CLOSURE PLAN

HAZARDOUS WASTE CONTAINER STORAGE AREA
OFF-SPECIFICATION PRODUCT STORAGE AREA

SOUTH PLANT

CEDAR CHEMICAL CORPORATION
VICKSBURG CHEMICAL DIVISION

for:

Cedar Chemical Corporation
Memphis, Tennessee

June 1992

Woodward-Clyde

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

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1.0 INTRODUCTION

This workplan defines the activities to be executed by Cedar Chemical Corporation at its facility in Vicksburg, Mississippi pursuant to closure of a container storage area. The workplan or closure plan is consistent with RCRA rules and regulations.

1.1 Description of the South Plant

The Vicksburg Chemical Division of Cedar Chemical Corporation is located in Warren County, Mississippi along the Mississippi River within the south section of the City of Vicksburg. (See Figure 1a). The address is:

Cedar Chemical Corporation
Vicksburg Chemical Division
Post Office Box 821003
Rifle Range Road
Vicksburg, Mississippi 39182

The facility is a manufacturer of chemicals. The plant site is divided physically and functionally into a "north plant" and a "south plant". The north plant is primarily a manufacturer of potassium nitrate, chlorine and nitrogen tetroxide. The south plant formerly manufactured pesticides and herbicides. The South Plant presently manufacturers nitric acid, which is used primarily as a raw material in the north plant, and Inhibited Red Fuming Nitric Acid (IRFNA). Some nitric acid is sold commercially

The south plant contained the manufacturing operations for production of the following products:

- Cyanazine
- Methyl Parathion
- Atrazine
- Toxaphene
- Dinitrobutyl phenol (dinoseb)
- Monosodium methane arsenate

1.2 History of the South Plant

All pesticide plants were shut down by 1986 and have been dismantled. Any non-deminimus spills from toxaphene would have been handled as a hazardous waste (P123). The monosodium methane arsenate (MSMA) plant generated listed RCRA waste K031, a by-product salt. The by-product salt cake was directly discharged into a "roll-off sludge container". When the container was full (2-4 days) it was transported by a hazardous waste transporter to a hazardous waste landfill. The MSMA plant was designed such that there was intended to be no effluent with all spills, etc. retained and recycled to the process.

The dinitrobutyl phenol (Dinoseb) plant produced process wastewater that was hazardous by virtue of characteristic (D002). The waste was pumped to 1-3 day storage and was transported by a hazardous waste transporter to off-site disposal by hazardous waste deep well injection. At times the manufactured process wastewater was neutralized with ammonia and pumped to a 1.6 million gallon storage tank. After neutralization, the water did not exhibit the characteristic of a hazardous waste and was pumped through activated carbon prior to discharge to the surface impoundment.

The hazardous waste container storage area and off-specification product storage area (See Figure 1b - SWMUs 1 and 17) were in operation from 1976 to 1986. The hazardous waste container storage area stored contaminated debris, trash and waste product material in 55-gallon drums. The off-specification product storage area stored 55-gallon drums and 5-gallon pails of product returned from clients which could be put back into the manufacturing process and recovered.

1.3 Description of the Container Storage Area's

The two container storage areas which are to be closed are two distinct sections or areas of a continuous concrete area in the South Plant. This area is a six-inch (minimum) poured 3,000 psi reinforced concrete slab with sumps, curbs, containment areas (See Figure 2).

The hazardous waste container storage area stored trash and debris contaminated with products or byproducts produced at the South Plant. This area also stored off-specification

product which could not be reclaimed or recycled into new product. These wastes were typically stored in 55-gallon drums. The area is trapezoidal in shape, approximately 30 feet by 46 feet by 14 feet by 40 feet. Photographs and maps of the area have been included as Figures 3, 4 and 5.

The off-specification product storage area is a covered area immediately adjacent to the hazardous waste storage area but separated by curbs. This is a 2,000 Square Foot area roughly 28 feet by 70 feet which stored off-specification product until it could be returned to the manufacturing process and recycled into new product. This area stored an assortment of 55-gallon drums, and 5-gallon pails and 1 gallon containers. Photographs and maps of the area have been included as Figures 3 through 7.

1.4 Description of Wastes Stored

The container storage areas stored off-specification products, products, waste products or trash and debris contaminated with the following chemical compounds:

Toxaphene	(P123)
Dinitrobutyl phenol (dinoseb)	(P020)
Monosodium Methane Arsonate (MSMA)	(K031)

Atrazine

Toluene contained in pesticide formulations

The maximum inventory of hazardous wastes is estimated to be 50 drums in the hazardous waste container storage area. The contents of drums stored in the off-specification product storage area were for the most part recycled. It is estimated that at most 10 drums stored at one time were not suitable for recycle and therefore became classified as hazardous waste.

2.0 CLOSURE PERFORMANCE STANDARD

This closure plan is based upon closure of both container storage areas with no wastes or contamination remaining in place above the health based action levels. This closure plan is intended to result in a "clean" closure which will eliminate the need for post-closure maintenance and care. The levels of clean-up will be used for the soils underneath the concrete pad and immediately adjacent to the pad.

This closure plan calls for concrete surfaces to be hydroblasted, after which the concrete will be analyzed. The analyses of the concrete will have to meet the same health based criteria required of soil in order to be judged clean closed. There may be instances where analysis of hydroblast water is indicative of residual concentrations. One of the secondary criteria by which concrete may be judged to be clean is when the concentrations of arsenic and toxaphene in the water are less than the primary drinking water standards. The standard for arsenic is 0.05 ppm and the standard for toxaphene is 0.005 ppm. Since Dinoseb is not a parameter in the primary drinking water standards the Table 8-7 "Health Based Criteria for Systemic Toxicants" reading for Dinoseb in water will be used (Appendix C); that concentration is 0.040 ppm. The standard for atrazine in the hydroblast water is 0.175 mg/l based on a Reference Dose (RfD) of 0.005 mg/kg-d.

2.1 Methodology for Calculation of Cleanup Criteria

The development of site-specific health-based remedial goals is based on the health risk assessment process in accordance with EPA Risk Assessment Guidelines for Superfund (RAGS). Remedial goals for the identified constituents of potential concern are obtained through backcalculation of health risk estimation calculations.

2.1.1 Calculations of Cancer Risk

The calculation of cancer risk is herein summarized. In the calculation of potential carcinogenic health risk at a site, the concentration of constituent in the medium (Column A) is multiplied by a receptor specific intake factor (Column B) to obtain the lifetime average daily intake of chemical (Column C) for the receptor. To estimate cancer risk (Column E) the daily intake (Column C) is multiplied by the slope factor (Column D).

Chemical Concentration (mg/kg)	Intake Factor (kg/kg/day)	Lifetime Average Daily Intake (mg/kg/day)	Slope Factor $(mg/kg/day)^{-1}$	Cancer Risk
A	B	C	D	E

$$Daily\ Intake = (Chemical\ Concentration)\ (Intake\ Factor)$$

$$C = (A)\ (B)$$

$$Cancer\ Risk = (Slope\ Factor)\ (Lifetime\ Average\ Daily\ Intake)$$

$$E = (D)\ (C)$$

2.1.2 Calculation of Noncarcinogenic Health Effects (Hazard Quotient)

The calculation of the potential for noncarcinogenic health effects, called the hazard quotient, is summarized as follows. The calculation is similar to the calculation for carcinogens. The concentration of the constituent in the medium (Column A) is multiplied by a receptor specific intake factor (Column B) to obtain the average daily intake of chemical (Column C) for the receptor. To estimate the hazard quotient (Column E), the daily intake (Column C) is multiplied by the reciprocal of the reference dose (Column D).

Chemical Concentration (mg/kg)	Intake Factor (kg/kg/day)	Average Daily Intake (mg/kg/day)	RfD (mg/kg/day)	Hazard Quotient
A	B	C	D	E

$$\textit{Average Daily Intake} = (\textit{Intake Factor})\ (\textit{Chemical Concentration})$$

$$C = (B)\ (A)$$

$$\textit{Hazard Quotient} = \frac{\textit{Daily Intake}}{1}\ \frac{1}{\textit{RfD}}$$

$$E = C\ \frac{1}{D}$$

2.1.3 Cleanup Criteria Calculations for Carcinogens

To derive site-specific concentrations in a medium that are protective of human health, the calculations presented above are reversed. For carcinogens, an acceptable cancer risk level is designated (Column E) and divided by the slope factor (Column D) to yield the acceptable daily chemical intake (Column C). The acceptable lifetime average daily intake (Column C) is then divided by the intake factor (Column B) to obtain an acceptable concentration of chemical in the medium; i.e., a chemical-specific cleanup goal (Column A).

Acceptable Cancer Risk	Slope Factor $(mg/kg/day)^{-1}$	Lifetime Average Daily Intake (mg/kg/day)	Intake Factor (kg/kg/day)	Chemical Concentration mg/kg
E	D	C	B	A

$$\textit{Acceptable Lifetime Average Daily Intake} = \frac{\textit{Acceptable Cancer Risk}}{\textit{Slope Factor}}$$

$$C = \frac{E}{D}$$

$$\textit{Acceptable Chemical Concentrations} = \frac{\textit{Acceptable Lifetime Average Daily Intake}}{\textit{Intake Factor}}$$

$$A = \frac{C}{B}$$

2.1.4 Cleanup Criteria Calculations for Noncarcinogens

Cleanup goals are usually governed by potential carcinogens found onsite although cleanup goals for noncarcinogenic compounds may also be evaluated. Where toxicity values for the evaluation of both carcinogenic and noncarcinogenic health effects are available, cleanup criteria were calculated for both and cleanup criteria will be established based on the more conservative chemical concentration calculated.

For noncarcinogenic constituents, the hazard quotient (Column E) is assigned an acceptable value which is multiplied by the reference dose (Column D) to yield the acceptable average daily chemical intake (Column C). The acceptable daily chemical intake is divided by the intake factor (Column B) to obtain the acceptable concentration of chemical in the medium; i.e., a chemical-specific cleanup goal (Column A).

Acceptable Hazard Quotient	RfD (mg/kg/day)	Average Daily Intake (mg/kg/day)	Intake Factor (kg/kg/day)	Acceptable Chemical Concentration mg/kg
E	D	C	B	A

$$\textit{Acceptable Average Daily Chemical Intake} = (\textit{Acceptable Hazard Quotient})\ (\textit{RfD})$$

$$C = (E)\ (D)$$

$$\textit{Acceptable Chemical Concentration} = \frac{\textit{Acceptable Average Daily Chemical Intake}}{\textit{Intake Factor}}$$

$$A = \frac{C}{B}$$

2.1.5 Target Cancer Risks

An acceptable level of potential cancer risk is selected after evaluation of site variables including the types and activities of receptors on or near the site, types of potential exposures, the inherent toxicity of chemicals found on or near the site, and the EPA guidelines governing remedial goals and risk management decisions (OSWER Directive 9355.0-30).

A noncumulative potential cancer risk of $1x10^{-4}$ has been selected for the site. This level of potential risk has been selected based on the following:

- The areas are currently inactive and access is restricted.
- Future site use will be industrial/commercial.
- Topographic analysis indicates that potential exposure to residential receptors is not likely to occur.

- Potential future exposures will be transient and related primarily to the duration and frequency with which workers are on-site.

- The potential carcinogens on the site are known to induce unrelated target organ-specific effects, therefore potential carcinogenicity should not be treated as additive.

- EPA guidelines state that for the calculation of cleanup goals for known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of 10^{-4} (EPA OSWER Directive 9355.0-30).

2.1.6 Target Hazard Quotient

A target potential hazard quotient of 1 has been selected for the development of soil cleanup criteria at the former pesticide facility. A hazard quotient less than 1 represents an exposure level that is without adverse health effects in exposed populations (EPA RAGS).

2.2 Specific Calculations for Cedar - Carcinogens

Based on the assumptions noted above, an intake factor is calculated:

$$Intake\ Factor = \frac{(IR)(EF)(ED)(ME)(FI)(CF)(SS)}{(BW)(AT)}$$

$$= \frac{(50\ mg/day)(250\ days/yr)(25\ years)(1 \times 10^{-6}\ kg/mg)}{(70\ kg)(365\ days/yr \times 70\ years)}$$

$$= 1.74 \times 10^{-7}\ kg/kg/day$$

where:

IR = Ingestion rate (mg soil/day)
50 mg/day (OSWER Directive 9285.6-0.3, "Standard Default Exposure Factors", 3/25/91)

FI = Fraction ingested from contaminated source (unitless)
Pathway-specific value (should consider contaminant location and population activity patterns); assume FI = 1

EF = Exposure frequency (days/year)
250 workdays/year at Cedar

ED = Exposure duration (years)
25 years for Cedar workers

CF = Conversion factor (10^{-6} kg/mg)

BW = Body weight (kg)
70 kg (adult, average; EPA 1989d)

AT = Averaging time (period over which exposure is averaged, days) Pathway-specific period of exposure for noncarcinogenic effects (i.e., ED x 365 days/year), and 70-year lifetime for carcinogenic effects (i.e., 70 years x 365 days/year)

ME = Matrix effect; use 1

SS = Site-specific factor; assume 1

The following table is then prepared from calculations of noncumulative carcinogenic exposure:

Acceptable Concentration in Soil (ppm or mg/kg)	Intake Factor (kg/kg/day)	Acceptable Lifetime Average Daily Chemical Intake (mg/kg/day)	Oral Slope Factor ($mg/kg/day^{-1}$)	Acceptable Risk Goal
Atrazine 2,586 ppm	1.74E-07	4.5E-04	2.2E-01	10^{-4}
Toxaphene 523 ppm	1.74E-07	9.1E-05	1.1E+00	10^{-4}
Arsenic 328 ppm	1.74E-07	5.7E-05	1.75E+00	10^{-4}

2.3 Specific Calculations for Cedar - Noncarcinogens

The intake factor is similar to the carcinogen calculation except that AT = (365 days/yr x 25 years).

$$Intake\ Factor = \frac{(IR)(EF)(ED)(ME)(FI)(CF)(SS)}{(BW)(AT)}$$

$$= \frac{(50\ mg/day)(250\ days/yr)(25\ years)(1 \times 10^{-6}\ kg/mg)}{(70\ kg)(365\ days/yr \times 25\ years)}$$

$$= 4.89 \times 10^{-7}$$

The following table is then prepared from calculations of noncumulative noncarcinogenic exposure:

Acceptable Concentration in Soil (ppm or mg/kg)		Intake Factor (kg/kg/day)	Acceptable Average Daily Chemical Intake (mg/kg/day)	Oral RfD (mg/kg/day)	Acceptable HQ Goal
Atrazine	10,225 ppm	4.89×10^{-7}	5E-03	5E-03	1
Dinoseb	2,045 ppm	4.89×10^{-7}	1E-03	1E-03	1
Arsenic	2,045 ppm	4.89×10^{-7}	1E-03	1E-03	1
Toluene	613,497 ppm	4.89×10^{-7}	3E-01	3E-01	1

2.4 Conclusions

The calculated acceptable soil concentrations are lower for carcinogens than for noncarcinogens for atrazine and arsenic. Therefore, the carcinogen-based soil concentration for these chemicals will be used in order to be conservative. Based on the carcinogen and noncarcinogen calculations for the five chemicals of concern, the

following soil concentrations are initially proposed for remediation:

Chemical	Soil Remediation Concentration
Atrazine	2,586 ppm
Arsenic	328 ppm
Dinoseb	2,045 ppm
Toluene	613,497 ppm
Toxaphene	523 ppm

Toluene should be dropped from the final remediation list due to the low relative toxicity concern compared to the other chemicals of concern at the site and the likelihood that toluene residues should be present in very minor quantities in the medium of concern (soil).

The potential cancer risks and hazard quotients associated with these cleanup goals were recalculated and are presented as follows:

Chemical	Soil Remediation Concentration	Cancer Risk	Hazard Quotient
Atrazine	2,586 ppm	1.0×10^{-4}	0.25
Arsenic	328 ppm	1.0×10^{-4}	0.16
Dinoseb	2,045 ppm	*NA	1.00
Toxaphene	523 ppm	1.0×10^{-4}	*NA

* Not Applicable.

For noncarcinogens, the potential hazard could be viewed as additive since dinoseb, atrazine and possibly arsenic are known to induce some form of reproductive toxicity. The cumulative hazard index (sum of the hazard quotients) is slightly greater than 1.0 (1.41), which may indicate the potential for noncarcinogenic toxicity in humans assuming additivity of effects. However, it is unlikely that true additivity of reproductive toxicity would be seen with these chemicals due to the complex toxicological mechanisms

associated with reproductive toxicity. Therefore, it is not believed that cleanup goals should be governed by noncarcinogenic toxicity at this site.

In regard to carcinogens, potential carcinogenicity at the site should not be treated as additive since the potential carcinogens are known to induce unrelated target organ-specific effects. For instance, arsenic targets the skin and lung, whereas atrazine targets mammary glands and toxaphene limits its effects to the liver and thyroid gland. The use of EPA-recommended soil cleanup concentrations would unnecessarily reduce the potential cancer risks due to the presence of arsenic and toxaphene to the 10^{-5} and 10^{-6} range, respectively. By way of comparison, the following list incorporates EPA-based cleanup levels for potential contaminants for which guidance soil concentrations have been published:

Chemical	Soil Remediation Concentration
Atrazine	2,586 ppm
Arsenic	80 ppm[1]
Dinoseb	80 ppm[2]
Toluene	613,497 ppm
Toxaphene	60 ppm[3]

[1] Federal Register (July 27, 1990), Appendix A.
[2] RCRA Facility Investigation Guidance Document, Volume 1, Table 8-7.
[3] Federal Register (July 27, 1990), Appendix C.

A 10^{-4} risk level should be acceptable for an industrial site (such as the Cedar Chemical Site) in which residential exposure is expected to be minimal (55 FR 30798; July 27,

1990) and for which the site is expected to remain in use for industrial purposes only. Site-specific exposure scenarios are a necessary component for determination of clean closure (Clean Closure Guidance Document - OSWER 9476-00.8.c). In conclusion the following soil concentrations are proposed for remediation:

Chemical	Soil Remediation Concentration
Atrazine	2,586 ppm
Arsenic	328 ppm
Dinoseb	2,045 ppm
Toxaphene	523 ppm

3.0 CLOSURE ACTIVITIES

3.1 Waste Inventory Removal

No waste is stored for more than 90 days.

