosive

DOT Hazard Class: (I) and (II) Oxidizer or (III) Corrosive Material

DOT ID Nos. (I) UN2032; (II) UN2031; (III) NA1760

IMO Class: 8 (All Types of Nitric Acid)

IMO Label: (I) Corrosive, Oxidizer, Poison; or (II) and (III) Corrosive

References: 1, 2, 26, 38, 84-94, 100, 112, 113, 114.

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Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD

**CEDAR CHEMICAL CORPORATION
VICKSBURG CHEMICAL DIVISION
VICKSBURG, MISSISSIPPI**

**MATERIAL SAFETY DATA SHEET
(Equivalent to OSHA form 174)**

PRODUCT NAME: NITROGEN TETROXIDE (N₂O₄)

DATE: 5/20/88 PAGE 1

SECTION I

Manufacturer's Name: Vicksburg Chemical Division
P. O. Box 3
Vicksburg, MS 39180

Information Phone No.: 1-601-636-1231
Emergency Phone No.: 1-800-424-9300
Prepared by: M. S. Bernard

SECTION II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

INGREDIENTS	OSHA PEL	ACGIH TLV	PERCENT
Nitrogen Tetroxide N ₂ O ₄ CAS# 10544-72-6	cl 5 ppm	3 ppm	100.0

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F) 70	Specific Gravity 1.49 @ 32°F	Melting Point(°F) 11.8
Vapor Pressure(psia) 17.7 @ 77°F	Evaporation Rate n/d	Vapor Density(Air=1) 1.58
Solubility in Water: infinite	Appearance and Odor: Dark green or brown, liquid. Acidic odor	

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): Non-flammable Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media: Non-flammable
Special Fire Fighting Procedures: Self contained air supply and resistant clothing are required.
Unusual Fire and Explosion Hazards: Powerful oxidizer. Will increase the intensity of a fire though it is not flammable itself. May increase risk of explosion.
Noxious fumes, oxides of nitrogen, may form. Reacts violently with organic chemicals.

SECTION V REACTIVITY DATA

Stability: Stable in normal use and storage. Conditions to Avoid: Moisture
Incompatibility: Bases, most metals, and organics. Decomposition Byproducts: Oxides of nitrogen
Hazardous Polymerization: Will not occur. No known conditions to avoid.

SECTION VI HEALTH HAZARD DATA

Route(s) of Entry: Inhalation: High toxicity Skin: Corrosive
Ingestion: High toxicity

Continued on page 2

Health Hazards(Acute and Chronic): Oral Ingestion: Highly corrosive to tissue. May be fatal. Acute LD₅₀ unknown.
Eye Contact: Highly corrosive. May cause permanent injury.
Skin Contact: Highly corrosive. May cause serious burns.
Skin Absorption: Not known to be absorbed through the skin.
Inhalation: Highly corrosive. May cause pulmonary damage and edema. May be fatal.

Carcinogenicity: NTP Negative
IARC Monographs: Negative
OSHA Regulated: Negative

Signs and Symptoms of Exposure: Small amounts: Yellow staining of skin. Eye and mucous membrane irritation. Large amounts: Burns to tissue and pulmonary tract. Corrosive to teeth.

Medical Conditions Generally Aggravated by Exposure: Emphysema.

Emergency and First Aid Procedures:

- Oral Ingestion: Give large quantities of water do not induce vomiting. Seek medical attention immediately.
- Eye Contact: Flush immediately with continuous irrigation of flowing water for at least 30 minutes. Seek medical consultation immediately.
- Skin Contact: Promptly wash skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing. Seek medical attention if burned.
- Inhalation: Remove to fresh air. Administer artificial respiration if breathing has stopped. Seek medical attention.

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps To Be Taken In Case Material Is Released or Spilled:

Evacuated personnel upwind. Use proper safety equipment. Contain material. Flush with water. neutralize with sodium carbonate or lime. Keep out of lakes or streams.

Waste Disposal Method:

N₂O₄ will evaporate if the temperature is above 70°F. Neutralize liquid residue with dilute inorganic basic solution such as NaOH, NaCO₃, or lime. Dispose of away from streams or water supplies in accordance with State, local, Federal regulations.

Precautions To Be Taken in Handling and Storing:

Do not get on skin, on clothing, or in eyes. Keep out of reach of children.

Other Precautions:

Avoid breathing vapors. Avoid contact with water, bases or organic material.

SECTION VIII CONTROL MEASURES

Respiratory Protection:

Self-contained air supply or full face respirator.

Ventilation:

Required to control TLV.

Protective Gloves: Acid resistant.

Eye Protection: Full face shield.

Other Protective Clothing or Equipment: Acid resistant clothing.

Work/Hygienic Practices: Shower after handling.

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
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205

POTASSIUM NITRATE

Issued: January 1987

SECTION 1. MATERIAL IDENTIFICATION

22

MATERIAL NAME: POTASSIUM NITRATE

DESCRIPTION/USES: Used in pyrotechnics; explosives; matches; as a specialty fertilizer; reagent; to modify burning properties of tobacco; in glass manufacture; tempering steel; curing foods; as an oxidizer in solid rocket propellants.

OTHER DESIGNATIONS: Nitric Acid, Potassium Salt; Niter; Saltpeter;

KNO₃; CAS #7757-79-1

MANUFACTURER/SUPPLIER: Available from several suppliers, including:
Aldrich Chemical Co., Inc., PO Box 355, Milwaukee, WI 53201; Telephone:
(414) 273-3850



HMS

Nonfire

Fire

H 1

F 0

R 1

PPE*

*See Sect. 8

R 1

I --

S 2

K 0

SECTION 2. INGREDIENTS AND HAZARDS

%

HAZARD DATA

Potassium Nitrate, CAS #7757-79-1

>99%

ACGIH TLV:
None Established

OSHA PEL:
None Established

Oral, Rat,
LD₅₀: 3750 mg/kg

Oral, Rabbit,
LD₅₀: 1901 mg/kg

SECTION 3. PHYSICAL DATA

Melting Point ... 633°F (334°C)
Boiling Point ... 400°C (Decomposes)
Specific Gravity @ 16°C ... 2.11
Vapor Pressure @ 20°C ... Negligible
% Volatiles ... 0
Evaporation Rate ... Not Found

Solubility in Water, at 0°C ... 13.3 g/100 cc
at 100°C ... 247 g/100 cc
pH of 5% Solution, at 25°C ... 4.5-7.0
Molecular Weight ... 101.1

Appearance and odor: White crystalline powder or granules. No odor.