3.2 Pad and Equipment Decontamination

Decontamination of the container storage areas will be performed in the manner that is described below.

All surfaces, the pad surface and containment curbing, will be cleaned utilizing a hydroblaster. Heavy duty plastic sheeting will be wrapped around the outside of the section of the container storage area being hydroblasted by attaching the plastic sheeting to supports temporarily assembled for the purpose. A barrier, covered by heavy-duty plastic sheeting, will also be placed across the open end of the container storage area to confine the water that will be generated. The pad will be cleaned three times and vacuumed up by a shop vacuum or equivalent.

The water from the cleaning operations will be disposed of onsite. The water will be transported by truck to the Cedar activated carbon wastewater treatment facility. The water will be pumped directly through the activated carbon and will not enter the surface impoundment. The treated water will be discharged to the Mississippi River under the Cedar NPDES permit.

A representative composite sample containing bits of plastic sheeting, dislodged concrete, and any other solids generated during the decontamination operations will be sent to a offsite laboratory to test for Dinoseb, Arsenic, Atrazine and Toluene. If the results of the analyses of the concrete plastic sheeting and generated solids samples performed as a part of clean closure are less than the action levels then the waste will be disposed in a commercial solid waste disposal facility that is permitted to accept industrial waste. Otherwise, the waste will be disposed in a hazardous waste facility.

Decontamination of the hydroblaster used in cleaning the container storage areas will not be necessary because it will not come into contact with any waste since the waste has been contained in closed 55-gallon drums. The interior of the shop vacuum or equivalent equipment will be triple cleaned. The water will be collected and treated as described in the previous paragraph.

3.3 Contaminated Soil Removal

If soil field analysis indicates high levels of contamination then the concrete in the area of that sample will be removed. The contaminated soil will be exposed and excavated for offsite disposal. The remaining soil will then be resampled to ascertain whether health based criteria have been met.

3.4 Proof of Decontamination

3.4.1 Water Sample Collection Procedures. Samples of final hydroblast will be obtained by placing a sample bottle in the water and letting the bottle fill. Care will be taken to avoid disturbing the water by agitation which could introduce excess oxygen. The VOA bottles will be completely filled to eliminate any air space, and they will be immediately capped after filling. Each sample label will contain the following information:

- o Sample number,
- o Sample location,
- o Sample depth (if applicable),
- o Date/time of collection, and
- o Sampler's initials.

3.4.2 Soil Sampling. To confirm that no leaks have occurred, the following procedures will be employed to sample the soil for contamination under the concrete pad. Of the fourteen proposed sample locations, eleven are located beneath cracks and beneath the sumps (see Figure 2). For those locations located beneath concrete, a concrete saw will be used to cut and remove a small section or plug of the concrete pad. Additionally, two samples of concrete from the concrete removed in the hazardous waste container storage area and two samples of concrete removed in the off-specification product storage area will be submitted for separate analysis with the soil samples.

Samples of soil underneath the concrete will be taken utilizing a 1-inch diameter stainless steel tube encased in a 2-foot long stainless steel soil probe. A stainless steel soil probe is attached to extension rods and will be driven six inches into the soil by a hammer attachment. Following the removal of the soil probe, the tube containing the sample will be extracted from the soil probe. The soil sample will be extruded and transferred to sample bottles, appropriately labeled, and placed on ice for transport to the laboratory. If the soil probe is unable to obtain a representative sample then a hand auger will be employed. All equipment will be cleaned in accordance with decontamination procedures before collection of each sample.

Sample points were chosen at locations of joints and/or cracks where contamination could most likely accumulate if released. According to OSWER 9476-00-8.C a clean closure demonstration may be made with one sample per 2500 ft^2; the areal locations meet the criterion.

Comm #6 The mobility of pesticides in soil underneath the concrete will be limited; therefore, the highest concentrations would be found in areas where there are cracks just below the concrete/soil interface. In the event that clean closure criteria are not met, soil removal and additional sampling would be required. Comm #4

All equipment will initially be decontaminated before use and again after each sample is collected. The following decontamination procedures will be employed:

- Washing in tap water and a detergent (Alconox) solution. Brush, if necessary, to remove particulate matter and surface films.
- Rinsing thoroughly with tap water.
- Rinsing with distilled, deionized water.
- Rinsing twice with pesticide - grade solvent.
- Rinsing with organic - free water.
- Allow to air dry as long as possible.

After decontaminating, the sample equipment will be wrapped in aluminum foil for protection until its subsequent use. All wash fluids will be containerized for later disposal by Cedar Chemical in their activated carbon wastewater treatment process as previously described.

The Data Collection Plan and Data Management Plan are attached as Appendix D and E. The plans are taken from the RFI Workplan and are to be used as guidance where parameters are applicable.

3.5 Documentation of Sample Acquisition

Additionally, all information pertinent to field observations and sampling will be

recorded in a logbook with consecutively numbered pages. Entries in the logbook will include at least the following:

- o Sketch of the container storage area with measurements
- o A grid of the site area
- o Purpose of Sampling
- o Number and approximate volume of samples taken
- o Exact location of sampling point on grid
- o Description of sampling point
- o Date and time of collection
- o Collector's sample identification number(s)
- o References, such as maps or photographs of the sampling site
- o Field observations
- o Weather conditions

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

Proper sample preservation is important in retaining the sample characteristics prior to analysis. Sample preservation is documented on the chain-of-custody form and also in the field logbook. The proposed analytical methods required that the sample be kept on ice until transferred to the laboratory.

Once the sample has been transferred to an appropriate laboratory sample container, sample tags will be completed and affixed to the sample container.

3.5.1 Sample Tagging. Each sample will be tagged and sealed properly immediately after collection. Sample tags are necessary to prevent misidentification of samples. The tag will include at least the following information:

- o Name of collection
- o Date and time of collection
- o Place of collection

- o Collector's sample number, which uniquely identifies the sample

An example of a sample tag that will be used is shown in Figure 9.

3.5.2 Chain-of-custody. In addition in the field logbook, each sample will be recorded on a chain-of-custody record. (Figure 8). An identifying code will be assigned to each sample and this code will be used on the chain-of-custody and in the logbook to ensure that the sample description is identifiable. A brief description of the sampling point will also be placed on the chain-of-custody form.

Chain-of-custody forms will become the permanent records of all sample handling and shipment. If standard sampling procedures are not used, a written justification of each deviation will be placed in the project file. Upon completion of sampling, the sample will be prepared for shipment in accordance with the applicable sampling instruction, including preservation, labeling, and logging.

The person collecting a sample will initiate document(s) at the source of sample and start the chain-of-custody procedure.

The sample will be kept in limited access or locked storage at the proper temperature until custody is relinquished from the site and formal documentation of the transfer is completed.

Upon each transfer of custody, the person involved will verify sample numbers and condition and will document the sample acquisition and transfer. The field sampler will properly package the samples, indicate method of shipping, obtain documentation of the shipment, such as certified mail receipt or bill of lading number, and sample identification records (one of each with the shipment, one of each by mail to the laboratory, and one of each returned with field records).

On transfer of custody of the samples to the transport agency, the field sample custodian will sign and retain a copy of the chain-of-custody, witness the transport company custody signature, and send two copies of the chain-of-custody with the samples. On arrival at

the laboratory, the sample custodian will sign for custody and return a copy of the completed chain-of-custody to Cedar Chemical. Custody procedures will then proceed according to the procedures of the selected testing laboratory.

3.5.3 Evaluation of Sampling Results. The analytical results from Cedar Chemical's sampling efforts will be summarized and evaluated. The raw data will be included as an appendix to the report submitted.

3.5.4 Analytical Methods and Parameters. Cedar Chemical proposes to use its onsite laboratory when possible for screening. This laboratory will analyze for Dinoseb. This parameter was chosen because it was one of the main products manufactured at the South Plant. These parameters were chosen because these were the main products manufactured at the south plant. Copies of methods which Cedar Chemical intends to use for screening is included as Appendix A. A summary of the parameter and methods to be employed by the offsite laboratory for verification sampling are as follows or per methods described in the Sampling and Analyses Plan of the RCRA Interim Measures Workplan submitted as a 30 day deliverable under the Consent Decree:

Toxaphene	EPA SW-846, Method 608 or 8080
Dinitrobutyl Phenol (Dinoseb)	See Exhibit A for screening method. EPA SWA-846, Method 8150.
Arsenic	EPA SW-846, Method 7060
Atrazine	GC/ECD, GC/NPD or HPLC EPA 505, 507 or 525 (drinking water)

Cedar will use Analytical Technologies in Pensacola, Florida as the off site laboratory.

3.6 Equipment Decontamination

Any sampling equipment that has come in direct contact with the material in the storage areas will be deemed contaminated. The waste materials handled are not corrosive, reactive or ignitable. However, special personnel protective equipment will be used and

precautions taken when necessary. Product Material Safety Data Sheets are included as Appendix B.

3.7 Site Restoration

Upon completion of the work the holes will be filled with concrete or grout. The location of the holes will be marked on a map which will be included in the final report. Additionally the sample number will be imprinted in the concrete.

4.0 FINAL REPORT AND CERTIFICATION

After the container storage areas have been decontaminated and any contaminated soil removed Cedar Chemical will submit a final report to the MSDEQ and EPA for review. This report will contain analytical results from sampling, site investigation information and a draft certification of closure.

Upon approval by the MSDEQ and EPA that the closure is complete, Cedar Chemical will submit a certification of closure signed by an independent engineer registered in the State of Mississippi. This is a clean closure, therefore, no notice is required for the local land authority.

5.0 CLOSURE COST ESTIMATE

The proposed closure cost estimate provided in Table 1 is based on removal of any contamination in the concrete pad and removal of concrete at fourteen sampling locations for soil testing, then disposing these materials in a permitted offsite facility.

6.0 CLOSURE SCHEDULE

The "Clean Closure" will be accomplished within 210 days of the date of approval of this plan by the MSDEQ and EPA. A detailed schedule is attached as Table 2.

7.0 CONTINGENT CLOSURE PLAN

It is Cedar's clear intention to achieve clean closure. In the event that Cedar is unable to practically achieve clean closure, Cedar will prepare a flexible cleanup plan based on actual exposure and actual intended land use. The plan will be based on results of data obtained from prior and/or additional sampling and analysis. Both the plan for cleanup and request for a post closure permit would be submitted to the MSDEQ and EPA within 45 days of the occurrence of the unexpected event. Details on the closure plan would be submitted at the time.

8.0 POST CLOSURE CARE

In the event that it is necessary to execute the contingent closure plan, monitoring and maintenance will be required for a period of thirty years. The contingent closure plan would include the installation of one (1) well upgradient and three (3) wells downgradient. Monitoring will consist of sampling and analyzing the wells semi-annually for a period of two years and annually for twenty eight (28) years. The analytes will be toxaphene, dinoseb, MSMA, Atrazine and Toluene. Details on post closure care would be submitted with the contingent closure plan.

9.0 FINANCIAL ASSURANCE

Upon approval of this plan by MSDEQ and the EPA Cedar will establish a proper financial vehicle concurrent with the execution of the work. A copy of the trust agreement that will be executed is attached as Appendix F.

TABLES

TABLE 1

PROPOSED CLOSURE COST ESTIMATE

Item	Unit Cost	Quantity	Subtotal
Concrete Pad Decontamination			
Mobilization			500.00
Temporary framing			1,000.00
Hydroblasting	2,000/day	2	4,000.00
Laboratory Analysis Onsite (1)	N/A	N/A	
Removal of Concrete Plugs	500/day	2	1,000.00
Transportation and Disposal	500/ton	1	500.00
Laboratory Analysis Offsite (2)	350	16	5,600.00
Site Restoration	500/day	1	500.00
Closure Report and Sampling Results and			---
Regulatory Liason and Certification by Registered Engineer	800/day	3	2,400.00
Project Management			
Subject contractor *including site visits*	800/day	3	2,400.00
Project Liason	800/day	2	1,600.00
Transportation and Expenses			2,000.00
15% Contingency			3,000.00
		(Estimated) TOTAL	24,500.00

(1) Cedar Chemical intends to use its onsite laboratory for rapid field analysis

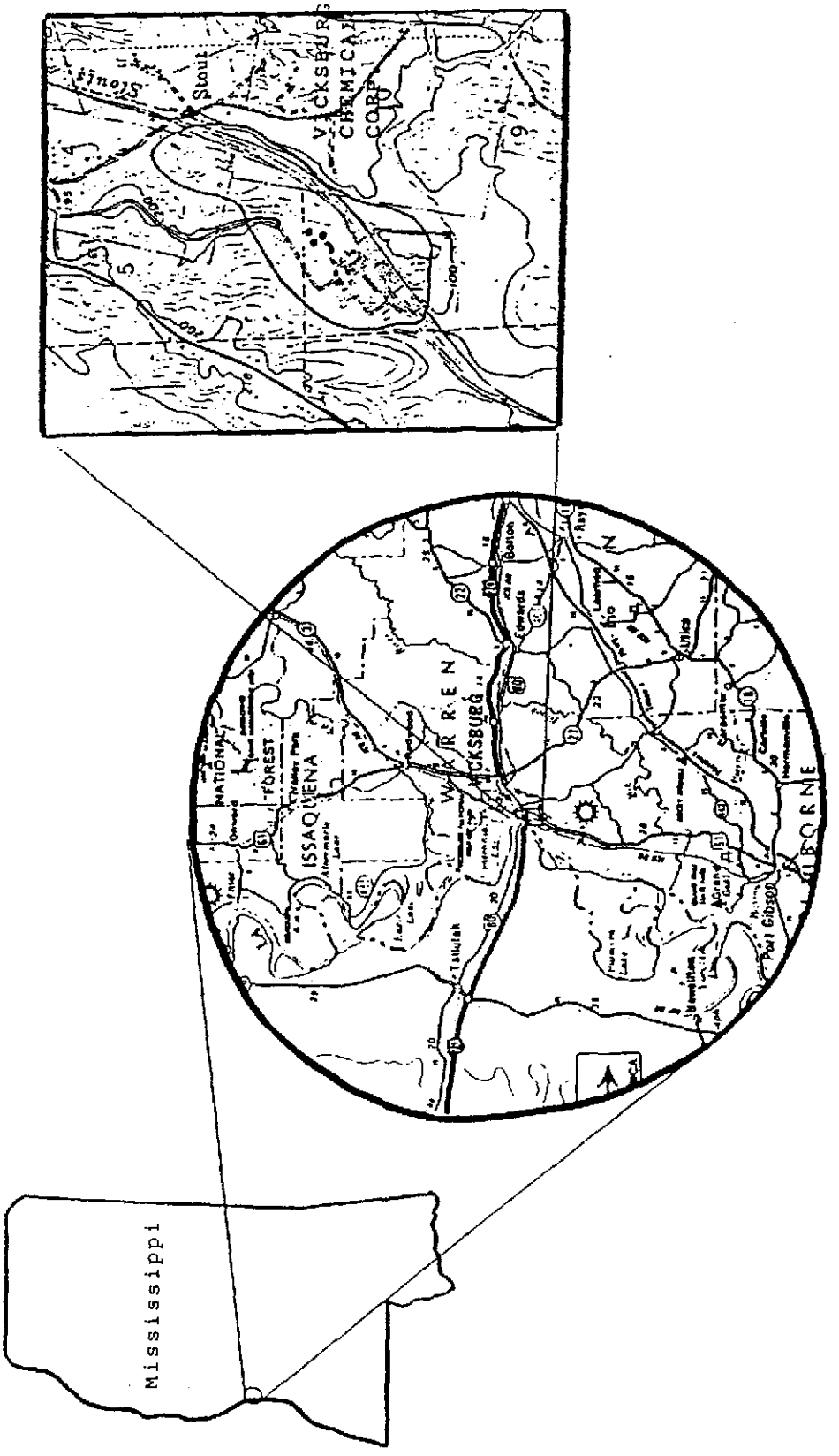
(2) Cedar will use an offsite laboratory for decontamination confirmatory analysis

TABLE 2

SCHEDULE OF CLOSURE

Receive approval to proceed with plan	Day 0
Issue request for quotation for contractor to do the hydroblasting and cut the concrete	Day 15
Receive bids	Day 30
Execute purchase order	Day 45
Start work	Day 75
Complete work and sampling	Day 120
Receive results of sampling	Day 150
Validate data	Day 180
Final Report	Day 210

FIGURES



CEDAR CHEMICAL CORP
VICKSBURG CHEMICAL DIVISION
VICKSBURG, MISSISSIPPI

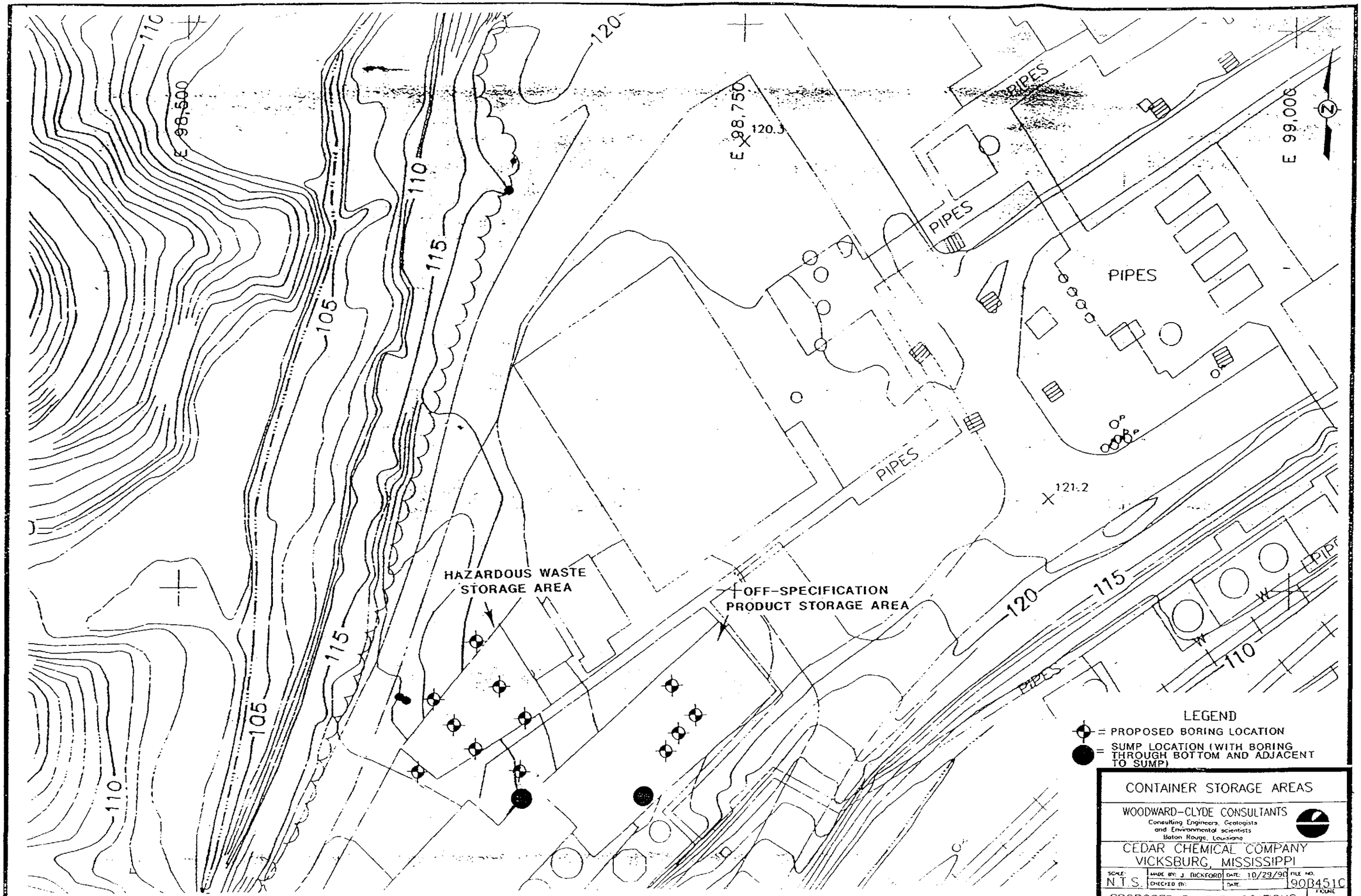
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Baton Rouge, Louisiana

FACILITY LOCATION MAP

SCALE:	DRAWN BY: SB	DATE: 4/91
	CHKD. BY:	DATE:

FILE NO. 92B007C

FIG. NO. 1a


E 98,500
E 98,750
E 99,000
120.3
121.2
PIPES
PIPES
PIPES
PIPES
PIPES
HAZARDOUS WASTE STORAGE AREA
OFF-SPECIFICATION PRODUCT STORAGE AREA
110
105
115
120
N
LEGEND
= PROPOSED BORING LOCATION
= SUMP LOCATION (WITH BORING THROUGH BOTTOM AND ADJACENT TO SUMP)
CONTAINER STORAGE AREAS
WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental scientists
Baton Rouge, Louisiana
CEDAR CHEMICAL COMPANY
VICKSBURG, MISSISSIPPI
SCALE: N.T.S.
MADE BY: J. RICKFORD
DATE: 10/29/90
CHECKED BY:
DATE:
FILE NO. 90B451C
PROPOSED SAMPLE LOCATIONS
FIGURE 2

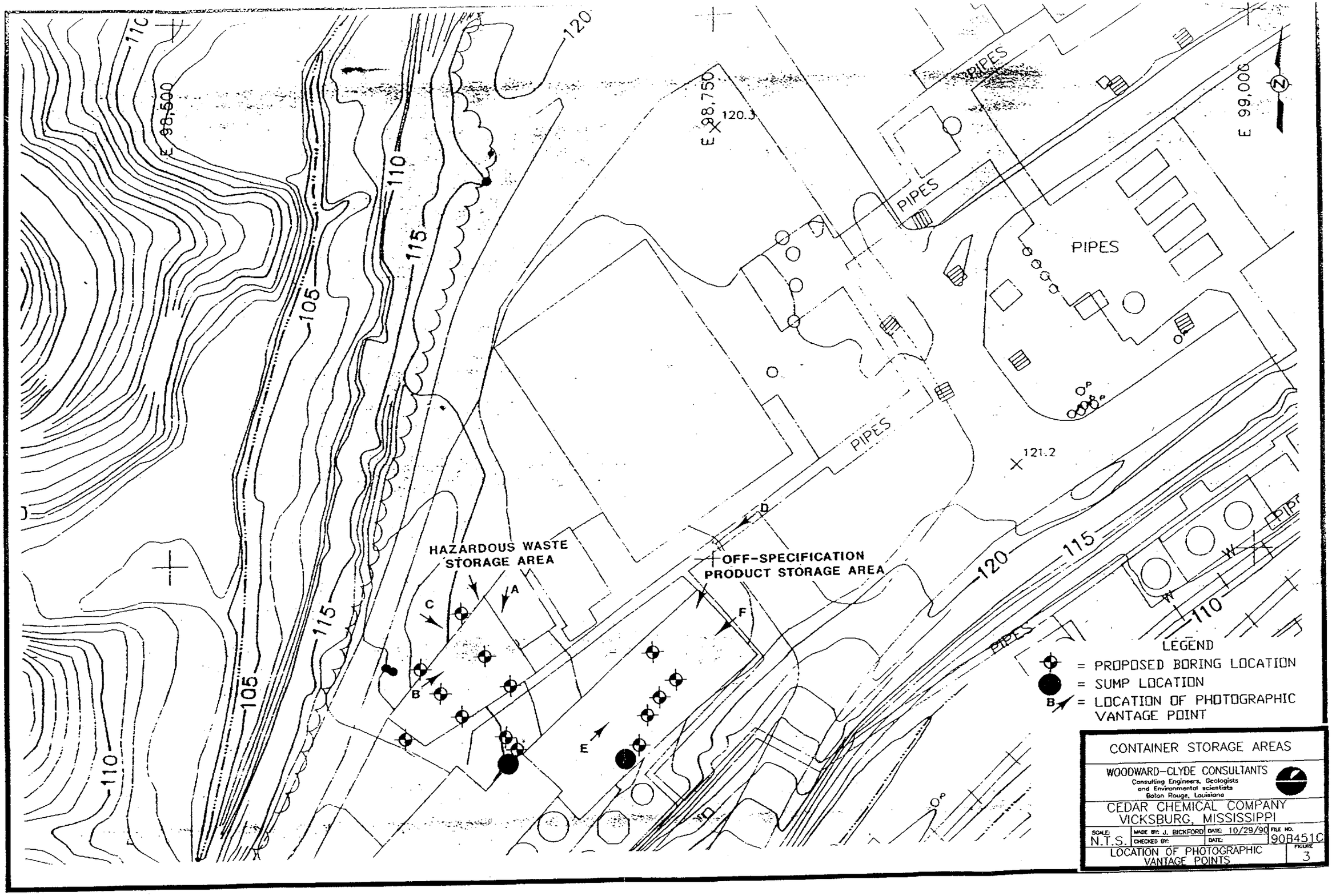

E 98,500
E 98,750
E 99,006
120.3
121.2
PIPES
PIPES
PIPES
PIPES
PIPES
PIPE
110
115
120
105
HAZARDOUS WASTE STORAGE AREA
OFF-SPECIFICATION PRODUCT STORAGE AREA
A
B
C
D
E
F
LEGEND
= PROPOSED BORING LOCATION
= SUMP LOCATION
= LOCATION OF PHOTOGRAPHIC VANTAGE POINT
CONTAINER STORAGE AREAS
WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental scientists
Baton Rouge, Louisiana
CEDAR CHEMICAL COMPANY
VICKSBURG, MISSISSIPPI
SCALE: N.T.S.
MADE BY: J. BICKFORD
DATE: 10/29/90
CHECKED BY:
DATE:
FILE NO. 90B451C
LOCATION OF PHOTOGRAPHIC VANTAGE POINTS
FIGURE 3

FIGURE 4

FIGURE 5

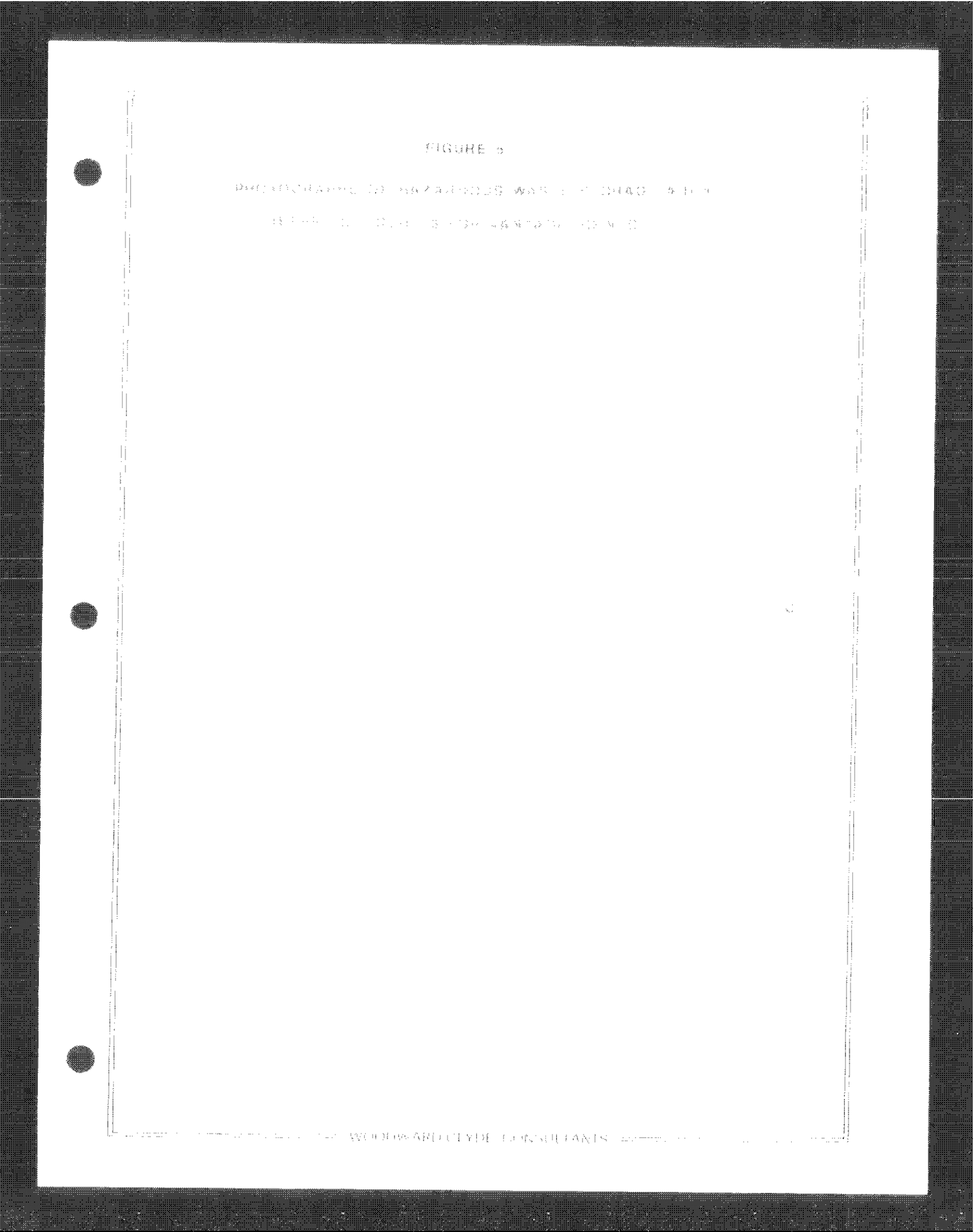


FIGURE 6

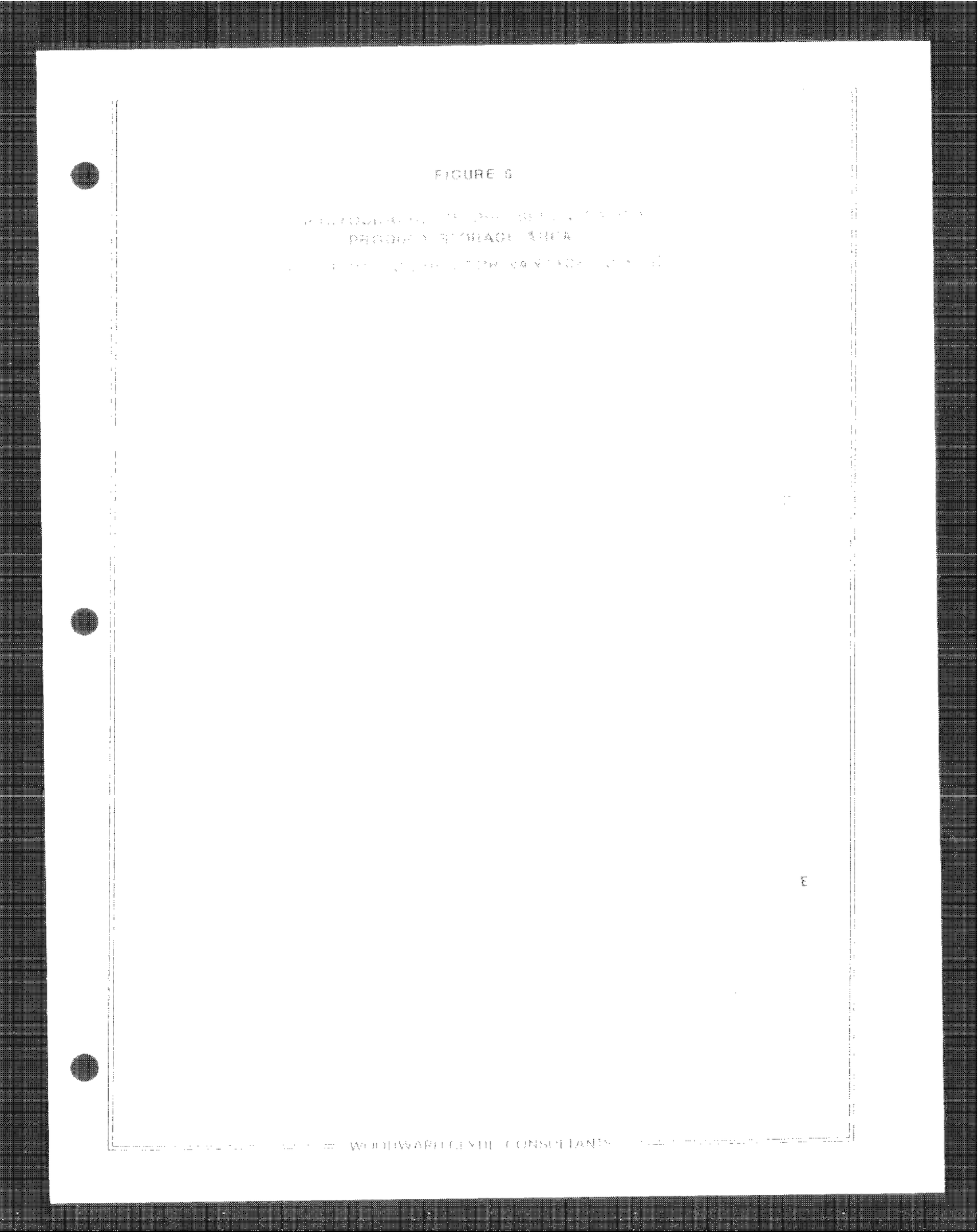


FIGURE 7

Woodward-Clyde Consultants

CHAIN - OF - CUSTODY RECORD

SAMPLE NO.	MATRIX	YR:___ DATE MM/DD	TIME	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	STATION LOCATION	TOTAL NO. CONTAINERS					

SAMPLE COLLECTION:

PROJECT NO. AND NAME _____

LOCATION OF SAMPLE: _____

TEAM LEADER: _____ TELEPHONE: (___) _____

COMPANY NAME: _____

ADDRESS: _____

WITNESS: _____ COMPANY NAME: _____

FIELD INFORMATION:

TYPES OF SAMPLES: LIQUID (LI) FISH (FI) SLUDGE (SL) SOIL (SO)
(MATRIX) WIPE (W) SEDIMENT (SE) OTHER (SPECIFY) _____

FIELD NOTES: _____

TRANSPORTER: _____ AIRBILL/INVOICE: _____ DESTINATION: _____

SAMPLE TRANSFER (Original must be retained with sample at all times)

		RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
1	NAME:				
	COMPANY:				
2	NAME:				
	COMPANY:				
3	NAME:				
	COMPANY:				

TERMINATION OF CHAIN-OF-CUSTODY:

AUTHORIZED BY: _____ DATE: _____ TIME: _____

COMPANY NAME: _____

SAMPLE DISPOSTION: STORAGE _____ DISPOSAL _____ OTHER _____

EXAMPLE OF SAMPLE LOG

SAMPLE I.D. [ ]

PROJECT NUMBER _____

PROJECT NAME _____

EXACT SAMPLING LOCATION _____

FIELD TESTS	MATERIAL SAMPLED		PRESERVATIVE	
OVA	SOLID WASTE	☐	NONE	☐
pH	LIQ. WASTE	☐	ICE	☐
SALINITY	SOIL	☐	H_2SO_4	☐
S. COND.	G. WATER	☐	HNO_3	☐
TEMP	S. WATER	☐	OTHER	☐
OTHER	OTHER	☐		

REMARKS _____

WEATHER _____ TIME _____

SIGNATURE _____ DATE _____

Figure 9

APPENDIX A

CEDAR CHEMICAL DINOSEB TEST METHOD

Dinoseb in Soil - Spectrophotometric Method

A. Sample Preparation

1. Slurry 10 grams of soil in 100 mls of water in a 250 ml beaker.
2. Make alkaline to pH > 10 with NaOH.
3. Place stirring bar in beaker and stir for 15 minutes.
4. Filter slurry through glass fiber filter paper and wash with two successive 50 ml portions of water.
5. Make up to standard volume in volumetric flask.