SECTION 4. FIRE AND EXPLOSION DATA

LOWER UPPER

Flash Point and Method

Autoignition Temperature

Flammability Limits in Air

Not Found

Not Found

Not Found

--

--

Potassium nitrate is not combustible. However, it is a strong oxidizer and can initiate and intensify combustion of flammable materials.

EXTINGUISHING AGENTS: Flood fires involving this material with water. Keep fire-exposed containers cool with water spray. Remove containers from the fire area if it can be done safely.

UNUSUAL FIRE/EXPLOSION HAZARDS: At high temperatures this material can fuse or melt; application of water when large quantities are involved can result in extensive scattering of molten material.

SPECIAL FIRE-FIGHTING PROCEDURES: Toxic fumes/gases can be evolved in a fire situation. Fire fighters should use self-contained breathing apparatus and wear full protective gear.

SECTION 5. REACTIVITY DATA

Potassium nitrate is stable at room temperature. It does not polymerize.

Violent reactions (including fire and explosion) may occur on its contact with organic materials, combustible materials, and reducing agents. Specific incompatibles under various conditions include aluminum, titanium, antimony, germanium, zinc, zirconium (and other metals), calcium disilicide, chromium nitride, metal sulfides, boron, carbon, sulfur, phosphorus, phosphides, sodium phosphinate, sodium thiosulfate, citric acid, tin chloride, sodium acetate, and thorium carbide.

Potassium nitrate decomposes at approximately 752°F (400°C) with the evolution of oxygen and oxides of nitrogen (toxic).

SECTION 6. HEALTH HAZARD INFORMATION

Potassium nitrate has not been identified as a known or suspected carcinogen by the NTP, IARC, or OSHA. This material can enter the body if it is inhaled or swallowed.

EFFECTS OF OVEREXPOSURE: Inhalation of excessive concentrations may be irritating to the nose, throat, and respiratory tract. Prolonged exposure may cause anemia, methemoglobinemia (the presence of methemoglobin, a soluble brown crystalline blood pigment that differs from hemoglobin in that it contains ferric iron and is unable to combine reversibly with molecular oxygen), and kidney injury (nephritis). Ingestion can cause severe gastrointestinal distress with abdominal pain, nausea, vomiting, and diarrhea. Eye contact may cause irritation.

FIRST AID: EYE CONTACT: Flush eyes, including under the eyelids, with a gentle flow of running water. Get medical help.*

SKIN CONTACT: Wash affected area with mild soap and water. If irritation persists, prevent further contact and get medical help.* **INHALATION:** Remove victim from exposure. Get medical help if irritation or discomfort persists.*

INGESTION: Give victim a large quantity of water to drink. Induce vomiting and get prompt medical help.* Keep him warm and at rest.

NOTE: Never give anything by mouth or induce vomiting if the victim is unconscious.

* **GET MEDICAL ASSISTANCE** - In plant, community, paramedic. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Ventilate the potassium nitrate spill area. Prevent contact of spilled material with combustible and incompatible materials. Cleanup personnel should wear personal protective equipment as necessary to prevent skin/eye contact and dust inhalation. Carefully scoop spilled material into a suitable container for reclamation or disposal. Avoid generating dust during cleanup. Absorb small solution spills on inert (noncombustible) material such as dry sand or earth.

Disposal: Potassium nitrate requires disposal as a hazardous waste. Reclaim material when possible. Contact your supplier or a licensed chemical waste disposal contractor for treatment and disposal instructions. Follow all applicable Federal, state, and local regulations.

Reportable Spill Quantity: Not listed in 40 CFR 117.3, "Reportable Quantities of Hazardous Substances."

EPA Hazardous Waste Number: D001 (Ignitable, 40 CFR 261.21)

SECTION 8. SPECIAL PROTECTION INFORMATION

Use local exhaust ventilation to control airborne levels where potassium nitrate dust, mist, or fumes are generated.

Use an appropriate NIOSH-approved respirator for protection against potassium nitrate dust/mist where airborne levels are excessive. Respirator usage must be in accordance with OSHA requirements (29 CFR 1910.134).

Wear protective clothing (aprons, coveralls, etc.) where the possibility of skin or clothing contamination exist. Wear rubber gloves and safety goggles when handling this material.

Eyewash stations and washing facilities should be readily accessible to workers handling this material.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Particles may adhere to contact lenses and cause corneal damage.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store potassium nitrate in closed containers in a cool, dry location on a noncombustible surface. Store it away from flammable and combustible materials, reducing agents, and other incompatible materials (see sect. 5). Protect containers from physical damage.

Practice good housekeeping. Clean up spills promptly. Use procedures and techniques that minimize dust generation. Practice good personal hygiene. Wash thoroughly after handling this material and before eating, drinking, and smoking. Do not eat, drink, or smoke in the work area. Remove contaminated clothing promptly. Launder it before wearing it again. Do not take this material out of your work area or to your home on your clothing or equipment.

DOT Hazard Classification: Oxidizer (49 CFR 172.101) DOT ID No. UN1486 DOT Label: Oxidizer

Data Source(s) Code: 4, 5, 6, 9, 25, 49, 58, 77, 82, CV

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Approvals *J.P. [Signature]*

Indust. Hygiene/Safety *[Signature]* 4/87

Medical Review *[Signature]* 8/7

Material Safety Data Sheet

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No. 317
TOLUENE
(Revision D)

Issued: August 1979
Revised: April 1986

SECTION 1. MATERIAL IDENTIFICATION

20

MATERIAL NAME: TOLUENE

OTHER DESIGNATIONS: Methyl Benzene, Methyl Benzol, Phenylmethane, Toluol, C₇H₈, CAS #0108-88-3

MANUFACTURER/SUPPLIER: Available from many suppliers, including:
Allied Corp., PO Box 2064R, Morristown, NJ 07960; Telephone: (201) 455-4400
Ashland Chemical Co., Industrial Chemicals & Solvents Div., PO Box 2219,
Columbus, OH; Telephone: (614) 889-3844

HMIS

H: 2

F: 3

R: 0

PPE*

*See sect. 8



R 1

I 3

S 2

K 4

SECTION 2. INGREDIENTS AND HAZARDS

%

HAZARD DATA

Toluene



ca 100

8-hr TLV: 100 ppm, or
375 mg/m³ (Skin)**

Man, Inhalation, TClO:
100 ppm: Psychotropic***

- * Current (1985-86) ACGIH TLV. The OSHA PEL is 200 ppm with an acceptable ceiling concentration of 300 ppm and an acceptable maximum peak of 500 ppm/10 minutes.
- ** Skin designation indicates that toluene can be absorbed through intact skin and contribute to overall exposure.
- *** Affects the mind.