B. Sample Analysis

1. Prepare a 10 ppm standard solution of Dinoseb from stock solution.
2. Dilute the 10 ppm standard 2:1 and 5:1 in clean volumetric glassware to give three concentrations for preparation of a standard curve.
3. Read the adsorbances of the standards and plot the values to prepare the standard curve.

    a. Set the spectrophotometer at 380 nm wavelength.
    b. Prepare a blank by acidifying a portion of the unknown sample to pH 3 or less to remove color.
    c. Zero and span and instrument to 0 and 100% transmittance with the blank and a light blocker.
    d. After reading the standards and preparing a standard curve, read the unknown sample. If the sample absorbance is too high, dilute a portion to a known volume and read again.
    e. Compare the absorbance of the unknown to the standards to determine the concentration of Dinoseb in extract from the soil sample. Adjust calculations for aliquoting.
    f. From the dry weight of the sample and the amount of Dinoseb in the extract, calculation the concentration in the soil sample.

This method is a suitable screen for the presence and general quantitation of Dinoseb. Interferences from other compounds having similar adsorption curves is possible. More exact determinations should be made using gas-liquid chromatographic techniques.

APPENDIX B

MATERIAL SAFETY DATA SHEETS FOR PRODUCTS

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

For latest data, contact manufacturer.

STREET ADDRESS: 2100 Poplar Avenue

Prepared by: M. S. Bernard

Date: 5/27/86

CITY, STATE, ZIP CODE: Memphis, TN 38137

CHEMICAL NAME, TRADE NAME AND SYNONYMS: Toxaphene technical 90%

FORMULA OF PRIMARY COMPONENTS (STRUCTURAL)

$C_{10}H_{10}Cl_8$ 67-69% chlorine

Section 2 INGREDIENTS

	%	TLV (units)
Active Ingredient: Chlorinated camphene	90.0	
Inert Ingredients: Xylene type solvents	10.0	

Section 3 PHYSICAL DATA

BOILING POINT (°F)	212	SPECIFIC GRAVITY (H_2O = 1)	1.525
VAPOR PRESSURE (mmHg at 20° C)	1	% VOLATILE BY VOLUME	10 @ 100°C
VAPOR DENSITY (air = 1)	N/A	COLOR AND ODOR	brown, chlorine
SOLUBILITY IN WATER	1ppm	PHYSICAL STATE	thick liquid

Section 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) °F: 212°F. TCC

FLAMMABLE LIMITS STP: L.F.L. N/D U.F.L. N/D

EXTINGUISHING MEDIA: WATER FOG [X] FOAM [ ] ALCOHOL FOAM [X] CO_2 [X] DRY CHEMICAL [ ] OTHER

SPECIAL FIRE FIGHTING PROTECTIVE EQUIPMENT: Self-contained air supply

UNUSUAL FIRE AND EXPLOSION HAZARDS: Noxious fumes (hydrogen chloride) produced under fire conditions.

Confine water used in fire fighting from entering water supplies.

Section 5 REACTIVITY DATA

STABILITY: Stable [X]; FIRE CONDITIONS [ ]

CONDITIONS TO AVOID: May burn under extreme heat.

INCOMPATIBILITY (Materials to avoid): [ ] WATER [ ] ACID [ ] BASE [ ] CORROSIVE* [ ] OXIDIZING MATERIAL [ ] OTHER

HAZARDOUS DECOMPOSITION PRODUCTS: fire conditions. Hydrogen chloride and others.

10-20-80

Section 6 HEALTH HAZARD DATA

L INGESTION
High single dose oral toxicity, LD50 male rats 69 mg/kg.

EYE CONTACT
oderate irritation may occur.

CONTACT
May cause moderate irritation.

ABSORPTION
bsorbed through skin, high toxicity. LD50 rats 1075 mg/kg.

ALATION TLV OR SUGGESTED CONTROL FIGURE)
CGIH TLV for toxaphene is 0.5mg/m³

ECTS OF OVEREXPOSURE
ausea, depression, convulsions, and death.

FIRST AID PROCEDURES
yes:Flush with water 30 minutes. Consult physician. Skin:Wash with soap and water 15 minutes.
Ingestion:Toxic by ingestion. Induce vomiting if victim is alert. Clear airway. Control
convulsions. Contact physician immediately.

Section 7 SPILL OR LEAK PROCEDURES

S TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
se proper safety equipment. Absorb spill with absorbent, inert material such as oil-sorb.
ike area for large spills. Keep out of streams and water supplies.

OSAL METHOD
ispose of in non-crop areas away from water supplies or in an approved landfill
n accordance with State, Federal, and local regulations.

Section 8 SPECIAL PROTECTION INFORMATION

VENTILATION	**LOCAL EXHAUST**	**SPECIAL**
	MECHANICAL (General)	**OTHER**
equired	To control TLV of toxaphene	

PIRATORY PROTECTION (Specify Type)
None normally needed with adequate ventilation. During spraying use organic vapor respirator.

PROTECTIVE CLOTHING
Impervious gloves, boots, and apron, and clean body-covering clothing.

PROTECTION
- ☐ NOT NORMALLY NECESSARY
- ☐ SAFETY GLASSES WITHOUT SIDE SHIELDS
- ☐ SAFETY GLASSES WITH SIDE SHIELDS OR
- ☒ CHEMICAL WORKERS GOGGLES
- ☐ GAS TIGHT GOGGLES OR EQUIVALENT
- ☐ OTHER:

OTHER PROTECTIVE EQUIPMENT
Eye wash fountain and wash facilities at work area.

Section 9 SPECIAL PRECAUTIONS OR OTHER COMMENTS

CAUTIONS TO BE TAKEN IN HANDLING AND STORING
Do not get in eyes, on skin or on clothing. Keep out of reach of children.

PRECAUTIONS
Avoid breathing sprey mists or vapors. Keep away from heat or flame.
Extremely toxic to fish, keep out of streams, lakes, and other bodies of water.

10-26-90 14:01

VERTAC CHEMICAL CORPORATION

MATERIAL SAFETY DATA SHEET

Section 1 NAME & PRODUCT

MANUFACTURER'S NAME
ac Chemical Corporation

ADDRESS
Poplar Avenue

CITY, STATE, ZIP CODE
is, TN 38137

IN CASE OF EMERGENCY TELEPHONE
For most info, contact manufacturer.
1-800-424-9300

Prepared by: M. S. Bernard
Date: 10/17/84

CHEMICAL NAME, TRADE NAME AND SYNONYMS
rtac MSMA 800, 6#/gal Monosodium Acid Methanearsonate, MSMA

FORMULA OF PRIMARY COMPONENTS (STRUCTURAL)

Section 2 INGREDIENTS

INGREDIENTS	%	TLV (units)
dium Acid Methane Arsonate	58.5	
Ingredients	41.5	

Section 3 PHYSICAL DATA

ING POINT (°F)		% SPECIFIC GRAVITY (H_2O = 1)	1.648
OR PRESSURE (mmHg at 20° C)	Low	% VOLATILE BY VOLUME	40.7
VAPOR DENSITY (air = 1)	N/A	% COLOR AND ODOR	Very light yellow
SOLUBILITY IN WATER	Miscible	% PHYSICAL STATE	Clear Liquid

Section 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED)
Aqueous Solution - No Flash

% FLAMMABLE LIMITS STP
L.F.L. U.F.L.

EXTINGUISHING MEDIA: WATER [X] FOG [X] FOAM [X] ALCOHOL FOAM [X] CO_2 [X] DRY CHEMICAL [X] OTHER

SPECIAL FIRE FIGHTING PROTECTIVE EQUIPMENT
-contained breathing apparatus, chemical gloves and boots

UNUSUAL FIRE AND EXPLOSION HAZARDS
r EXTREME conditions such as strong acidic enviroment and strong heat, arsine gas poisonous gas) may be produced.

Section 5 REACTIVITY DATA

STABILITY

CONDITIONS TO AVOID
Extreme heat and strong acid

FIRE CONDITIONS

INCOMPATIBILITY [ ] WATER [ ] ACID [ ] BASE [ ] CORROSIVE* [ ] OXIDIZING MATERIAL

Section 6 HEALTH HAZARD DATA

GESTION Acute Oral LD50 Rats 1359mg/kg

ACT Mild Irritant.

ACT Mild to none irritation, depending on individual's sensitivity.

SORPTION Not absorbed

NTITY OR SUGGESTED CONTROL FIGURE)

Not normally a problem

S OF OVEREXPOSURE Subacute: salty taste, burning in throat, colicky stomach pains. headache, vomiting, diarrhea, stupor, convulsions

PROCEDURES Eyes: flush with water. Consult physician if irritation persists. Wash with soap and water. Oral Ingestion: empty stomach by vomiting or lavage. Lavage with 3 liters isotonic saline. BAL (Dimercaprol) is antidotal; ...er in 3mg/kg body weight every 4 hours.

Section 7 SPILL OR LEAK PROCEDURES

TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Spill and transfer to suitable container. Absorb remaining free liquid with ...ent.

METHOD

local pollution control authorities or EPA office.

Section 8 SPECIAL PROTECTION INFORMATION

...ATION		
	LOCAL EXHAUST Not normally required	SPECIAL
	MECHANICAL (General)	OTHER

...RY PROTECTION (Specify Type) ...ally required

...IVE CLOTHING ...loves, boots, chemical goggles

...CTION ...NORMALLY ...ESSARY: ☐ SAFETY GLASSES WITHOUT SIDE SHIELDS ☒ SAFETY GLASSES WITH SIDE SHIELDS OR ☐ CHEMICAL WORKERS GOGGLES

...TIGHT GOGGLES EQUIVALENT ☐ OTHER:

...TECTIVE EQUIPMENT required

Section 9 SPECIAL PRECAUTIONS OR OTHER COMMENTS

...NS TO BE TAKEN IN HANDLING AND STORING ...dard procedures for chemical handling

...CAUTIONS ...ay from foods, feeds, seeds, fertilizers, insecticides, and fungicides.

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

DATE: 08/15/86 PAGE 1

CODE NAME: TECHNICAL DINOSEB
EPA REG. NO.: 56077-3

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137

Emergency Phone Number: 1-800-424-9300
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 Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	95.00
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, CO_2, 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. LD_{50} 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. LD_{50} 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. [illegible] OR IMPLIED, IS MADE.

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

DATE: 4/20/89 PAGE 1

PRODUCT NAME: POTATO TOP KILLER 300

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137, USA

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
Dinoseb (2-sec-butyl-4,6-dinitrophenol)	n/d	0.3mg/m³	30.2
CAS # 88-85-78	200ppm	100ppm	
Toluene			
CAS # 108-88-3			

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	above 212	Specific Gravity	approx 0.900	Vapor Density(Air=1)	n/d
Vapor Pressure(mmHg.)	below 20	Evaporation Rate	n/d	Melting point	n/a
Solubility in Water:	Emulsifiable				
Appearance and Odor	Brown liquid. Organic acid odor.				

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 84°F TCC
Flammable Limits: LEL= n/d UEL= n/d
Extinguishing Media: Water Fog, Foam, CO_2, and Dry Chemical
Special Fire Fighting Procedures: Self contained air supply recommended. Confine water used in fire fighting.
Unusual Fire and Explosion Hazards: Noxious fumes (Oxides of Nitrogen) may form. Vapors may ignite. Dinoseb undergoes rapid exothermic decomposition at 190°C.

SECTION V REACTIVITY DATA

Stability: Stable in normal use and storage.
Conditions to Avoid: Heating above 100°C. Avoid ignition sources. Product undergoes rapid exothermic decomposition at 190°C.
Incompatibility: Strong Acids and Strong Oxidizers.
Hazardous Decomposition By-products: 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
[illegible]: Readily Absorbed

Continued on page 2.

Health Hazards(Acute and Chronic): Oral Ingestion: High single dose toxicity.
Acute Oral LD_{50} (rats) 98 mg/kg for Dinoseb.

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.
Stains skin yellow.

Skin Absorption: Readily absorbed through skin. Highly toxic.
Dermal LD_{50} (guinea pigs) 100-200 mg/kg for Dinoseb.

Inhalation: May be irritating. Control vapor or dust levels to recommended levels for Dinoseb and Toluene.

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

Signs and symptoms of Exposure: Yellow stained skin. Increased body temperature and metabolic rate. fatigue, sweating, and thirst.

Medical Conditions Generally Aggravated by Exposure: None known.

Emergency and First Aid Procedures:

Oral Ingestion: Toxic by ingestion. Induce vomiting then give 2 teaspoons of baking soda in water and seek medical help immediately.

Eye Contact: Flush immediately with continuous irrigation of water for at least 30 min. Seek medical consultation immediately. Stain for evidence of corneal injury. Treat if injuried by instilling antibotic steriod preparation frequently.

Skin Contact: Promptly wash skin with plenty of soap and water for a least 15 min. while removing contaminated clothing. Consult physician. Wash clothing before reuse.

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

NOTE TO PHYSICIAN: No known antidote. Treat symptomatically. Keep patient quient in cool place. If feverish, cool with cold compresses or by immersion in cool water.

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps To Be Taken In Case Material Is Released or Spilled:
Use proper safety equipment. Sweep-up material with the aid of an inert absorbant material such as oil-dry. Keep out of streams and water supplies. Contact Chemtrec for assistance.

Waste Disposal Method:
Incineration is recommended. Check with regulatory authorities for landfill disposal regulations.

Precautions To Be Taken in Handling and Storage:
Do not get on skin, on clothing, or in eyes. Keep out of reach of children.

Other Precautions:
Avoid breathing vapors. Keep away from flame.

SECTION VIII CONTROL MEASURES

Respiratory Protection: None normally needed. During use and handling use dust mask or respirator as conditions warrant.

Ventilation: Recommended to control TLV of Dinoseb and Toluene.

Protective Gloves: Impervious rubber gloves.

Eye Protection: Chemical worker's goggles or full face shield.

Other Protective Clothing or [illegible] body-covering clothing

THE INFORMATION HEREIN IS [illegible] NO WARRANTY, EXPLICIT OR IMPLIED.

Chemical Name
Common Name
Manufacturer

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

PRODUCT NAME: PREMERGE 3 DATE: 08/15/86 PAGE 1
EPA REG. NO.: 56077-13

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137
Emergency Phone Number: 1-800-424-9300
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 Alkanolamine Salts	n/d	0.3mg/m³	50.70
Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	200ppm	200ppm	15.00
Methanol CAS # 67-56-1			

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	above 212	Specific Gravity	1.130
Vapor Pressure(mm Hg.)	50	Melting Point(°F)	n/a
Vapor Density(Air=1)	n/a	Evaporation Rate	n/d

Solubility in Water: Infinite
Appearance and Odor: Brown liquid. sweet alcohol odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 85°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog. Foam. Alcohol Foam. CO_2. 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 Avoid ignition sources.
Incompatibility: Strong Acids 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: Moderate Single Dose Oral Toxicity. LD_{50} Male Rats 170 mg/kg, Female Rats 130 mg/kg. May be fatal if swallowed. May cause blindness.
Eye Contact: May cause severe irritation and corneal injury, possible permanent impairment of vision.
Skin Contact: May cause slight irritation, colors skin yellow.
Skin Absorption: Readily absorbed through skin, high toxicity.
Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m³. ACGIH TLV for methanol is 200ppm.

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

Signs and Symptoms of Exposure:
Fatigue, sweating, thirst, and fever (due to Dinoseb) plus optic nerve injury and blindness, CNS depression, drunkenness, nausea, anesthesia, and vomiting (due to methanol).

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 impairment of vision.
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 TLV of methanol.

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.

Chemical Name

Common Name

Manufacturer

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

DATE: 08/15/86 PAGE 1

PRODUCT NAME: PREMERGE PLUS
EPA REG. NO.: 56077-16

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137

Emergency Phone Number: 1-800-424-9300
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 Sodium Salt Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	11.50
Naptalam Sodium Salt Naptalam (N-1-naphthylphthalamic acid) CAS # 132-66-1	n/d	n/d	22.30

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	188	Specific Gravity	1.150
Vapor Pressure(mm Hg.)	12	Melting Point(°F)	n/a
Vapor Density(Air=1)	n/a	Evaporation Rate	0.24

Solubility in Water: Infinite
Appearance and Odor: Brown liquid, sweet odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): above 212°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO_2, 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. Dinoseb 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. Dinoseb undergoes rapid exothermic decomposition at 190°C. Avoid ignition sources.
Incompatibility: Strong Acids 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: Absorbed
Ingestion: Moderate Toxicity

Health Hazards (Acute and Chronic):
Oral Ingestion: Moderate Single Dose Oral Toxicity. LD_{50} Male Rats 232 mg/kg. May be fatal if swallowed.
Eye Contact: May cause moderate irritation and non-permanent corneal injury.
Skin Contact: May cause slight irritation. stains skin yellow.
Skin Absorption: Readily absorbed through skin. moderate toxicity. LD_{50} Rabbits above 400mg/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:
Yellow staining of skin. profuse sweating. thirst. fever. excessive fatigue. and hypothermia.

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.
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 vapor levels to guidelines.

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.

Chemical Name

Common Name

Manufacturer

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

PRODUCT NAME: SELECTIVE WEED KILLER DATE: 08/15/86 PAGE 1
EPA REG. NO.: 56077-11

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137
Emergency Phone Number: 1-800-424-9300
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 Ammonium Salt Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	13.70
Isopropanol CAS # 67-56-1	400ppm	400ppm	

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	175	Specific Gravity	0.860
Vapor Pressure(mm Hg.)	35	Melting Point(°F)	n/a
Vapor Density(Air=1)	n/a	Evaporation Rate	n/d

Solubility in Water: Infinite
Appearance and Odor: Brown liquid, alcohol odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 66°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO_2, 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 Acids 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: Moderate Toxicity

Health Hazards (Acute and Chronic):
Oral Ingestion: Moderate Single Dose Oral Toxicity. LD_{50} Male Rats 205 mg/kg, Female Rats 178 mg/kg. May be fatal if swallowed.
Eye Contact: May cause moderate irritation and corneal injury.
Skin Contact: May cause slight irritation, colors skin yellow.
Skin Absorption: Readily absorbed through skin, moderate toxicity. LD_{50} Rabbits 212mg/kg.
Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m³. ACGIH TLV for isopropanol is 400ppm.