Rat, Oral, LD₅₀: 5000 mg/kg
Rat, Inhalation, LCLo:
4000 ppm/4 hrs.
Rabbit, Skin, LD₅₀: 14 gm/kg

Human, Eye: 300 ppm

SECTION 3. PHYSICAL DATA

Boiling Point ... 231°F (111°C)
Vapor Pressure @ 20°C, mm Hg ... 22
Water Solubility @ 20°C, wt. % ... 0.05
Vapor Density (Air = 1) ... 3.14

Evaporation Rate (BuAc = 1) ... 2.24
Specific Gravity (H₂O = 1) ... 0.866
Melting Point ... -139°F (-95°C)
Percent Volatile by Volume ... ca 100
Molecular Weight ... 92.15

Appearance and odor: Clear, colorless liquid with a characteristic aromatic odor. The odor is detectable to most individuals in the range of 10 to 15 ppm. Because olfactory fatigue occurs rapidly upon exposure to toluene, odor is not a good warning property.

SECTION 4. FIRE AND EXPLOSION DATA

LOWER UPPER

Flash Point and Method

Autoignition Temp.

Flammability Limits in Air

40°F (4°C) CC

896°F (480°C)

% by Volume

1.27

7.1

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, alcohol foam. Do not use a solid stream of water because the stream will scatter and spread the fire. Use water spray to cool tanks/containers that are exposed to fire and to disperse vapors.

UNUSUAL FIRE/EXPLOSION HAZARDS: This OSHA class IB flammable liquid is a dangerous fire hazard. It is a moderate fire hazard when exposed to oxidizers, heat, sparks, or open flame. Vapors are heavier than air and may travel a considerable distance to an ignition source and flash back.

SPECIAL FIRE-FIGHTING PROCEDURES: Fire fighters should wear self-contained breathing apparatus with full facepiece operated in a positive-pressure mode when fighting fires involving toluene.

SECTION 5. REACTIVITY DATA

CHEMICAL INCOMPATIBILITIES: Toluene is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization. This material is incompatible with strong oxidizing agents, dinitrogen tetroxide, silver perchlorate, tetranitromethane, and uranium hexafluoride. Contact with these materials may cause fire or explosion. Nitric acid and toluene, especially in the presence of sulfuric acid, will produce nitrated compounds that are dangerously explosive.

CONDITIONS TO AVOID: Avoid exposure to sparks, open flame, hot surfaces, and all sources of heat and ignition. Toluene will attack some forms of plastics, rubber, and coatings. Thermal decomposition or burning produces carbon dioxide and/or carbon monoxide.

SECTION 6. HEALTH HAZARD INFORMATION | TLV

Toluene is not considered a carcinogen by the NTP, IARC, or OSHA. **SUMMARY OF RISKS:** Vapors of toluene may cause irritation of the eyes, nose, upper respiratory tract, and skin. Exposure to 200 ppm for 8 hours causes mild fatigue, weakness, confusion, lacrimation (tearing) and paresthesia (a sensation of prickling, tingling, or creeping on the skin that has no objective cause). Exposure to higher concentrations may cause headache, nausea, dizziness, dilated pupils, and euphoria, and, in severe cases, may cause unconsciousness and death. The liquid is irritating to the eyes and skin. Contact with the eyes may cause transient corneal damage, conjunctival irritation, and burns if not promptly removed. Repeated and/or prolonged contact with the skin may cause drying and cracking. It may be absorbed through the skin in toxic amounts. Ingestion causes irritation of the gastrointestinal tract and may cause effects resembling those from inhalation of the vapor. Chronic overexposure to toluene may cause reversible kidney and liver injury. **FIRST AID: EYE CONTACT:** Immediately flush eyes, including under eyelids, with running water for at least 15 minutes. Get medical attention if irritation persists. * **SKIN CONTACT:** Immediately flush skin (for at least 15 minutes) while removing contaminated shoes and clothing. Wash exposed area with soap and water. Get medical attention if irritation persists or if a large area has been exposed. * **INHALATION:** Remove victim to fresh air. Restore and/or support breathing as required. Keep victim warm and quiet. Get medical help. * **INGESTION:** Give victim 1 to 2 glasses of water or milk. Contact a poison control center. Do not induce vomiting unless directed to do so. Transport victim to a medical facility. Never give anything by mouth to a person who is unconscious or convulsing. * **GET MEDICAL ASSISTANCE** - In plant, paramedic, community. Get medical help for further treatment, observation, and support after first aid, if indicated.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Notify safety personnel of large spills or leaks. Remove all sources of heat and ignition. Provide maximum explosion-proof ventilation. Limit access to spill area to necessary personnel only. Remove leaking containers to safe place if feasible. Cleanup personnel need protection against contact with liquid and inhalation of vapor (see sect. 8). **WASTE DISPOSAL:** Absorb small spills with paper towel or vermiculite. Contain large spills and collect if feasible, or absorb with vermiculite or sand. Place waste solvent or absorbent into closed containers for disposal using nonsparking tools. Liquid can be flushed with water to an open holding area for handling. Do not flush to sewer, watershed, or waterway. **COMMENTS:** Place in suitable container for disposal by a licensed contractor or burn in an approved incinerator. Consider reclaiming by distillation. Contaminated absorbent can be buried in a sanitary landfill. Follow all Federal, state, and local regulations. TLM 96: 100-10 ppm. Toluene is designated as a hazardous waste by the EPA. The EPA (RCRA) HW No. is U220 (40 CFR 261). The reportable quantity (RQ) is 1000 lbs/454 kg (40 CFR 117).

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV requirements. Ventilation fans and other electrical service must be nonsparking and have an explosion-proof design. Exhaust hoods should have a face velocity of at least 100 fpm (linear feet per minute) and be designed to capture heavy vapor. For emergency or nonroutine exposures where the TLV may be exceeded, use an organic chemical cartridge respirator if concentration is less than 200 ppm and an approved canister gas mask or self-contained breathing apparatus with full facepiece if concentration is greater than 200 ppm. Safety glasses or splash goggles should be worn in all work areas. Neoprene gloves, apron, face shield, boots, and other appropriate protective clothing and equipment should be available and worn as necessary to prevent skin and eye contact. Remove contaminated clothing immediately and do not wear it until it has been properly laundered.

Eyewash stations and safety showers should be readily available in use and handling areas.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

STORAGE SEGREGATION: Store in a cool, dry, well-ventilated area away from oxidizing agents, heat, sparks, or open flame. Storage areas must meet OSHA requirements for class IB flammable liquids. Use metal safety cans for handling small amounts. Protect containers from physical damage. Use only with adequate ventilation. Avoid contact with eyes, skin, or clothing. Do not inhale or ingest. Use caution when handling this compound because it can be absorbed through intact skin in toxic amounts. **SPECIAL HANDLING/STORAGE:** Ground and bond metal containers and equipment to prevent static sparks when making transfers. Do not smoke in use or storage areas. Use nonsparking tools. **ENGINEERING CONTROLS:** Preplacement and periodic medical exams emphasizing the liver, kidneys, nervous system, lungs, heart, and blood should be provided. Workers exposed to concentrations greater than the action level (50 ppm) should be examined at least once a year. Use of alcohol can aggravate the toxic effects of toluene.

COMMENTS: Emptied containers contain product residues. Handle accordingly!

Toluene is designated as a hazardous substance by the EPA (40 CFR 116). DOT Classification: Flammable liquid. UN1294.

Data Source(s) Code: 1-9, 12, 16, 20, 21, 24, 26, 34, 81, 82. CR

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Approvals *J. O. Resacco, 11/86.*

Indust. Hygiene/Safety *JW 12-86*

Medical Review *[Signature]*

TOXAPHENE

TXP

Common Synonyms Dichlorocyclohexane		Waxy solid or in solution Amber Solid sinks in water, solution floats on water.		6. FIRE HAZARDS 6.1 Flash Point: 94°F C.C. (solution) 6.2 Flammable Limits in Air: 1.1%-6.4% (solvent only) 6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective. 6.5 Special Hazards of Combustion Products: Toxic vapors are generated when heated. 6.6 Behavior in Fire: Solution in systems may produce corrosive products when heated. 6.7 Ignition Temperature: 990°F (solution) 6.8 Electrical Hazard: Not pertinent 6.9 Spilling Rate: 5.5 cm/min. 6.10 Adiabatic Flame Temperature: Data not available		10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) H-A-T-U	
If you discharge it, please keep people away. Call the Department. Avoid contact with solid and solution, solids and remove discolored material. Notify local health and pollution control agencies.				11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: OSHA 11.2 NIOSH Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: Not listed			
Fire		Solid not flammable, but readily dissolved in combustible liquid. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Extinguish with foam, dry chemical or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.		7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Bases: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Water Ratio (Resistant to): Product: Data not available 7.8 Reactivity Group: Data not available		12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 60°C and 1 atm: Waxy solid 12.2 Molecular Weight: 414 (avg.) 12.3 Boiling Point at 1 atm: Decomposes 12.4 Freezing Point: 148-154°F = 65-60°C = 209-323°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.5 at 15°C (solid) 12.8 Liquid Surface Tension: Not pertinent 12.9 Liquid Water Interfacial Tension: Not pertinent 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Boils of Specific Heats of Vapor (Heat): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.18 Heat of Fusion: Data not available 12.19 Limiting Value: Data not available 12.20 Solid Vapor Pressure: Data not available	
Exposure		CALL FOR MEDICAL AID SOLID OR SOLUTION POISONOUS IF SWALLOWED. Irritating to skin and eyes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim quiet and warm.		8. WATER POLLUTION 8.1 Aquatic Toxicity: 0.05 ppm/20 days/goldfish/100% MB/fresh water 0.02 ppm/72 hours/100% MB/fresh water 0.002 ppm/24 hr/apeel/100% MB/salt water *Time period not specified. 8.2 Waterfowl Toxicity: 30.8 mg/kg 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: None		9. SHIPPING INFORMATION 9.1 Grade of Purity: Technical; 40% dust concentrate; 50% solution in xylene 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirements 9.4 Venting: Sealed containers in well-ventilated area	
Water Pollution		HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Solution is floating to shoreline. May be dangerous if it enters water intakes. Notify local health and waste officials. Notify operators of nearby water intakes.		1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-poison, water containers should be removed. Chemical and physical treatment.		2. LABEL 2.1 Category: None 2.2 Class: Not pertinent	
1. CHEMICAL DESIGNATIONS 1.1 CG Compatibility Class: Not listed 1.2 Formula: C ₁₂ H ₁₄ Cl ₂ 1.3 HIO/UN Designation: Not listed 1.4 DOT ID No.: 2781 1.5 CAS Registry No.: 8001-36-2		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Waxy solid 4.2 Color: Amber 4.3 Odor: Mild turpentine odor					
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Chemical-type respirator; rubber gloves; chemical goggles or face shield. 5.2 Symptoms Following Exposure: May be absorbed through skin, lungs, or intestinal tract. Symptoms include salivation, leg and back muscle spasms, nausea, vomiting, hyperexcitability, tremors, shivering, clonic convulsions, then tetanic contractions of all skeletal muscles. Lethal doses cause respiratory failure. Respiration, affected as a result of the spasm from vomiting or convulsions, is first arrested because of tetanic muscular contractions, then increased in both amplitude and rate as the muscles relax. 5.3 Treatment of Exposure: If symptoms of poisoning appear, promptly remove the unabsorbed pesticide from the stomach by inducing vomiting with warm salty or soapy water (if the patient is conscious) or from the skin with soap and water. Keep patient warm and quiet. Call a physician. 5.4 Threshold Limit Value: 0.5 mg/m ³ 5.5 Short Term Inhalation Limit: Not pertinent 5.6 Toxicity by Ingestion: Grade 4; LD ₅₀ below 50 mg/kg (dog) 5.7 Lethal Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: The solid is non-volatile. For solutions, see meta-xylene. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smearing and reddening of the skin. 5.10 Odor Threshold: Not pertinent 5.11 IDLH Value: 200 mg/m ³				6. FIRE HAZARDS (Continued) 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available			

Material Safety Data Sheet

From Genium's Reference Collection
 Genium Publishing Corporation
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No. 316

XYLENE (Mixed Isomers)
 (Revision D)
 Issued: November 1980
 Revised: August 1988

26

SECTION 1. MATERIAL IDENTIFICATION

Material Name: XYLENE (Mixed Isomers)
Description (Origin/Uses): Used as a raw material for the production of benzoic acid, phthalic anhydride, isophthalic and terephthalic acids and their dimethyl esters in the manufacture of polyester fibers; in sterilizing catgut; with Canadian balsam as oil-immersion in microscopy; and as a cleaning agent in microscopic techniques.
Other Designations: Dimethylbenzene; Xylol; C_8H_{10} ; CAS No. 1330-20-7
Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek*
Buyers' Guide (Genium ref. 73) for a list of suppliers.
Comments: Although there are three different isomers of xylene (*ortho*, *meta*, and *para*), the health and physical hazards of all three isomers are very similar. This MSDS is written for a xylene mixture of all three isomers, which is usually commercial xylene.