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

Signs and Symptoms of Exposure:
Yellow staining of skin, profuse sweating, thirst, fever, excessive fatigue, and hypothermia.

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.
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 vapor levels to guidelines.
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.

CIBA–GEIGY

MATERIAL SAFETY DATA SHEET

CIBA–GEIGY Corporation
Agricultural Division
Post Office Box 18300
Greensboro, NC 27419

(A) (52)

In Case of Emergency, Call
CIBA–GEIGY: 1-800-888-8372
1-800-334-9481
CHEMTREC: 1-800-424-9300

I. MATERIAL IDENTIFICATION

Product Name: Atrazine Technical **CAS #:** 1912-24-9

Active Ingredient (%): 97.0
Chemical Name: 2-chloro-4-ethylamino-6-isopropylamino-s-triazine
Chemical Class: Triazine Herbicide
EPA Signal Word: Caution

II. REGULATORY INFORMATION

SARA Title III Classification
Acute and Chronic Health Hazard

Proposition 65 (CA Only)
Not Determined

Reportable Quantity (RQ)
None

RCRA Classification
Not Applicable

DOT Classification
No Label or Placard Required

B/L Freight Classification
Compound, Weed Killing (Herbicide), N.O.S.

NFPA Hazard Ratings	
Health	1
Flammability	1
Reactivity	0

0 Least
1 Slight
2 Moderate
3 High
4 Severe

III. HAZARDOUS INGREDIENTS

Material	OSHA PEL	ACGIH TLV	NTP/IARC/OSHA Carcinogen
Atrazine	5 mg/m³	5 mg/m³	
Cyanazine	--	--	

IV. FIRST AID PROCEDURES

If poisoning is suspected, immediately contact a physician, the nearest hospital, or the nearest Poison Control Center. Tell the person contacted the complete product name, and the type and amount of exposure. Describe any symptoms and follow the advice given.

Ingestion: If victim is fully conscious, give 1 or 2 glasses of water to drink and induce vomiting. Never give anything by mouth to an unconscious person.

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Eye Contact: Immediately rinse eyes with a large amount of running water. Hold eyelids apart to rinse the entire surface of the eye and lids. Do not apply any medicating agents except on the advice of a physician.

Skin Contact: Wash with plenty of soap and water, including hair and under fingernails. Do not apply any medicating agents except on the advice of a physician. Remove contaminated clothing and wash before reuse.

Inhalation: Move victim from contaminated area to fresh air. Apply artificial respiration if necessary.

Notes to Physician
There is no specific antidote if atrazine is ingested. Induce emesis or lavage stomach. If a small amount has been ingested, administration of activated charcoal in water can be considered.

Based on the acute oral LD_{50} in rats, ingestion of 1/4 pound may be fatal to an adult human.

Medical Conditions Likely to be Aggravated by Exposure
Persons with allergy history or pre-existing dermatitis should use extra precautions in handling atrazine.

V. HEALTH HAZARD INFORMATION

Symptoms of Acute Exposure
Slight, temporary, eye or skin irritation may occur. Repeated skin contact may cause a sensitization (allergic) reaction in sensitive individuals.

Acute Toxicity/Irritation Studies

Ingestion: slightly toxic
Oral LD_{50} (Rat) = 1,869 mg/kg body weight

Dermal Absorption: slightly toxic
Dermal LD_{50} (Rat) = >3,100 mg/kg body weight

Inhalation: moderately toxic
Inhalation LC_{50} (Rat) = >0.71* mg/l air - 1 hour; 1.3* mg/l air - 4 hours (90% atrazine formulation)

*Highest attainable concentrations; no animal deaths or symptoms occurred.

Eye Contact: slightly irritating (Rabbit)

Skin Contact: slightly irritating (Rabbit)

Skin Sensitization: sensitizer (Guinea Pig)

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Chronic Toxicity Studies
Long-term exposure to low levels of atrazine is not known to cause any chronic ill effects in humans.

An elevated incidence of mammary tumors was observed in female Sprague-Dawley rats during a long-term feeding study with Atrazine Technical. This response did not occur in male rats or mice and is considered to be sex- and strain-specific. In other long-term feeding studies, very high doses of atrazine caused signs of cardiotoxicity in dogs and mice. Atrazine caused no adverse reproductive effects over two generations of rats and was not teratogenic in rats or rabbits. Atrazine has been reported to cause mutagenic effects in barley seeds and corn plants, however those findings have been successfully refuted, and data from studies documented as reliable in determining mutagenic potential indicate that atrazine is not a mutagen.

A metabolite of atrazine, 2,3-diamino-6-chloro-s-triazine (DACT), has caused signs of cardiotoxicity in dogs at high doses.

Toxicity of Other Components
Atrazine Technical may contain a very small amount (1.0% or less) of cyanazine as a process-related impurity. Cyanazine has been determined to cause birth defects (teratogenicity) in rats and rabbits at high dose levels.

VI. PERSONAL PROTECTION AND PRECAUTIONS

Ingestion:	Store the material in a well-ventilated, secure area out of the reach of children and domestic animals. Do not store food, beverages, or tobacco products in the storage area. Prevent eating, drinking, tobacco usage, and cosmetic application in areas where there is a potential for exposure to the material. Always wash thoroughly after handling.
Eye Contact:	To avoid eye contact, wear chemical safety glasses or goggles.
Skin Contact:	To avoid skin contact, wear rubber gloves, impervious boots, long-sleeved shirt, long pants, and hat.
Inhalation:	To avoid breathing dust, wear a dust mask.

VII. PHYSICAL HAZARD INFORMATION

Fire and Explosion

Flash Point (Test Method):	>200°C (Pensky-Martens CC)
Flammable Limits (% in Air):	Not Applicable
Autoignition Temperature:	480°C

Reactivity

Stability:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid:	None Known
Hazardous Decomposition Products:	May Include Carbon Monoxide, Hydrogen Cyanide, Acetonitrile

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Physical Properties

Appearance:	White Powder
Odor:	Odorless
Melting Point:	175-177°C
Solubility in H_2O:	33 ppm @ 22°C
Boiling Point:	Not Applicable
Specific Gravity:	1.19 @ 25°C
Vapor Pressure:	6.6×10^{-7} mm Hg @ 25°C
pH:	Not Available
Evaporation Rate:	Not Applicable

Unusual Fire, Explosion and Reactivity Hazards
Presents a possible dust explosion hazard.

VIII. ENVIRONMENTAL PROTECTION

In Case of Spill or Leak
Wear chemical safety glasses or goggles, rubber gloves, impervious boots, long-sleeved shirt, long pants, hat, and dust mask. For small spills, sweep up as much material as possible, keeping dust to a minimum, and place in an approved chemical waste container. Wash the spill area with water containing a strong detergent, absorb with pet litter or other absorbent material, sweep up and place in a chemical waste container. Seal container and dispose of in an approved manner. Rinse the spill area with water to remove any residue. Do not allow wash or rinse water to contaminate water supplies.

In Case of Fire
Use dry chemical, foam, or CO_2 extinguishing media. Wear full protective clothing and self-contained breathing apparatus. Evacuate nonessential personnel from the area to prevent human exposure to fire, smoke, fumes, or products of combustion. Prevent use of contaminated buildings, area, and equipment until decontaminated.

Disposal
Do not reuse product containers. Dispose of product containers, waste containers, and residues according to local, state, and federal health and environmental regulations.

Questions concerning the safe handling of Atrazine Technical should be referred to:

CIBA-GEIGY Corporation
Environmental Safety & Compliance
(919) 292-7100

Issued Date: 11/25/85
Revised Date: 2/06/89 Supercedes: 3/09/88

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein.

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APPENDIX C

PUBLISHED EPA HEALTH BASED ACTION LEVELS, IRIS PRINTOUT AND HEAST TABLE ON ATRAZINE AND OSWER DIRECTIVE 9355.0-30

Table 8-7. (continued)[1]

Constituent	CAS No.	RfD[2] (mg/kg/day)	Soil (mg/kg)	Water (ug/l)	Air (ug/m³)
Dichlorodifluoro-methane	75-71-8	2E-01	2E+04	7E+03	–
1,1-Dichloroethylene	75-35-4	9E-03	7E+02	See MCL	–
Dichloromethane (Methylene chloride)	75-09-2	6E-02	9E+03	2E+03	–
2,6-Dichlorophenol	120-83-2	3E-03	2E+02	1E+02	1E+01
1,3-Dichloropropene	26952-23-8	3E-04	2E+01	1E+01	–
Dieldrin	60-57-1	5E-05	4E+00	2E+00	–
Diethyl phthalate	84-66-2	8E-01	6E+04	3E+04	–
Dimethoate	60-51-5	2E-02	2E+03	7E+02	–
2,4-Dinitrophenol	51-28-5	2E-03	2E+02	7E+01	7E+00
Dinoseb	88-85-7	1E-03	8E+01	4E+01	–
Diphenylamine	127-39-4	3E-02	2E+03	1E+03	–
Disulfoton	298-04-4	4E-05	3E+00	1E+00	–
Endosulfan	115-29-7	5E-05	4E+00	2E+00	2E-01
Endothal	145-73-3	2E-02	2E+03	7E+02	–
Engrin	72-20-8	3E-04	2E+01	See MCL	1E+00
Ethylbenzene	100-41-4	1E-01	8E+03	4E+03	–
Heptachlor	76-44-8	5E-04	4E+01	2E+01	–
Heptachlor epoxide	1024-57-8	1E-05	8E-01	4E-01	–
Hexachlorobuta-diene	87-68-3	2E-03	2E+02	7E+01	–
Hexachlorocyclo-pentadiene	77-47-4	7E-03	6E+02	2E+02	–
Hexachloroethane	67-72-1	1E-03	8E+01	4E+01	–
Hydrogen cyanide	74-90-8	2E-02	2E+03	7E+02	–
Hydrogen sulfide	7783-06-4	3E-03	2E+02	1E+02	–
Isobutyl alcohol	78-83-1	3E-01	2E+04	1E+04	1E+03
Isophorone	78-59-1	2E-01	2E+04	7E+03	–
Lindane (hexa-chlorocyclohexane)	58-89-9	3E-04	2E+01	See MCL	–
Maleic hydrazide	108-31-6	5E-01	4E+04	2E+04	–
Methacrylonitrile	126-98-7	1E-04	8E+00	4E+00	–
Methomyl	16752-77-5	3E-02	2E+03	1E+03	–
Methyl ethyl ketone	78-93-3	5E-02	4E+03	2E+03	–
Methylisobutyl-ketone	108-10-01	5E-02	4E+03	2E+03	–

Note: These criteria are subject to change and will be confirmed by the regulatory agency prior to use.

APPENDIX C—RANGE OF CONCENTRATIONS FOR ESTABLISHING MEDIA PROTECTION STANDARDS FOR CARCINOGENS—Continued

Constituent name	Class	MaxAir (ug/m 3)	MinAir (ug/m 3)	Max-Water (mg/L)	MinWater (mg/L)	MaxSoil (mg/kg)	MinSoil (mg/kg)
Styrene	C						
1,1,1,2-Tetrachloroethane	C	1E+01	1E-01	1E-01	3E+03	3E+03	3E+01
1,2,4,5-Tetrachlorobenzene	D						
1,1,2,2-Tetrachloroethane	C	1E+01	1E-01	1E-01	1E-03	3E+03	3E+01
1,1,2,2-Tetrachloroethane	C	2E-00	2E-02	2E-02	2E-04	4E+02	4E-00
Tetrachloroethylene	B2	1E+02	1E-00	7E-02	7E-04	1E+03	1E+01
2,3,4,6-Tetrachlorophenol	D						
Tetraethyl lead	D						
Tetraethyldithiopyrophosphate	D						
Thallic oxide	D						
Thallium acetate	D						
Thallium carbonate	D						
Thallium chloride	D						
Thallium nitrate	D						
Thallium sulfate	D						
Thiosemicarbazide	D						
Thiram	D						
Toluene	D						
Toxaphene	B2	3E-01	3E-03	3E-03	3E-05	6E+01	6E-01
1,2,4-Trichlorobenzene	D						
1,1,1,Trichloroethane	D						
1,1,2-Trichloroethane	C	6E-00	6E-02	6E-02	6E-04	1E+03	1E+01
Trichloroethylene	B2			3E-01	3E-03	6E+03	6E+01
Trichloromonofluoromethane	D						
2,4,5-Trichlorophenol	D						
2,4,6-Trichlorophenol	B2	2E+01	2E-01	2E-01	2E-03	4E+03	4E+01
2,4,5-Trichlorophenoxyacetic acid	D						
1,2,3-Trichloropropane	D						
Vanadium pentoxide	D						
Xylenes	D						
Zinc cyanide	D						
Zinc phosphide	D						

Appendix D: Recommended Exposure Assumptions for Use in Deriving Action Levels

(Sections 264.521 (a)(2); (b); (c)(3); and (d))

1. In deriving action levels for hazardous constituents in ground-water, assume a water intake of 2 liters/day for 70 kg adult/70 year lifetime exposure period.

2. In deriving action levels for hazardous constituents in air, assume air intake of 20 cubic meters/day for 70 kg adult/70 year lifetime exposure period.

3. In deriving action levels for hazardous constituents in soil, which are known or suspected to be carcinogens, assume soil intake of 0.1 gram/day for 70 kg adult/70 year lifetime exposure period.

4. In deriving action levels for hazardous constituents in soil, other than those which are known or suspected to be carcinogens, assume soil intake of 0.2 gram/day for 16 kg child/5 year exposure period (age 1–6).*

5. In deriving action levels for hazardous constituents in surface water designated by the State for use as a drinking water source, assume a water intake of 2 liters/day for 70 kg adult/70 year lifetime exposure period, unless intake of aquatic organisms is also of concern.

*Not to be averaged over a 70-year lifetime.

Appendix E: Examples of Calculations of Action Levels

I. Governing Equations for Calculating Action Levels

A. *Systemic Toxicants*

$C_m = [RfD * W]/[I * A]$

where:

C_m = action level in medium (units are medium-dependent);
RfD = reference dose (mg/kg/day);
W = body weight (kg);
I = intake assumption (units are medium-dependent); and
A = absorption factor [1] (dimensionless).

B. *Carcinogenic Constituents*

$C_m = [R * W * LT]/[CSF * I * A * ED]$

where:

C_m = action level in medium (units are medium-dependent);
R = assumed risk level (dimensionless) (10^{-6} for class A & B; 10^{-5} for class C carcinogens);
W = body weight (kg);
LT = assumed lifetime (years);
CSF = carcinogenic slope factor (mg/kg/day)$^{-1}$;
I = intake assumption (units are medium-dependent);
A = absorption factor (dimensionless); and
ED = exposure duration (years).

[1] Assumed to be 1 for this appendix, based upon the assumption that the human absorption rate will be the same as the rate in the study upon which the RfD or CPF was developed.

II. Example Calculations for Hazardous Constituents in Air

A. *Systemic Toxicants*

Example calculation for 2,4-dinitrophenol:

$C_m = [0.002\ (mg/kg/d) * 1000\ (\mu g/mg) * 70(kg)]/[20\ (m^3/d) * 1] = 7.0\ \mu g/m^3$

where:

C_m = action level in air ($\mu g/m^3$)
RfD = 0.002 mg/kg/day
W = 70 kg adult
I = 20 m^3/day
A = 1

B. *Carcinogenic Constituents*

Example calculation for 1,1,2,2-tetrachloroethane:

$C_m = [10^{-5} * 1000\ (\mu g/mg) * 70\ (yrs) * 70\ (kg)]/[0.20\ (mg/kg/day)^{-1} * 20\ (m^3/day) * 1 * 70\ (yrs)] = .175\ \mu g/m$

where:

C_m = action level in air ($\mu g/m^3$)
R = 10^{-5} (1,1,2,2-Tetrachloroethane is a Class C carcinogen)
W = 70 kg adult
LT = 70 year lifetime
CSF = 0.20 (mg/kg/day)$^{-1}$
I = 20 m^3/day
A = 1
ED = 70 year exposure duration

III. Sample Calculation for Hazardous Constituents in Water

A. *Systemic Toxicants*

Sample calculation for toluene:

$C_m = [0.30\ (mg/kg/day) * 70\ (kg)]/[2\ (L/day) * 1] = 10.5\ mg/L$

where:

C_m = action level in water (mg/L)

develop and conduct these further Regulatory Impact Analyses.

The new analyses will be conducted in accordance with the existing Agency guidance on Regulatory Impact Analysis and the draft Regulatory Impact Analysis Guidance published in the 1988 Regulatory Program of the United States. The analyses will explicitly examine the costs, health and environmental benefits, and technological limitations for the key regulatory requirements contained in the proposal—especially for the several alternative approaches to ground water remediation outlined in the proposed rule. This analysis will also estimate the aggregate impacts, identified above, for sites eligible for remediation under this rule and for those sites which are listed on the NPL, and will, therefore, look to this rule as an ARAR, under the provisions of CERCLA. Upon completion of the revised analyses, EPA will solicit comment on the results of the analyses and the methodology used to derive them. The Agency will then assess these comments, along with comments which will have been received previously on the proposed rule. Through these actions EPA will ensure that the net social benefits (including environmental and health benefits) of the rule proposed today are maximized, taking into account costs, technological limitations, risks, and realistic assessments of both actual and reasonably expected uses of each site. If the revised RIA, together with the comments received, demonstrate that the rule proposed today does not achieve this outcome, the Agency will make appropriate modifications to the final rule, or if necessary, will repropose the rule.

B. Regulatory Flexibility Act

The Regulatory Flexibility Act requires Federal agencies to fully analyze the economic effects of regulations on small entities. The Agency analyzed the economic impacts for the regulatory options that are most similar to today's proposed rule (*i.e.*, "Immediate Cleanup to Health-Based Standards" and "Flexible Cleanup to Health-Based Standards").

The RIA assumes that a small business is significantly impacted if its excess of cash flow over ten percent of its total liabilities is insufficient to meet corrective action costs, or if its net income is insufficient to meet its corrective action costs.

For the alternative analyzed, it was found that small firms encounter more severe impacts from the corrective action requirements than large firms. The options most similar to the proposed rule result in incremental impacts (*i.e.*, relative to the baseline) on approximately 9 to 11 percent of small businesses owning RCRA facilities.

Based on the Agency's guidelines for implementing the Regulatory Feasibility Act, the results of the analysis as summarized above, suggest that the proposed rule does not impose significant impacts on small entities.

C. Paperwork Reduction Act

The information collection requirements in this proposed rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* Reporting and recordkeeping burden on the public for this collection is estimated at 42,497 hours for the 674 respondents, with an average of 1.151 hours per response. (Burden estimates should include all aspects of the collection effort and may include time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, completing and reviewing the collection of information, *etc.*)

If you wish to submit comments regarding any aspect of the collection of information, including suggestions for reducing the burden, or if you would like a copy of the information collection request (please reference ICR #1451), contact Rick Westlund, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460 (202-382-2745); and Tim Hunt, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

List of Subjects in 40 CFR Parts 264, 265, 270, and 271

Administrative practice and procedure, Corrective action, Hazardous waste; Insurance, Reporting and recordkeeping requirements.

Dated: July 5, 1990.

William Reilly,

Administrator.

XI. Supplementary Documents

APPENDIX A.—EXAMPLES OF CONCENTRATIONS MEETING CRITERIA FOR ACTION LEVELS

[Section 264.521(a)(2)(i-iv)]

Constituent name	Class	Air(ug/m^3)	Water (mg/L)	Soils (mg/kg)
	D		4E-00	6E+03
Acetone	D		2E-01	5E+02
Acetonitrile	D	2E-01	4E-00	6E+03
Acetophenone	B2	8E-04	8E-06	2E-01
Acrylamide	B1	1E-02	6E-05	1E-00
Acrylonitrile	D		5E-02	1E+02
Aldicarb	B2	2E-04	2E-06	4E-02
Aldrin	D		2E-01	4E+02
Allyl alcohol	D		1E-02	3E+01
Aluminum phosphide	B2		6E-03	1E+02
Aniline	D		1E-02	3E+01
Antimony	A	7E-05	(1)	8E+01
Arsenic	A	2E-02		
Asbestos (2)	D		2E-00	6E+03
Barium cyanide	D	4E-01	(1)	4E+03
Barium, ionic	A	2E-05	2E-07	3E-03
Benzidine	B2	4E-04	8E-06	2E-01
Beryllium	B2		2E-03	5E+01
Bis(2-ethylhexyl)phthalate	B2	3E-03	3E-05	6E-01
Bis(chloromethyl)ether	B2		3E-06	5E-01
Bromochloromethane (3)	D		7E-01	2E+03
Bromoform (3)	D	3E+01	5E-02	1E+02
Bromomethane	C		7E-00	2E+04
Butyl benzyl phthalate				

HEALTH EFFECTS ASSESSMENTS SUMMARY TABLE B: CARCINOGENICITY
Update: December, 1990

Compound	Exposure: Inhalation; Oral	Species: Inhalation	Species: Oral	Tumor Site: Inhalation	Tumor Site: Oral	EPA Group/Unit Risk [Slope Factor]: Inhalation ($\mu g/m^3)^{-1}$ [$(mg/kg/day)^{-1}$]	EPA Group/Unit Risk [Slope Factor]: Oral $(\mu g/\ell)^{-1}$ [$(mg/kg/day)^{-1}$]	Reference: Inhalation/Oral
Aniline	NA; 2-year dietary	NA	rat	NA	spleen	B2/ND	B2/1.4E-7 [5.7E-3][a]	U.S. EPA, 1990/ CIIT, 1982; U.S. EPA, 1985, 1990
Aramite	NA; 400 ppm in diet for 104 weeks (20 mg/kg/day)	NA	rat	increased incidence of liver tumors (also see Table A)	increased incidence of liver tumors	B2/7.1E-5 [2.5E-2][a]	B2/7.1E-6 [2.5E-2]	Popper et al., 1950; Oser and Oser, 1962; U.S. EPA, 1989/ Popper et al., 1950; Oser and Oser, 1962; U.S. EPA, 1989
Arsenic	100-5000 $\mu g/m^3$ continuous; 0.01-1.0 mg/ℓ in drinking water	human	human	respiratory tract (also see Table A)	skin	A/4.3E-3 [5.0E+1][a,p]	A/NA[k]	Brown and Chu, 1983a,b,c; Lee-Feldstein, 1983; Higgins, 1982; Enterline and Marsh, 1982; U.S. EPA, 1984a,b, 1990/U.S. EPA, 1990
Asbestos	occupational; dietary	human	rat	lung and mesothelioma	large intestine	A/2.3E-1 (fibers/mℓ)$^{-1}$[m]	A/ND	U.S. EPA, 1988, 1990/NTP, 1985; U.S. EPA, 1985, 1990
Atrazine	NA; 2-year dietary	NA	rat	NA	mammary gland adenoma, fibro-adenomas, adeno-carcinomas and carcinosarcomas	C/ND	C/6.3E-8 [2.22E-1][f]	U.S. EPA, 1984/ Ciba-Geigy, 1988, U.S. EPA, 1984
Azobenzene	NA; 2-year dietary	NA	rat	NA	abdominal cavity	B2/3.1E-5 [1.1E-1][a,b]	B2/3.1E-6 [1.1E-1][a]	U.S. EPA, 1986/ NCI, 1979; U.S. EPA, 1988, 1990
Benzene	occupational; occupational	human	human	leukemia	leukemia	A/8.3E-6 [2.9E-2][a]	A/8.3E-7 [2.9E-2][a,b]	Ott et al., 1978; Rinsky et al., 1981; Wong et al., 1983; U.S. EPA, 1985, 1987, 1988, 1990/ Ott et al., 1978; Rinsky et al., 1981; Wong et al., 1983; U.S. EPA, 1985, 1987, 1988, 1990

ATTACHMENTS

- *IRIS Printout - Atrazine*
- **HEAST Table - Atrazine**
- **OSWER Directive 9355.0-30**

1 - IRIS
IRSN - 206
DATE - 910114
UPDT - Complete Update on 01/14/91, 52 fields added/edited/deleted.
STAT - Oral RfD Assessment (RDO) on-line 01/01/91
STAT - Inhalation RfC Assessment (RDI) no data
STAT - Carcinogenicity Assessment (CAR) pending
STAT - Drinking Water Health Advisories (DWHA) no data
STAT - U.S. EPA Regulatory Actions (EXSR) no data
IRH - 03/01/88 RDO Confidence levels revised
IRH - 08/22/88 RDO Withdrawn; new oral RfD in preparation
IRH - 09/07/88 RDO Revised oral RfD summary added
IRH - 10/01/89 REFS Bibliography on-line
IRH - 03/01/90 RDO Withdrawn; new oral RfD in preparation
IRH - 03/01/90 OREF Oral RfD references withdrawn
IRH - 05/01/90 RDO Oral RfD summary replaced; RfD unchanged
IRH - 05/01/90 OREF Oral RfD references replaced
IRH - 01/01/91 RDO Text edited
IRH - 01/01/91 CAR Carcinogen assessment now under review
RLEN - 13131
NAME - Atrazine
RN - 1912-24-9
SY - A 361
SY - AATREX
SY - AATREX 4L
SY - AATREX 80W
SY - AATREX NINE-O
SY - 2-AETHYLAMINO-4-CHLOR-6-ISOPROPYLAMINO-1,3,5-TRIAZIN
SY - 2-AETHYLAMINO-4-ISOPROPYLAMINO-6-CHLOR-1,3,5-TRIAZIN
SY - AKTIKON
SY - AKTIKON PK
SY - AKTINIT A
SY - AKTINIT PK
SY - ARGEZIN
SY - ATAZINAX
SY - ATRANEX
SY - ATRASINE
SY - ATRATOL A
SY - ATRAZIN
SY - Atrazine
SY - ATRED
SY - ATREX
SY - CANDEX
SY - CEKUZINA-T
SY - 2-CHLORO-4-ETHYLAMINEISOPROPYLAMINE-s-TRIAZINE
SY - 1-CHLORO-3-ETHYLAMINO-5-ISOPROPYLAMINO-2,4,6-TRIAZINE
SY - 1-CHLORO-3-ETHYLAMINO-5-ISOPROPYLAMINO-s-TRIAZINE
SY - 2-CHLORO-4-ETHYLAMINO-6-ISOPROPYLAMINO-1,3,5-TRIAZINE
SY - 2-CHLORO-4-ETHYLAMINO-6-ISOPROPYLAMINO-s-TRIAZINE
SY - 6-CHLORO-N-ETHYL-N'-(1-METHYLETHYL)-1,3,5-TRIAZINE-2,4-DIAMINE
SY - 2-CHLORO-4-(2-PROPYLAMINO)-6-ETHYLAMINO-s-TRIAZINE
SY - CRISATRINA
SY - CRISAZINE
SY - CYAZIN
SY - FARMCO ATRAZINE
SY - FENAMIN
SY - FENAMINE
SY - FENATROL
SY - G 30027
SY - GEIGY 30,027
SY - GESAPRIM
SY - GESOPRIM
SY - GRIFFEX
SY - HUNGAZIN
SY - HUNGAZIN PK
SY - INAKOR

SY - OLEOGESAPRIM
SY - PRIMATOL
SY - PRIMATOL A
SY - PRIMAZE
SY - RADAZIN
SY - RADIZINE
SY - STRAZINE
SY - TRIAZINE A 1294
SY - s-TRIAZINE, 2-CHLORO-4-ETHYLAMINO-6-ISOPROPYLAMINO-
SY - 1,3,5-TRIAZINE-2,4-DIAMINE, 6-CHLORO-N-ETHYL-N'-(1-METHYLETHYL)-
SY - VECTAL
SY - VECTAL SC
SY - WEEDEX A
SY - WONUK
SY - ZEAZIN
SY - ZEAZINE

RDO -

o ORAL RFD SUMMARY :

Critical Effect	Experimental Doses*	UF	MF	RfD
Decreased body weights of F2 generation pups on postnatal day 21	NOEL: 10 ppm (0.5 mg/kg/day)	100	1	5E-3 mg/kg/day
2-Generation Rat Reproduction Study	LEL: 50 ppm (2.5 mg/kg/day)			
Ciba-Geigy, 1987a				

*Conversion Factors: 1 ppm = 0.05 mg/kg/day (assumed rat food consumption)

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o ORAL RFD STUDIES :

Ciba-Geigy Corporation. 1987a. MRID No. 40431303.
Available from EPA. Write to FOI, EPA, Washington, DC 20460.

In a 2-generation reproduction study, 120 rats/sex were randomly distributed into 4 treatment groups and fed atrazine at 0, 10, 50, or 500 ppm (0, 0.5, 2.5, and 25 mg/kg/day). Exposure to the test material began when male rats were 47 days old and females were 48 days old. They were maintained on these diets for 10 weeks prior to mating. Males and females were housed together in a 1:1 ratio and allowed 3 weeks for mating. The rats were separated following evidence of mating. One litter was produced in each generation. After weaning, 30 males and 30 females from the first generation were selected to be the second parental generation. The remaining male parental animals were sacrificed on days 133 to 134 of the study. Animals selected for the second generation were exposed to test diets for 12 weeks prior to mating. Mating was conducted in the same manner as for the first generation. Parental males were sacrificed on day 138 of the study and parental females on days 138, 139, and 152 after weaning of their litters.

The NOEL for reproductive toxicity is 10 ppm (0.5 mg/kg/day) based on statistically significantly lower F2 generation pup weights at postnatal day 21 at 50 and 500 ppm (2.5, and 25 mg/kg/day). The NOEL for parental toxicity is 50 ppm (2.5 mg/kg/day) based on statistically signficantly decreased body weights, body weight gain and food consumption for males and females throughout the study at 500 ppm (25 mg/kg/day). In addition, a statistically significant increase in relative testes weights was seen in both generations.

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o ORAL RFD UNCERTAINTY :

UF = 100. An uncertainty factor of 100 was used to account for the inter- and intraspecies differences.

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o ORAL RFD MODIFYING FACTOR :

MF = 1.

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o ORAL RFD COMMENTS :

Data Considered for Establishing the RfD

1) 2-Generation Reproduction - rat: see previous description; core grade minimum (Ciba-Geigy Corp., 1987a)
2) 1-Year Feeding - dog: Dietary levels tested: 0, 15, 150, and 1000 ppm (Male: 0, 0.48, 4.97, and 33.65 mg/kg/day; Female: 0, 0.48, 4.97, and 33.8 mg/kg/day). NOEL=150 ppm (4.97 mg/kg/day); LEL=1000 ppm (43 mg/kg/day) (HDT; based on death, cachexia, ascites, decreased body weight and body weight gain, decreased food consumption; EKG changes [irregular heart beat and increased heart rate, decrease P-II values, atrial premature complexes, atrial fibrillation]; cardiac lesions [dilation of atria, atrial degeneration]); core grade minimum (Ciba-Geigy Corp., 1987b)
3) 2-Year Feeding (oncogenic) - rat: Dietary levels tested: 0, 70, 500, and 1000 ppm (0, 3.5, 25, and 50 mg/kg/day). Administration of atrazine to male and female CD-1 Sprague-Dawley rats resulted in decreased mean body weights for males and females receiving 500 and 1000 ppm. Survival was decreased in high-dose females but increased in high-dose males. Red blood cell parameters (hemoglobin, hematocrit, and red cell count) were decreased in high-dose females only. The serum glucose level was decreased in high-dose females at 3, 6, and 12 months and serum triglyceride levels showed a decreasing trend in high-dose males throughout the study. There were decreases in organ-to-body weight ratios in high-dose animals, which were probably the result of body weight decreases. Hyperplastic changes in high-dose males (mammary gland, bladder, and prostate) and females (myeloid tissue of bone marrow and transitional epithelium of the kidney) were of questionable toxicologic importance. There was an increase in retinal degeneration and in centrilobular necrosis of the liver in high-dose females and an increase in degeneration of the rectus femoris muscle in high-dose males and females when compared to controls. Based on decreased body weight gain, the LEL for males and females is 500 ppm (25 mg/kg/day) and the NOEL is 70 ppm (3.5 mg/kg/day); core grade minimum (Ciba-Geigy Corp., 1986)
4) Developmental toxicity - rat: Dietary levels tested: 0, 10, 70, and 700 mg/kg/day (by gavage). Administration of atrazine technical to Charles River CD rats from days 6 to 15 of gestation resulted in maternal toxicity during and after the treatment period at the high-dose. Signs of toxicity at the high-dose included death (21 of 27 dams), reduced food consumption, reduced weight gain, salivation, ptosis, swollen abdomen, oral/nasal discharge, and bloody vulva. Maternal toxicity was also found at the 70 mg/kg/day dose level. Toxicity signs in this group included reduced food consumption, reduced body weight, and reduced weight gain. No maternal toxicity was observed in the 10 mg/kg/day or control groups. Based on the above effects, the maternal toxicity NOEL is 10 mg/kg/day and the LEL is 70 mg/kg/day. At 70 mg/kg/day, there were statistically significant increases in both fetal and litter incidences for skeletal variations indicating delayed ossification. Variations included: skull not completely ossified, metacarpals not ossified, metacarpals bipartite, and phalanx not ossified. Based on these effects the NOEL and LEL for developmental toxicity are 10 and 70 mg/kg/day, respectively.; core grade minimum (Ciba-Geigy Corp., 1984a)
5) Developmental toxicity - rabbit: Dietary levels tested: 0, 1, 5, 75 mg/kg/day (by gavage). Administration of atrazine technical to New Zealand White rabbits from days 7 to 19 of gestation resulted in maternal toxicity during the treatment period at doses of 5 and 75 mg/kg/day. Does in the 75 mg/kg/day group did not recover from symptoms of this toxicity during the period after dosing. Signs of maternal toxicity in the 5 mg/kg/day dose group were decreased food consumption and decreased body weight. Signs of maternal toxicity in the high-dose group included blood on vulva or in cage, decreased food consumption, abnormal stools, and decreased body weight and body weight gain. No effects were observed at the lowest dose

tested, 1 mg/kg/day. Based on the above effects, the maternal toxicity NOEL is 1 mg/kg/day and the LEL 5 mg/kg/day. An increased number of resorptions in the HDT was statistically significant and was not observed at any other dose level. In the HDT, the weights of both the male and female fetuses were significantly reduced. No compound-related malformations were observed. Skeletal variations, especially delayed ossification of appendicular skeletal elements, were found more frequently in the HDT. Based on the above effects, the developmental toxicity NOEL is 5 mg/kg/day and the LEL 75 mg/kg/day; core grade minimum (Ciba-Geigy Corp., 1984b)

Other Data Reviewed:

1) Chronic Feeding - mouse: Dietary levels tested: 0, 10, 300, 1500, and 3000 ppm (Male: 0, 1.4, 38.4, 194.0, and 385.7 mg/kg/day; Female: 0, 1.6, 47.9, 246.9, and 482.7 mg/kg/day). This study shows that there are dose-related effects of atrazine in CD-1 mice fed diets containing 1500 or 3000 ppm of atrazine. The dose-related effects were the production of cardiac thrombi, decreases of 23.5% and 11.0% in the mean body weight gain at 91 weeks in males and females, respectively, and decreases in erythrocyte count, hematocrit and hemoglobin concentration. An increase in the incidence of cardiac thrombi was found in females receiving 1500 and 3000 ppm. Based on the above effects, the LEL for systemic toxicity is 1500 ppm (Male: 194.0 mg/kg/day; Female: 246.9 mg/kg/day). The NOEL for systemic toxicity is 300 ppm (Male: 38.4 mg/kg/day; Female: 47.9 mg/kg/day).; core grade guideline (Ciba-Geigy Corp., Agricultural Division, 1987c)
2) 2-Year Feeding - dog: Dietary levels tested: 0, 14.1, 141.5, and 1415 ppm (0, 0.35, 3.54, and 35.38 mg/kg/day). The NOEL for systemic toxicity is 14.1 ppm (0.35 mg/kg/day) based on increased heart and liver weights in females at 141.5 ppm (3.54 mg/kg/day). Effects observed at 1415 ppm (35.38 mg/kg/day) included reduced food intake, decreased body weight, and reduced hemoglobin and hematocrit values. core grade supplementary (Ciba-Geigy Corp., 1964)
3) Developmental toxicity - rat: Dietary levels tested: 0, 100, 500, and 1000 mg/kg/day. Administration of atrazine at 1000 mg/kg/day produced 7 deaths in the 30 dams treated. Slight weight losses in females were observed at 500 mg/kg/day. A reduction in mean fetal weights and an increase in the number of embryonic and fetal resorptions were observed in the mid- and high-dose groups. Based on the above effects, the maternal toxicity and fetotoxicity NOEL and LEL are 100 and 500 mg/kg/day, respectively; core grade minimum (Ciba-Geigy, Corp., 1971)

Data Gap(s): None

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o ORAL RFD CONFIDENCE :

Study: High
Data Base: High
RfD: High

The critical study is of good quality and is given a high confidence rating. Additional studies are supportive and of good quality; therefore, the data base is given a high confidence rating. High confidence in the RfD follows.