HMS
 H 2
 F 3
 R 0
 PPG*
 *See sect. 8

**R 1
 I 3
 S 2
 K 3**

SECTION 2. INGREDIENTS AND HAZARDS

Xylene (Mixed Isomers), CAS No. 1330-20-7*

*o-Xylene, CAS No. 0095-47-6
 m-Xylene, CAS No. 0108-38-3
 p-Xylene, CAS No. 0106-42-3

**Check with your supplier to determine if there are additions, contaminants, or impurities (such as benzene) that are present in reportable quantities per 29 CFR 1910.

***Immediately dangerous to life and health.

**** See NIOSH, *RTECS* (No. ZE2100000), for additional data with references to reproductive, irritative, and mutagenic effects.

EXPOSURE LIMITS

IDLH*** Level: 1000 ppm

OSHA PEL
 8-Hr TWA: 100 ppm, 435 mg/m³
 ACGIH TLVs, 1987-88
 TLV-TWA: 100 ppm, 435 mg/m³
 TLV-STEL: 150 ppm, 655 mg/m³

Toxicity Data****
 Human, Inhalation, TC_{50} : 200 ppm
 Man, Inhalation, LC₅₀: 10000 ppm/6 Hrs
 Rat, Oral, LD₅₀: 4300 mg/kg

SECTION 3. PHYSICAL DATA

Boiling Point: 275°F to 293°F (135°C to 145°C)*
Melting Point: -13°F (-25°C)
Evaporation Rate: 0.6 Relative to BuAc = 1
Specific Gravity (H₂O = 1): 0.86

Water Solubility (%): Insoluble
Molecular Weight: 106 Grams/Mole
% Volatile by Volume: Ca 100
Vapor Pressure: 7 to 9 Torr at 68°F (20°C)
Vapor Density (Air = 1): 3.7

Appearance and Odor: A clear liquid; aromatic hydrocarbon odor.

*Materials with wider and narrower boiling ranges are commercially available.

SECTION 4. FIRE AND EXPLOSION DATA

			LOWER	UPPER
Flash Point and Method	Autoignition Temperature	Flammability Limits in Air		
81°F to 90°F (27°C to 32°C)	867°F (464°C)	% by Volume	1%	7%

Extinguishing Media: Use foam, dry chemical, or carbon dioxide. Use water sprays to reduce the rate of burning and to cool containers.

Unusual Fire or Explosion Hazards: Xylene vapor is heavier than air and may travel a considerable distance to a low-lying source of ignition and flash back.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Xylene is stable in closed containers during routine operations. It does not undergo hazardous polymerization.

Chemical Incompatibilities: This material may react dangerously with strong oxidizers.

Conditions to Avoid: Avoid any exposure to sources of ignition and to strong oxidizers.

Hazardous Products of Decomposition: Carbon monoxide (CO) may be evolved during xylene fires.

SECTION 6. HEALTH HAZARD INFORMATION

Xylene is not listed as a carcinogen by the IARC, NTP, or OSHA.

Summary of Risks: Liquid xylene is a skin irritant and causes erythema, dryness, and defatting; prolonged contact may cause blistering. Inhaling xylene can depress the central nervous system (CNS), and ingesting it can result in gastrointestinal disturbance; and possibly hematemesis (vomiting blood). Effects on the eyes, kidneys, liver, lungs, and the CNS are also reported. Medical Conditions Aggravated by Long-Term Exposure: Problems with eyes, skin, central nervous system, kidneys, and liver may be worsened by exposure to xylene. Target Organs: CNS, eyes, gastrointestinal tract, blood, liver, kidneys, skin. Primary Entry: Inhalation, skin contact/absorption. Acute Effects: Dizziness; excitement; drowsiness; incoordination; staggering gait; irritation of eyes, nose, and throat; corneal vacuolization; anorexia; nausea; vomiting; abdominal pain; and dermatitis. Chronic Effects: Reversible eye damage, headache, loss of appetite, nervousness, pale skin, and skin rash.

FIRST AID: Eyes. Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. Skin. Immediately wash the affected area with soap and water. Inhalation. Remove the exposed person to fresh air, restore and/or support his or her breathing as needed. Have a trained person administer oxygen. Ingestion. Never give anything by mouth to someone who is unconscious or convulsing. Vomiting may occur spontaneously, but do not induce it. If vomiting should occur, keep exposed person's head below his or her hips to prevent aspiration (breathing the liquid xylene into the lungs). Severe hemorrhagic pneumonitis with grave, possibly fatal, pulmonary injury can occur from aspirating very small quantities of xylene.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid. If exposure is severe, hospitalization for at least 72 hours with careful monitoring for delayed onset of pulmonary edema is recommended.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all sources of ignition immediately. Cleanup personnel need protection against contact with and inhalation of xylene vapor (see sect. 8). Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.

Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z)

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. U239

CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per the Clean Water Act (CWA), section 311 (b) (9)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield as a supplementary protective measure. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine use (leaks or cleaning reactor vessels and storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will not protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specifics of the work operation to prevent prolonged or repeated skin contact with xylene. **Ventilation:** Install and operate general and local maximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of xylene below the OSHA PEL standard cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of xylene into general work areas by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. **Safety Stations:** Make eyewash stations, safety/quick-drench showers, and washing facilities available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do not wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean xylene from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do not eat, drink, or smoke in any work area. Do not inhale xylene vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store xylene in a cool, dry, well-ventilated area away from sources of ignition and strong oxidizers. Protect containers from physical damage.

Special Handling/Storage: Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. Ground and bond all containers, pipelines, etc., used in shipping, transferring, reacting, producing, and sampling operations.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Xylene

DOT ID No. UN1307

DOT Label: Flammable Liquid

DOT Hazard Class: Flammable Liquid

IMO Label: Flammable Liquid

IMO Class: 3.2 or 3.3

References: 1, 2, 12, 73, 84-94, 100, 103.

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Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD

APPENDIX D

INCIDENT REPORT FORM

HAZARDOUS WASTE INCIDENT REPORT

DATE

SITE

LOCATION

DESCRIPTION OF INCIDENT, INCLUDING INJURIES, PROPERTY DAMAGE AND EMERGENCY ACTION TAKEN AND PERSONNEL INVOLVED (use additional sheets if needed):

WITNESSES OF INCIDENT:

POSSIBLE OR KNOWN CAUSES:

WHAT ACTIONS ARE NEEDED TO PREVENT A SIMILAR INCIDENT?

REPORTER

SITE SAFETY OFFICER

PROJECT DIRECTOR

CEDAR HEALTH AND SAFETY OFFICER

CEDAR HEALTH AND SAFETY COMPLIANCE AGREEMENT

I, _____ (print name), have received a copy of the Safety Plan for the Hazardous Waste Management Workplans for Cedar Chemical Corporation, Vicksburg, Mississippi. I have read the plan, understand it, and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the safety requirements specified in the plan.