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o ORAL RFD SOURCE DOCUMENT :

The only U.S. EPA documentation at present is on IRIS.

Pesticide Registration Standard

Pesticide Registration Files

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o REVIEW DATES : 07/08/86, 12/09/86, 05/20/87, 06/22/88, 02/21/90

o VERIFICATION DATE : 02/21/90

HEALTH EFFECTS ASSESSMENTS SUMMARY TABLE B: CARCINOGENICITY
Update: December, 1990

Compound	Exposure Inhalation; Oral	Species Inhalation	Species Oral	Tumor Site Inhalation	Tumor Site Oral	EPA Group/Unit Risk [Slope Factor] Inhalation $(\mu g/m^3)^{-1}$ $[(mg/kg/day)^{-1}]$	EPA Group/Unit Risk [Slope Factor] Oral $(\mu g/L)^{-1}$ $[(mg/kg/day)^{-1}]$	Reference Inhalation/Oral
Aniline	NA; 2-year dietary	NA	rat	NA	spleen	B2/ND	B2/1.6E-7 [5.7E-3][a]	U.S. EPA, 1990/ CIIT, 1982; U.S. EPA, 1985, 1990
Aramite	NA; 400 ppm in diet for 104 weeks (20 mg/kg/day)	NA	rat	increased incidence of liver tumors (also see Table A)	increased incidence of liver tumors	B2/7.1E-6 [2.5E-2][b]	B2/7.1E-6 [2.5E-2]	Popper et al., 1960; Oser and Oser, 1962; U.S. EPA, 1988/ Popper et al., 1960; Oser and Oser, 1962; U.S. EPA, 1989
Arsenic	100-5000 $\mu g/m^3$ continuous; 0.01-1.8 mg/L in drinking water	human	human	respiratory tract (also see Table A)	skin	A/4.3E-3 [5.0E+1][a,p]	A/NA[k]	Brown and Chu, 1983a,b,c; Lee-Feldstein, 1983; Higgins, 1982; Enterline and Marsh, 1982; U.S. EPA, 1984a,b, 1988/U.S. EPA, 1990
Asbestos	occupational; dietary	human	rat	lung and mesothelioma	large intestine	A/2.3E-1 (fibers/mL)$^{-1}$[m]	A/ND	U.S. EPA, 1988, 1988/NTP, 1985; U.S. EPA, 1985, 1990
Atrazine	NA; 2-year dietary	NA	rat	NA	mammary gland adenoma, fibro-adenomas, adeno-carcinomas and carcinosarcomas	C/ND	C/6.3E-6 [2.22E-1][c]	U.S. EPA, 1984/ Cibe-Geigy, 1988, U.S. EPA, 1984
Azobenzene	NA; 2-year dietary	NA	rat	NA	abdominal cavity	B2/3.1E-5 [1.1E-1][a,b]	B2/3.1E-6 [1.1E-1][a]	U.S. EPA, 1980/ NCI, 1979; U.S. EPA, 1988, 1990
Benzene	occupational; occupational	human	human	leukemia	leukemia	A/8.3E-6 [2.9E-2][a]	A/8.3E-7 [2.9E-2][a,b]	Ott et al., 1978; Rinsky et al., 1981; Wong et al., 1983; U.S. EPA, 1985, 1987, 1988, 1990/ Ott et al., 1978; Rinsky et al., 1981; Wong et al., 1983; U.S. EPA, 1985, 1987, 1988, 1990

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 22 1991

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

OSWER DIRECTIVE 9355.0-30

MEMORANDUM

SUBJECT: Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions

FROM: Don R. Clay
Assistant Administrator

TO: Directors, Waste Management Division
Regions I, IV, V, VII, VIII
Director, Emergency and Remedial Response Division
Region II
Directors, Hazardous Waste Management Division
Regions III, VI, IX
Director, Hazardous Waste Division,
Region X

Purpose

The purpose of this memorandum is to clarify the role of the baseline risk assessment in developing Superfund remedial alternatives and supporting risk management decisions.

Specifically, the following points are made in the memorandum:

- Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4}, and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts. However, if MCLs or non-zero MCLGs are exceeded, action generally is warranted.

- Other chemical-specific ARARs may also be used to determine whether a site warrants remediation.

- A risk manager may also decide that a baseline risk level less than 10^{-4} is unacceptable due to site specific reasons and that remedial action is warranted.

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- compliance with a chemical-specific ARAR generally will be considered protective even if it is outside the risk range (unless there are extenuating circumstances such as exposure to multiple contaminants or pathways of exposure).

- The upper boundary of the risk range is not a discrete line at 1×10^{-4}, although EPA generally uses 1×10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions.

- The ROD should clearly justify the use of any non-standard exposure factors and the need for remedial action if baseline risks are within the generally acceptable risk range. The ROD should also include a table listing the final remediation goals and the corresponding risk level for each chemical of concern.

Background

The 1990 National Contingency Plan (NCP) (55 Fed. Reg. 8665-8865 (Mar. 8, 1990)) calls for a site-specific baseline risk assessment to be conducted, as appropriate, as part of the remedial investigation (Section 300.430(d)(1)). Specifically, the NCP states that the baseline risk assessment should "characterize the current and potential threats to human health and the environment that may be posed by contaminants migrating to ground water or surface water, releasing to air, leaching through soil, remaining in the soil, and bioaccumulating in the food chain" (Section 300.430(d)(4)). The primary purpose of the baseline risk assessment is to provide risk managers with an understanding of the actual and potential risks to human health and the environment posed by the site and any uncertainties associated with the assessment. This information may be useful in determining whether a current or potential threat to human health or the environment exists that warrants remedial action.

The "Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual - Part A" (HHEM) (EPA/540/1-89/002) provides guidance on how to conduct the human health portion of the baseline risk assessment. Volume II of the "Risk Assessment Guidance for Superfund" the "Environmental Evaluation Manual" (EPA/540/1-89/001) and the companion manual, "Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference" (EPA/600/3-89/013) provide guidance on conducting the environmental portion of the baseline risk assessment. Other pertinent guidance includes the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (RI/FS guidance, EPA/540/G-89/004), which describes how the baseline risk assessment fits into the overall RI/FS process. "Guidance on Preparing Superfund Decision Documents" (ROD guidance)

(EPA/624/1-87/001) provides information on how to document the results of the baseline risk assessment in the ROD.

Objective

The objective of this memorandum is to provide further guidance on how to use the baseline risk assessment to make risk management decisions such as determining whether remedial action under CERCLA Sections 104 or 106 is necessary. This memorandum also clarifies the use of the baseline risk assessment in selecting appropriate remedies under CERCLA Section 121, promotes consistency in preparing site-specific risk assessments, and helps ensure that appropriate documentation from the baseline risk assessment is included in Superfund remedy selection documents.

Implementation

RISKS WARRANTING REMEDIAL ACTION

Whenever there is a release or substantial threat of release of a hazardous substance into the environment (or a release or threat of release into the environment of a pollutant or contaminant "which may present an imminent and substantial danger to public health or welfare"), Section 104(a)(1) of CERCLA provides EPA with the authority to take any response action consistent with the National Contingency Plan it deems necessary to protect public health or welfare or the environment. Section 106 of CERCLA grants EPA the authority to require potentially responsible parties (or others) to perform removal or remedial actions "when the President determines that there may be an imminent and substantial endangerment to the public health or welfare or the environment because of an actual or threatened release of a hazardous substance from a facility."

As a general policy and in order to operate a unified Superfund program, EPA generally uses the results of the baseline risk assessment to establish the basis for taking a remedial action using either Section 104 or 106 authority. EPA may use the results of the baseline risk assessments to determine whether a release or threatened release poses an unacceptable risk to human health or the environment that warrants remedial action and to determine if a site presents an imminent and substantial endangerment. The risk assessment methodology for all sites should be the same regardless of whether the RI/FS or remedial design and remedial action is performed by EPA or potentially responsible parties.

Generally, where the baseline risk assessment indicates that a cumulative site risk to an individual using reasonable maximum exposure assumptions for either current or future land use exceeds the 10^{-4} lifetime excess cancer risk end of the risk

range, action under CERCLA is generally warranted at the site. For sites where the cumulative site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4}, action generally is not warranted, but may be warranted if a chemical specific standard that defines acceptable risk is violated or unless there are noncarcinogenic effects or an adverse environmental impact that warrants action. A risk manager may also decide that a lower level of risk to human health is unacceptable and that remedial action is warranted where, for example, there are uncertainties in the risk assessment results. Records of Decision for remedial actions taken at sites posing risks within the 10^{-4} to 10^{-6} risk range must explain why remedial action is warranted.

The cumulative site baseline risk should include all media that the reasonable maximum exposure scenario indicates are appropriate to combine and should not assume that institutional controls or fences will account for risk reduction. For noncarcinogenic effects of toxicants, unacceptable risk occurs when exposures exceed levels which represent concentrations to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, as appropriate to address teratogenic and developmental effects.

Chemical specific standards that define acceptable risk levels (e.g., non-zero MCLGs, MCLs) also may be used to determine whether an exposure is associated with an unacceptable risk to human health or the environment and whether remedial action under Section 104 or 106 is warranted. For ground water actions, MCLs and non-zero MCLGs will generally be used to gauge whether remedial action is warranted.

EPA uses the general 10^{-4} to 10^{-6} risk range as a "target range" within which the Agency strives to manage risks as part of a Superfund cleanup. Once a decision has been made to take an action, the Agency has expressed a preference for cleanups achieving the more protective end of the range (i.e., 10^{-6}), although waste management strategies achieving reductions in site risks anywhere within the risk range may be deemed acceptable by the EPA risk manager. Furthermore, the upper boundary of the risk range is not a discrete line at 1×10^{-4}, although EPA generally uses 1×10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions, including any remaining uncertainties on the nature and extent of contamination and associated risks. Therefore, in certain cases EPA may consider risk estimates slightly greater than 1×10^{-4} to be protective.

When an ARAR for a specific chemical (or in some cases a group of chemicals) defines an acceptable level of exposure,

compliance with the ARAR will generally be considered protective even if it is outside the risk range (unless there are extenuating circumstances such as exposure to multiple contaminants or pathways of exposure). Conversely, in certain situations EPA may determine that risks less than 1×10^{-6} are not sufficiently protective and warrant remedial action.

Where current conditions have not resulted in a release posing risks that warrant action but there is a significant possibility that a release will occur that is likely to result in an unacceptable risk, remedial action may also be taken. The significance of the potential future release may be evaluated in part based on the quantities of material at the site and the environmental setting.

RISKS CONSIDERED IN RISK MANAGEMENT DECISION

As noted above, both current and reasonably likely future risks need to be considered in order to demonstrate that a site does not present an unacceptable risk to human health and the environment. An adequate consideration of future risk may necessitate the assessment of risks assuming a land use different from that which currently exists at the site. The potential land use associated with the highest level of exposure and risk that can reasonably be expected to occur should be addressed in the baseline risk assessment. Further, this land use and these exposure assumptions should be used in developing remediation goals.

The preamble to the NCP states that EPA will consider future land use as residential in many cases. In general, residential areas should be assumed to remain residential; and undeveloped areas can be assumed to be residential in the future unless sites are in areas where residential land use is unreasonable. Often the exposure scenarios based on potential future residential land use provide the greatest risk estimates (e.g., reasonable maximum exposure scenario) and are important considerations in deciding whether to take action (55 Fed. Reg. at 8710).

However, the NCP also states that "the assumption of future residential land use may not be justifiable if the probability that the site will support residential use in the future is small." Sites that are surrounded by operating industrial facilities can be assumed to remain as industrial areas unless there is an indication that this is not appropriate. Other land uses, such as recreational or agricultural, may be used, if appropriate. When exposures based on reasonable future land use are used to estimate risk, the NCP preamble states that the ROD "should include a qualitative assessment of the likelihood that the assumed future land use will occur" (55 Fed. Reg. at 8710).

Unacceptable environmental risks also may prompt remedial action and may occur where there is no significant risk to human health. Threats or potential threats to sensitive habitats, such as wetlands, and critical habitats of species protected under the Endangered Species Act are especially important to consider when determining whether to take an action under CERCLA Section 104 or 106. Ambient Water Quality Criteria for aquatic organisms are chemical-specific standards that will generally be considered when determining whether to take an action based on the environmental risk of releases to surface waters.

NO-ACTION DECISIONS

If the baseline risk assessment and the comparison of exposure concentrations to chemical-specific standards indicates that there is no unacceptable risk to human health or the environment and that no remedial action is warranted, then the CERCLA Section 121 cleanup standards for selection of a Superfund remedy, including the requirement to meet applicable or relevant and appropriate requirements (ARARs), are not triggered. CERCLA section 121 (a) requires only that those remedial actions that are "determined to be necessary ... under section 104 or ... 106 ... be selected in accordance with section 121." If EPA determines that an action is necessary, the remedial action must attain ARARs, unless a waiver is invoked. Of course, sites that do not warrant action under CERCLA sections 104 or 106 may warrant action under another State or Federal statute, such as RCRA subtitle D requirements for the appropriate closure of a solid waste landfill.

The decision not to take action at an NPL site under section 104 and 106 should also be documented in a ROD. The decision documentation process should include the preparation of a proposed plan for public comment, ROD and eventually a closeout report and Federal Register deletion notice.

POINT OF DEPARTURE WHEN ACTION WARRANTED

Once remedial action has been determined to be warranted, the results of the baseline risk assessment may be used to modify preliminary remediation goals. These preliminary goals are developed at scoping based on ARARs and the 10^{-6} cancer risk point of departure pursuant to NCP section 300.430(e)(2)(i).

USE OF BASELINE RISK ASSESSMENT TO MODIFY PRELIMINARY REMEDIATION GOALS

Remediation goals developed under CERCLA Section 121 are generally medium-specific chemical concentrations that will pose no unacceptable threat to human health and the environment. Preliminary remediation goals are developed early in the RI/FS process based on ARARs and other readily available information,

such as concentrations associated with 10^{-6} cancer risk or a hazard quotient equal to one for noncarcinogens calculated from EPA toxicity information. These preliminary goals may be modified based on results of the baseline risk assessment, which clarifies exposure pathways and may identify situations where cumulative risk of multiple contaminants or multiple exposure pathways at the site indicate the need for more or less stringent cleanup levels than those initially developed as preliminary remediation goals. In addition to being modified based on the baseline risk assessment, preliminary remediation goals and the corresponding cleanup levels may also be modified based on the given waste management strategy selected at the time of remedy selection that is based on the balancing of the nine criteria used for remedy selection (55 Fed.Reg. at 8717 and 8718).

EARLY AND INTERIM ACTIONS

Early operable unit actions (e.g., hot spot removal and treatment) and interim actions (e.g., temporary storage or ground water plume containment) may be taken to respond to an immediate site threat or to take advantage of an opportunity to significantly reduce risk quickly (55 Fed. Reg. at 8705). For example, an interim containment action may be particularly useful early in the process for complicated ground water remedial actions, where concentrations greater than MCLs provide a good indication that remediation of a potential drinking water source is necessary; such quick remedial action is important to prevent further spread of the contaminant plume while a final ground water remedy is being developed.

Early and interim action RODs do not require a completed baseline risk assessment, although enough information must be available to demonstrate the potential for risk and the need to take action. Data sufficient to support the interim action decision can be extracted from the ongoing RI/FS for the site and set out in a focused feasibility study or other appropriate document that includes a short analysis of a limited number of alternatives (55 Fed. Reg. at 8704). These data should include a summary of contaminants of concern, concentrations and relevant exposure information. A discussion should accompany these data explaining the need for immediate remedial action based on the presence of contamination that, if left unaddressed in the short-term, either contributes immediate risk or is likely to contribute to increased site risk or degradation of the environment/natural resources. The early and interim action RODs should note that some exposure pathways at the site may not be addressed by the action.

An interim action ROD eventually must be followed by a subsequent ROD for that operable unit based on the complete RI/FS, that includes the baseline risk assessment, in order to document long-term protection of human health and the environment

at that portion of the site. The interim action ROD, however, should demonstrate qualitatively (and quantitatively if possible) that there is a risk or potential for risk and explain how the temporary measures selected will address a portion of this risk.

DOCUMENTATION OF BASELINE RISK ASSESSMENT RESULTS IN THE ROD

The Summary of Site Risks section of the ROD should include a discussion of the risks associated with current and future land use and a table presenting these risk levels for each exposure medium (e.g., direct contact with soil by potential future residents exposed via incidental soil ingestion and dermal contact). In some situations, risks from exposure via more than one medium (e.g., soil and drinking water) will affect the same potentially exposed individual at the same time. It is appropriate in these situations to combine the risks from the different media to give an indication of total risk that an individual may be exposed to from a site.

In addition to summarizing the baseline risk assessment information, the ROD (except no-action RODs) should include how remedial alternatives will reduce risks by achieving cleanup levels through treatment or by eliminating exposures through engineering controls for each contaminant of concern in each appropriate medium.