Signed:

Signature

Date

Title:

APPENDIX E

**TECO THERMOELECTRON MODEL 580 B
(PHOTOIONIZATION DETECTOR) (MODEL PI 101)**

APPENDIX E

TECO THERMOELECTRON MODEL 580 B (PHOTOIONIZATION DETECTOR) (MODEL PI 101)

GENERAL

The Model 580B Organic Vapor Meter is indeed a quantitative instrument and can certainly be used as such. It makes use of the Photoionization Detection System using a lamp with an ionization energy of 10.0 eV which is standard in the Model 580B. Almost all organic materials will be ionized at this energy level. There are some organic materials, such as a few of the freons, methane, ethane and propane that are not ionized and thus will not be detected. The ionization potentials for the various organic materials will simply tell whether the material will be detected by the Photoionization Detector. It does not give any clue as to the sensitivity of that detector for that particular material. Certainly, different organic vapors will have different sensitivities. It is important to understand that the Model 580B does indeed sense most organic vapors and that its response to these different organic vapors will indeed be different.

In this section of the manual, the aspects of calibrating the Model 580B for various vapors will be discussed. In the following section discussing applications, various ways of using the features of the Model 580B will be explained along with the various methods for calibration of the 580B. There will also be applications of the Model 580B in specific instances where the organic vapors or the mixtures of organic vapors are completely unknown. The 580B can be an extremely useful tool, even in areas such as those.

FACTORY CALIBRATION OF THE MODEL 580B

To complete testing and operation in the checkout area, each Model 580B has been calibrated and linearity checked at the factory. The particular gas chosen for this

calibration is isobutylene. The Model 580B has good response for isobutylene. Isobutylene standards prepared in air are relatively stable with time, undergoing no serious adsorption or reaction problems.

METHODS OF GENERATING CONCENTRATIONS OF VARIOUS MATERIALS IN AIR

This section is not intended to be exhaustive as far as the preparation of gas and vapor standards in air are concerned. Only those methods that have been found most practical for the calibration of the 580B are discussed here. There are basically two types of standards. Static standards in which a known volume of the gas or vapor is mixed with a known volume of air and the concentration of the gas or vapor in air calculated from knowing these volumes. The second method used is what is called a dynamic standard. Dynamic standard preparation involved mixing gases or vapors with air under a flowing condition whereby the flow of both gases are known prior to their mixing. The concentration then is calculated from flow rates.

Certainly commercially available standard cylinders of gaseous materials in air offer the most convenient method calibration. However, these are static standards. Standards prepared in this fashion in air for vapors organic liquids often show concentration reduction with time due to adsorption problems. In general, gases when mixed with air will maintain their reaction of the gas will cause a reduction of it in air. These precautions must be observed when using commercially prepared standards for calibration of the Model 580B. It is for this reason that isobutylene in air was chosen as a reference standard for Model 580B. However, it is important that these standards be used shortly after their preparation to reduce the significance of any adsorption problems. Static standards prepared for calibration of the Model 580B are best prepared in collapsible plastic bags. This is opposed to a fixed volume container. The sampling rate of the 580B, which is 500 ml/min, requires an appreciable amount of sample. Even one minute's sampling out of a fixed container will remove 500 ml/min from it. This should not significantly reduce the pressure inside the container. Thus, the collapsible bag provides the best means as opposed to a fixed volume. A 5 gallon polyethylene bag is a convenient size to use for the preparation of static standard.

A tube is inserted into the opened end of the bag and the bag opening then sealed around the tube. The tube should have a cutoff valve or some means of closing the volume of the bag. The volume of air introduced into the bag must be measured. This is most conveniently measured by a wet test meter. However, a source of air flowing through a flow meter can be used if the flow can be held, constant, then time is a measure of the volume of the air placed into the bag. All air is expelled from the bag by completely collapsing it prior to connection to the source of air. It can then be connected to a wet test meter or flow meter via a short length of rubber tubing hooked to the plastic tube of the bag. The air flow is started into the bag a rate of approximately 5 l/min. A total of 10 liters is a convenient volume for a 5 gallon bag. This would mean approximately 2 minutes for filling the bag.

For gaseous samples, the trace organic will be added via a glass hypodermic syringe. The 1 cc Tuberculin syringe is a convenient size. For an isobutylene standard, the 1 cc syringe is flushed with pure isobutylene and then filled to the 1 cc mark. While the air is flowing into the plastic bag, the short piece of rubber tubing is pierced by the needle from the 1 cc syringe and the plunger slowly depressed such that the 1 cc of isobutylene is added to the air flowing into the plastic bag. When 10 liters of air have been added to the plastic bag, the flow is immediately stopped and the valve on the tube or the closing clamp is applied to contain the air and isobutylene within the plastic bag. It is best at this stage of the procedure not to rely solely on the diffusion of isobutylene to form a uniform mixture inside the plastic bag. Slight kneading of the plastic bag will hasten the mixing of the isobutylene in air. The plastic tube from the bag is then connected to the probe on the Model 580B via a short length of rubber tubing and the valve on the plastic tube immediately opened. The Model 580B withdraws a sample from the bag at the sampling rate of 500 ml/min. Thus, 10 liters of sample in the bag will provide approximately 20 minutes. Certainly the calibration of the 580B can be accomplished in a shorter period of time. The concentration of isobutylene in ppm by volume will be equal to the sample size, which was 1 cc, divided by the volume of the bag in liters, which would be 10 liters, times 1000. In this particular instance, the concentration would be:

$$\text{Conc (ppm by Vol)} = \frac{1 \text{ cc Isobutylene} \times 100}{10 \text{ L Air}} = 100 \text{ ppm}$$

For organic materials, which are normally liquids at room temperature, the procedure is essentially the same except that an extremely small liquid sample is injected into the flowing air stream rather than the gas sample. This technique works well only for relatively volatile organic materials. The flowing air stream must vaporize all of the material or the calculation will be off. If the material is not rapidly volatile in that flowing air stream, the liquid should be injected through the surface of the plastic bag. Immediately after withdrawing the needle, the hole in the plastic bag should be covered with a piece of plastic tape.

Again significant kneading of the bag has hasten the evaporation of the sample and mixing of the vapor into the air to provide homogeneous samples. The introduction of this sample into the 580B is the same as before. The calculation of the concentration of the vapor in air is a two-step procedure whereby the small volume of liquid injected into the air stream or into the plastic bag is converted to a volume of vapor. This volume of vapor is then used in the same manner as the volume of gas in the case of isobutylene. The following equations apply:

$$\text{Volume Vapor (ul)} = \frac{\text{Liquid Volume (ul)} \times \text{Liquid Density} \times 24.45}{\text{Molecular Weight}}$$

The above gives the vapor volume at atmospheric pressure (760 torr) and 25 C (77 F).

$$\text{Then:} \quad \text{Concentration (ppm by Volume)}^5 = \frac{\text{Vapor Volume (ul)} \times 1000}{\text{Air Volume (liters)}}$$

The following is a sample calculation for benzene.

$$\text{Liquid Volume} = 2 \text{ ul}$$

$$\text{Benzene Density} = 0.879 \text{ g/cc}$$

$$\text{Molecular Weight Benzene} = 78.1$$

$$\text{Air Volume} = 10 \text{ liters}$$

$$\text{Vapor Volume} = \frac{2 \times 0.879 \times 24.45}{78.1} = 0.55 \text{ ul Benzene Vapor}$$

$$\text{Conc} = \frac{0.55 \times 1000}{10} = 55 \text{ ppm (Vol)}$$

The syringe used for the measurement of liquids in this particular instance is a small volume-type such as those manufactured by the Hamilton Company. A convenience size syringe is the 10 microliter volume.

Dymanic standards can be prepared of both gases and vapors by using the techniques of either permeation tubes for gases or diffusion tubes for vapors. These permeation or diffusion devices supply a very small flow of either the gas or vapor. This is mixed with a known flow rate of air providing a flowing stream that has a known amount of either gas or vapor in the air stream. These are probably the most reliable and accurate standards available for low level concentrations of gases and vapors in air. However, the techniques require some additional instrumentation in order to implement the use of these devices. The reader is referred to Thermo Environmental's applications notebook for the use of these techniques in the dymanic generation of standards.

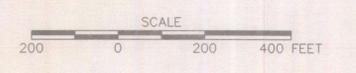


SWMU NUMBER	SOUTH PLANT
1	CONTAINER (DRUM) STORAGE AREA
2	INACTIVE LANDFILL
3	SURFACE IMPOUNDMENT (SOUTH PLANT)
4	ACTIVATED CARBON TREATMENT UNITS
5	SOUTH PLANT DRAINAGE SYSTEMS
6	WASTEWATER STORAGE (HILL) TANKS
7	FORMER DINOSEB PRODUCTION AREA
8	DINOSEB LOADING/UNLOADING AREA
9	DINOSEB DRUMMING AREA
11	FORMER MSMA PRODUCTION AREA
12	FORMER MSMA SALT UNLOADING AREA
13	SOUTH PLANT DRAINAGE DITCHES
14	FORMER TOXAPHENE PRODUCTION AREA
15	FORMER METHYL PARATHION PRODUCTION AREA
16	FORMER ATRAZINE PRODUCTION AREA
17	RETURNED PRODUCT STORAGE AREA
18	FORMER BLUE TANK AREA
20	RAILROAD CAR UNLOADING STATION

NORTH PLANT	
22	NORTH PLANT NEUTRALIZATION SYSTEM
23	EQUALIZATION/NEUTRALIZATION POND (NORTH PLANT)
25	NORTH PLANT WASTEWATER PIPES
26	C-10 SCRUBBER
29	OIL COLLECTION UNIT
30	NORTH PLANT WASTE OIL ACCUMULATION AREA
31	NO. 6 FUEL OIL AREA
33	NORTH PLANT DRAINAGE DITCHES

BOTH PLANTS	
34	SURPLUS EQUIPMENT STORAGE (JUNKYARD)

AOC NUMBER	AOC NAME
1	FISH POND (NORTH PLANT)
2	DRUM STORAGE AREA
3	NEUTRALIZATION TANKS (SOUTH PLANT)
4	CHEMICAL CRYPT (SEPTIC TANKS)



NO.	REVISION	DATE	INITIAL

INTERIM MEASURES

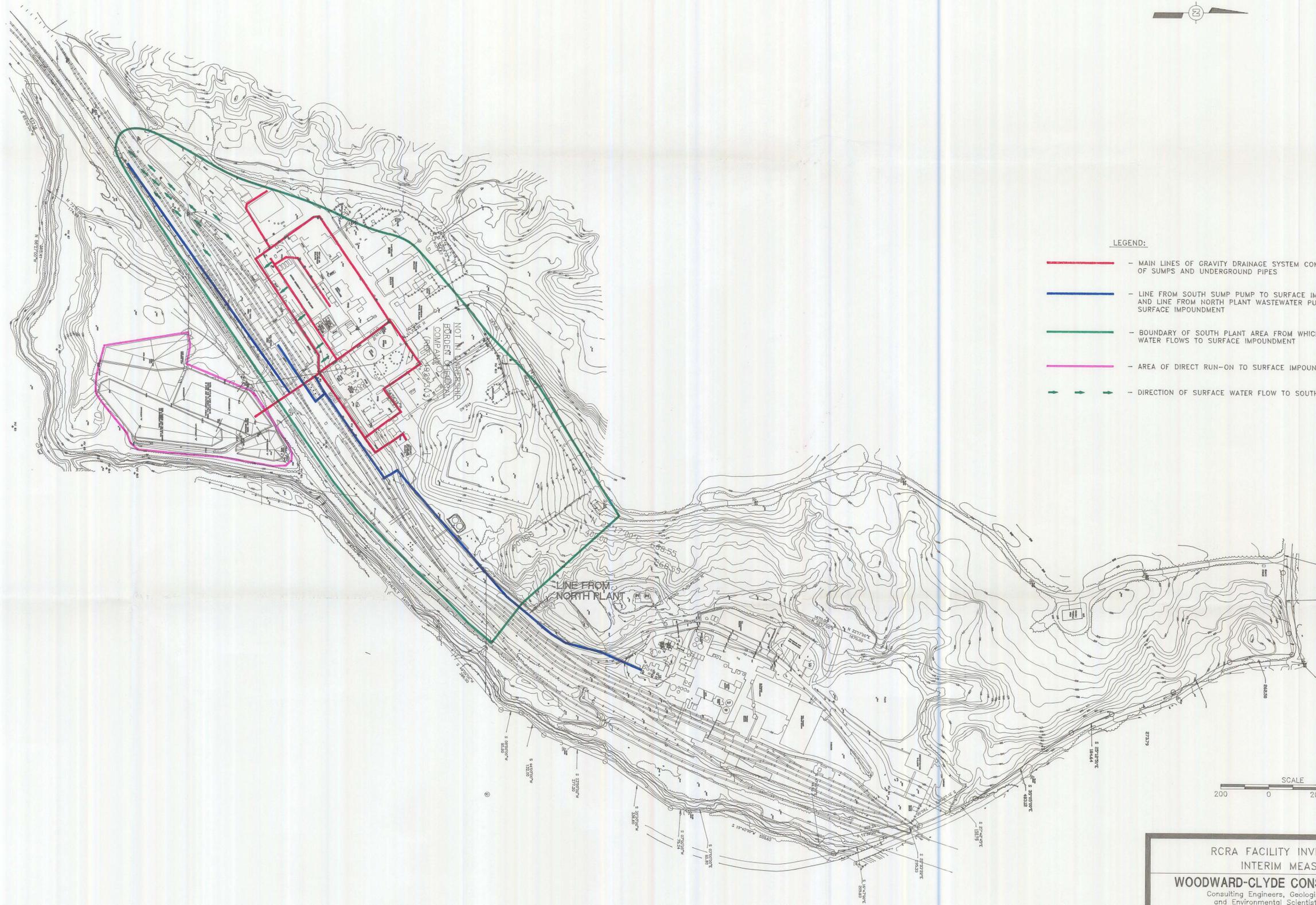
WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists
and Environmental Scientists
Baton Rouge, Louisiana

CEDAR CHEMICAL CORPORATION
VICKSBURG CHEMICAL DIVISION
VICKSBURG, MISSISSIPPI

SCALE: 1" = 200'	MADE BY: G. THORNTON	DATE: 4/6/92	FILE NO. 92B007C
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LOCATION OF SOLID WASTE
MANAGEMENT UNITS

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LEGEND:

- - MAIN LINES OF GRAVITY DRAINAGE SYSTEM COMPRISED OF SUMPS AND UNDERGROUND PIPES
- - LINE FROM SOUTH SUMP PUMP TO SURFACE IMPOUNDMENT AND LINE FROM NORTH PLANT WASTEWATER PUMP TO SURFACE IMPOUNDMENT
- - BOUNDARY OF SOUTH PLANT AREA FROM WHICH WATER FLOWS TO SURFACE IMPOUNDMENT
- - AREA OF DIRECT RUN-ON TO SURFACE IMPOUNDMENT
- - DIRECTION OF SURFACE WATER FLOW TO SOUTH SUMP



Location: BILJA File Name: K:\Users\CEDM\Documents\BILJA.dwg Plot Date: 05/05/92 @ 11:38

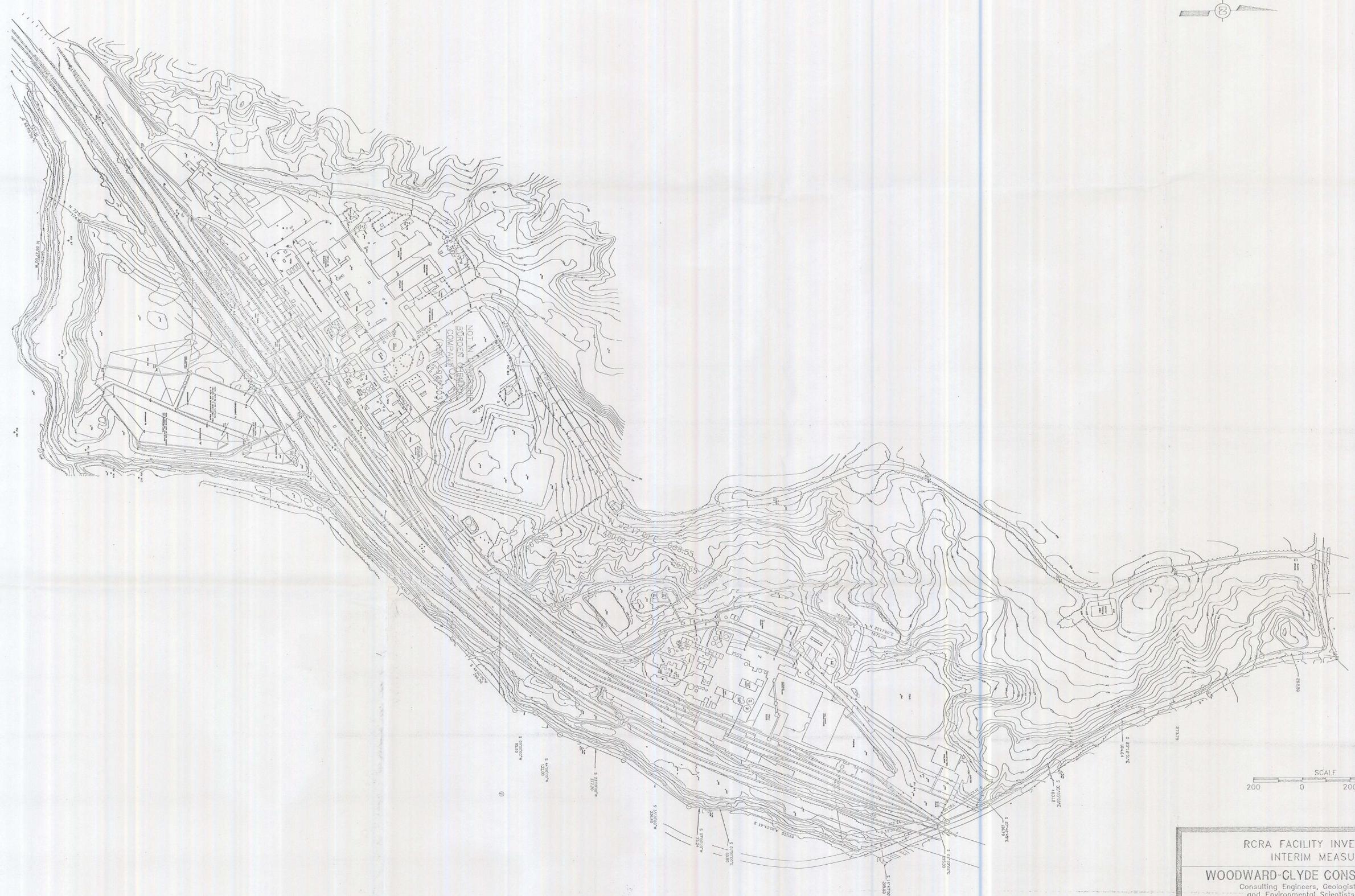
NO.	REVISION	DATE	INITIAL

RCRA FACILITY INVESTIGATION
INTERIM MEASURES

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CHECKED BY: <i>[Signature]</i>	DATE: <i>[Signature]</i>	92B007C	FIGURE
SURFACE IMPOUNDMENT INLET, RUN ON, AND SOURCES OF WATER FLOW DURING RAIN EVENTS			8



RCRA FACILITY INVESTIGATION
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	CHECKED BY: [Signature]	DATE: [Signature]	FIGURE 2

SITE TOPOGRAPHY MAP

NO.	REVISION	DATE	INITIAL

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