The Comparative Analysis should include a discussion of each of the nine criteria; consideration of risk is part of the discussion of several of the criteria. The discussion of overall protection of human health and the environment should include a discussion of how the remedy will eliminate, reduce, or control risks identified in the baseline risk assessment posed through each pathway and whether exposure levels will be reduced to acceptable levels. For example, if direct human contact with contaminated soil is identified as a significant risk at a site, the ROD (except no-action RODs) should indicate how the selected remedy will eliminate or control exposures to ensure protection of human health. The discussion of long-term effectiveness and permanence should include, where appropriate, an assessment of the residual risk from untreated residual waste remaining at the site. The short-term effectiveness discussion should address risks during remedial action to those on-site and nearby.

Finally, that part of the Decision Summary in the ROD that focuses on the selected remedy should show:

- the chemical-specific remediation level and corresponding chemical-specific risk level(s) to be attained at the conclusion of the response action and the points (or area) of compliance for the media being addressed; and

- The lead agency's basis for the remediation levels (e.g., risk calculation, ARARs).

The attached table, "Remediation Levels and Corresponding Risks," provides a direct means of displaying this information for health risks and, where appropriate, environmental protection (Table 1). The table should be completed for all media for which the ROD selects final cleanup levels. The table should serve as a summary of text in the selected remedy section of the ROD Decision Summary. For interim action RODs, only qualitative statements may be possible.

Additional guidance on the baseline risk assessment and its role in remedy selection is available from several sources. For guidance on the baseline risk assessment contact:

David Bennett, Chief
Toxics Integration Branch (OS-230)
Hazardous Site Evaluation Division
Office of Emergency and Remedial Response
phone: (FTS) or (202) 475-9486.

For additional guidance on the interaction of the baseline risk assessment and Superfund remedy selection, contact:

David Cooper
Remedial Operations and Guidance Branch (OS-220W)
Hazardous Site Control Division
Office of Emergency and Remedial Response
phone: (FTS) 398-8361
(commercial phone: (703) 308-8361)

For guidance on enforcement-lead sites contact:

Stephen Ells
Guidance and Evaluation Branch (OS-510)
CERCLA Enforcement Division
Office of Waste Programs Enforcement
phone: (FTS) or (202) 475-9803.

NOTICE: The policies set out in this memorandum are intended solely as guidance. They are not intended, nor can they be relied upon, to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided in this memorandum, or to act at variance with the guidance, based on an analysis of specific site circumstances. Remedy selection decisions are made and justified on a case-specific basis. The Agency also reserves the right to change this guidance at any time without public notice.

TABLE 1
Remediation Goals and Corresponding Risks [a]

Final Remediation Levels [b]					Corresponding Risk Levels [c]	
					Chemical-Specific RME Risk [d]	
Medium	Chemical	Remediation Level [e]	Point of Compliance [f]	Basis of Goal	Cancer	Non-Cancer
SOIL	A	2.0 ppm	All facility grounds	HI	N/A	0.5
	B	17.0 ppm		Risk	1.0×10^{-5}	N/A
	C	5.0 ppm		GW Risk	N/A	N/A
GROUND WATER	B	0.1 ppm	Waste Management Unit Boundary	Risk	1.0×10^{-5}	N/A
	C	4.0 ppm		MCL	1.0×10^{-5}	N/A
	F	7.0 ppm		MCLG	N/A	0.2
	G	15.0 ppm		MCL	6.0×10^{-6}	0.09
SEDIMENT	Q	100.0 ppm	Downstream from point A	Ecological Effects	N/A	N/A

---

a. Prepare summary sheets for selected remedy.

b. Final Remediation Levels are based on preliminary remediation goals developed in the Feasibility Study (FS) (RI/FS Guidance 4.2.1) as modified through the nine criteria evaluation and engineering design. In the process of achieving remediation levels for each chemical, some chemicals will be reduced to concentrations below their remediation levels.

c. Estimate of specific risks corresponding to associated remediation levels. Risks do not consider effects of exposures to other chemicals in media. If appropriate, risks may be summed to calculate media specific risks. Risks from other pathways is not considered.

d. Cancer risks are measured as individual incremental lifetime; non-cancer as Hazard Quotients.

e. Bases for values should be explained in the earlier Record Of Decision (ROD) table.

f. Bases for location and method for determining attainment (e.g., maximum value detected over area XYZ) should be explained in the description of the selected remedy.

N/A Not applicable

APPENDIX D

DATA COLLECTION QUALITY ASSURANCE PLAN

**(From RFI Workplan to be used as
Guidance for Closure Plan
where Parameters are Applicable)**

DATA COLLECTION QUALITY ASSURANCE PLAN

VICKSBURG CHEMICAL DIVISION
CEDAR CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI

for:

Cedar Chemical Corporation
Memphis, Tennessee

June 1992

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

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1.0
INTRODUCTION

The Vicksburg Chemical Division of Cedar Chemical Corporation (CCC) is located in Vicksburg, Mississippi. The facility is a manufacturer of chemicals. An 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.

CCC has retained Woodward-Clyde Consultants (WCC) to perform a RCRA Facility Investigation (RFI) at the Vicksburg facility. WCC will conduct the investigation in compliance with the Consent Decree. Among the requirements and/or guidelines include in the decree are procedures to control the quality of data acquired in during the investigation. This document presents the overall approach that WCC will undertake to verify that the information, data, and procured results meets the quality objectives. A detailed discussion of sampling procedures and methodologies for specific media is also given. For information on the project description and background, refer to the Preliminary Report.

2.0
DATA COLLECTION OBJECTIVES

2.1 DATA OBJECTIVES

The primary objectives of the RFI are as follows:

- Identify the contaminants of concern for each SWMU requiring further investigation
- Determine whether or not SWMUs in question are releasing hazardous constituents into the environment.
- Identify the source of contamination
- Determine vertical and horizontal extent of contamination.
- Collect data to be used in determining the necessity and feasibility of corrective action measures.

To meet the overall objectives of the investigation, WCC will collect surface soil, subsurface soil, and groundwater samples. The following sections present the data requirements and strategy for collection of samples from each media.

2.2 QUALITY ASSURANCE OBJECTIVES

The objectives of the Quality Assurance/Quality Control (QA/QC) procedures are to produce data that meet (or exceed) the requirements of standard analytical methods and satisfies the project requirements. The objectives of the QA efforts for this project are as follows:

- To provide the mechanism for ongoing control and evaluation of the quality of data measurement throughout the project.
- Utilizing quality control data to define data quality for various measurement parameters in terms of precision and accuracy.

- To verify that all chemical samples are accurately and precisely collected, analyzed and documented so that proper treatment and/or disposal of waste material can occur.
- To verify compliance with the Department of Transportation and other agency requirements.
- To verify that samples are properly collected, analyzed and documented to provide data as part of the H&S Plan.

2.2.1 Definitions of Quality Assurance Terms

Definitions of precision, accuracy, completeness, representativeness, and comparability are 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, 1980).

2.2.1.1 Precision Precision is "a measure of mutual agreement among individual measurements of the same property. It is a measure of variability of individual sample measurements. Precision will be assessed from the laboratory duplicate analyses of field samples and from the set of duplicate matrix spiked samples. Precision will be measured as the percent difference in the duplicate measurements.

Average precision and its standard deviation of the concentration data for individual parameters will be used to evaluate the data collected and its acceptability for the objectives of the sampling. Data to be used in evaluation will meet the criteria defined herein and in Section 4.73 of this QAP. Confidence intervals will be derived for data sets using standard statistical methods. The precision criteria for laboratory QC samples is presented in Table 5.

2.2.1.2 Accuracy Accuracy is "the degree of agreement of a measurement with an accepted reference or true value" and is a measure of a system bias. Bias is the difference between the mean of the true sample values and the mean of the laboratory analysis. Accuracy will be assessed using laboratory spiked standard matrix samples in conjunction with field and trip blank samples and laboratory method and reagent blanks.

Average accuracy and its standard deviation of the concentration data will be used if sufficient data are collected for a specific sampling activity. The accuracy criteria for the laboratory QC samples is presented in Table 5. Accuracy criteria for samples tested in accordance with SW 846, 3rd Edition procedures or equivalent will be in accordance with the appropriate analytical method.

2.2.1.3 Completeness Completeness is "a measure of the amount of the valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions." The completeness of data objectives reflect the degree to which required samples specified in the appropriate sampling plan have been collected and the necessary analysis performed, in order to create a sufficient data base to meet the objectives.

The completeness objective for laboratory samples is presented in Table 5. If the completeness objective is not met, an evaluation will be undertaken to determine if resampling is required to provide adequate data to meet specific task objectives.

2.2.1.4 Representativeness 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." Representativeness is a function of the sample site selection and sample collection and analysis techniques. The objective of this program is to obtain samples which are representative of the media to be measured. The rationale of the selection of sample sites is provided in the project plans (including this QAP).

2.2.1.5 Comparability Comparability "expresses the confidence with which one set of data can be compared with another." Comparability can be related to precision and accuracy since these quantities are measures of data reliability. Qualitatively, data subjected to strict QA/QC procedures will be deemed more reliable than data obtained from another project or previous study. To maintain comparability, the sampling method used, chain-of-custody procedures, EPA analytical methods and qualified laboratories and establishment of strict QA procedures and sampling guidelines provide the basis for uniformity in all data collection and analysis activities.

2.2.2 Accuracy, Precision, and Sensitivity of Laboratory Analysis

The QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols.

The TCL and TAL parameters to be analyzed in the first round of samples are listed in Tables 2 and 3. The detection limits for metals analyses in accordance with SW846, 3rd Edition are presented on Table 4.

Accuracy and precision criteria for the parameters to be tested in accordance with EPA CLP protocols and SW846 is shown in Table 5. The accuracy and precision of laboratory analyses for samples tested in accordance with CLP and SW846 protocols will be determined by testing of laboratory blanks, duplicates, and spiked samples in accordance with the frequencies shown in Table 1. Compounds that will be used as matrix and surrogate spikes for CLP and SW846 organic analyses, and their control limits from CLP Protocols, are included in Tables 6 and 7.

2.2.3 Quality of Field Samples

Field duplicates, rinsate blanks, trip blanks, and matrix spikes/matrix spike duplicates will be taken in the field and submitted to the analytical laboratory to provide a means to assess the quality of the data resulting from field investigation tasks. Field duplicate samples will be analyzed to check for sampling and analytical reproducibility. Field and trip blank samples will be analyzed to check for procedural contamination and cross-contamination during shipment and storage of samples. Matrix spike/matrix spike duplicate samples will be analyzed to verify that recoveries falling outside acceptance windows are attributable to sample matrix interferences and not to laboratory analytical errors.

Field duplicates will be obtained at the frequencies indicated in Table 9. The samples will consist of obtaining a duplicate sample set for analysis from the sample. Rinsate samples will be prepared by rinsing decontaminated equipment with deionized water and collecting the rinsate sample. Matrix spike and matrix spike duplicates will be collected in the field but they will be spiked in the laboratory. Trip blanks will be prepared by

the laboratory and shipped with the sample containers. The trip blanks will be kept with collected samples and shipped back to the laboratory for analysis.

2.2.4 Accuracy of Field Measurements

Measurement data will be generated in many field activities that are incidental to collecting samples for analytical testing or unrelated to sampling. These activities include, but are not limited to, the following:

- Documenting time and weather conditions
- Determining depths in a borehole or piezometer and static water levels
- Measuring pH and conductivity of ground water samples
- Screening samples with an organic vapor analyzer (OVA)

The general QA objective for such measurement data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of such data through the documented use of standard procedures.

The QC level of effort for the field measurement of pH consists of pre-measurement calibration and post-measurement verification using two standard reference solutions each time to sample pH. This procedure will be performed for each sample tested. The QC effort for field conductivity measurements will include daily calibration of the instrument using standard solutions of known conductivity.

The accuracy of field measurements of pH will be assessed through pre-measurement calibrations and pH-measurements verifications using at least two standard buffer solutions. The two measurements must each be within $\pm$ 0.1 standard unit of buffer solution values. If measurements not within $\pm$ 0.1, the problem will be evaluated. A fresh portion of buffer solution will be utilized. If the problem persists, a different (new) buffer solution will be used. Precision will be assessed through replicate measurements. (The electrode will be withdrawn, rinsed and de-ionized water and re-immersed between each replicate). The instrument used will be capable of providing measurements to 0.1 standard unit. A total of four replicates for pH and conductivity will be performed.

The accuracy of measuring depths (for boreholes and static water levels) will be assessed by using a measuring device (weighted tape or electronic water level indicator such as an M-scope) that has been calibrated before use by measuring two known lengths. Any measurements taken with the device will be adjusted by the difference (if any) in length over the appropriate depth interval. At least three replicate depth measurements will be made and the average depth measurement will be used.

The data from the OVA is used for screening only to select samples for analysis. After receiving laboratory data the OVA and lab data will be evaluated for comparability.

3.0
SAMPLING OBJECTIVES

The specific objectives of the collection of the data are further discussed in the subsequent paragraphs.

3.1 GROUNDWATER SAMPLING DATA OBJECTIVES

As stated in the Preliminary Report water-bearing zones have been identified in previous investigations. Additional groundwater data may be needed to characterize these zones if contamination is found. Groundwater data needed could include:

- Approximate vertical boundaries of zones and stratigraphic relationships.
- Basic flow characteristics of each zone (direction, lateral flow rate, hydraulic conductivity, transmissivity and storage capacity).
- Hydraulic inter-relationships of the zones (vertical interconnection transmissivity between zones, etc).
- Effect of stratigraphic variations within each zone on contaminant transport.
- Nature and extent of contamination in each zone (approximate boundaries of contaminant accumulation).

Identification of water-bearing zone boundaries and relevant soil strata will required a detailed description of soil features (such as color, lithology, bedding, identifying features and relative degree of water saturation) to a depth sufficient to identify the base of the deepest contaminated water-bearing zone. The description will require accuracy to the nearest foot and professional geologic judgment to recognize and describe pertinent features.

The zones to be monitored will require sufficient screening intervals to characterize each zone. For low density immiscible contaminants (floaters), the screen will extend approximately two feet above the top of the zone to provide for fluctuations in water levels. If dense non aqueous phase contaminants are the concern (sinkers) the screen

will cover the base of the upper pervious zones and extend slightly below the base of the zone (± 6 inches. If dissolved constituents are the concern, the screened interval will correspond to that portion of the zone which is judged to have the highest hydraulic conductivity. If required, deeper zones will be monitored utilizing similar approaches as describe above.

Determination of groundwater flow direction will require measurement of elevations of the top of the piezometric surface of each zone. A sufficient number and spacing of measurement stations will be installed as an Interim Measure Activity to construct idealized contours of the piezometric surface elevations. The locations of measuring stations will be established such that they can be plotted on a site location map. Locations should be to the nearest 0.1 foot. Water level measurements should be made to the nearest 0.01 foot accuracy and reported in feet mean sea level (MSL). This data will be evaluated to verify the designated upgradient shallow well location and to identify upgradient background wells. As additional samplings are performed, the data will be reevaluated to verify results of previous sampling.

Determination of the nature and extent of groundwater contamination will require sampling and chemical analysis of groundwater from each water-bearing zone. A sufficient number of samples will be required to identify approximate lateral limits of contamination and establish and nature and concentrations of contaminants. Investigation of zones below the upper pervious zone will be performed if data does not define the vertical extent of groundwater contamination.

The samples will require analysis for Target Compound List (TCL) and Target Analyte List (TAL) constituents plus dinoseb as presented in the Contract Laboratory Program CLP Statement of Work to identify or verify contaminants of concern. Sample collection and handling will require strict adherence to EPA approved procedures and close QA/QC surveillance. Sample analysis will be performed by CLP methods.

3.2 AQUIFER TESTING OBJECTIVES

Determination of lateral and vertical flow rates, hydraulic conductivities, transmissivities, storage capacities and vertical interconnection will require in-situ flow testing data.

Lateral hydraulic conductivity/transmissivity data should be collected by at least two different methods in order to evaluate the credibility of the data and subsequent calculations. Storage capacity calculations and vertical interconnection determinations should be based on field pumping test data.

3.3 SURFACE SOIL SAMPLING DATA OBJECTIVES

The primary purpose of collecting surface soil data is to aid in determining potential for contamination of site runoff-water, potential for offsite migration of contaminated sediments (water transported) and/or potential for human/animal contact and/or ingestion. Consequently, sampling need not extend beyond about 12 inches below the natural ground surface. Background samples at 0 to 12 inches to 12 to 36 inches will be obtained in the site vicinity. The background sample locations are selected based upon the lack of hazardous waste activities in those areas. The surface soil data must include laboratory analysis for soil classification and contaminant content. Soil classification data is needed to estimate the erosion susceptibility and transportability of the soil. Atterberg limits for cohesive soil and sieve analysis data for non-cohesive soils will be adequate for erosion susceptibility and transportability purposes. Laboratory analysis for contaminant content shall consist of TCL and TAL analyses using CLP methods.

3.4 SUBSURFACE SOIL SAMPLING DATA OBJECTIVES

The primary purpose of collecting subsurface soil (vadose zone) and soil structure data is to aid in determining the potential for downward percolation of contaminants into the shallow groundwater. Consequently sampling must be of sufficient quantity to identify lateral limits of contamination and must extent to a sufficient depth of identify and quantify accumulation of contaminants above and within the first occurring water-bearing zone. The data shall consist of laboratory analyses of the contaminated soil. Laboratory analyses shall consist of analysis for TCL and TAL compounds plus dinoseb in accordance with CLP protocol.

3.5 SAMPLING ACTIVITIES

The sampling activities will occur during the RFI to address the data objectives for the media of concern identified above. A sampling location map of the RFI sampling activities is presented as Figure 1. The field investigation tasks to obtain the data will generally consist of the following:

- Obtaining sampling location characteristic information from topographic and information surveys.
- Obtaining background and current groundwater quality data from the existing site monitor wells (already completed).
- Subsurface soil sampling to evaluate the vertical and horizontal extent of contamination and constituents if released.
- Surface soil sampling for determination of sediment transport of contaminants from the retention basins and for background information.
- Groundwater assessment and sampling (monitor well installation, sampling and evaluation) to determine the areal and vertical extent of groundwater contamination and determine groundwater characteristics (i.e. flow direction, flow rate, transmissivity, etc).

As discussed in the RFI workplan approach and scope of work, the field investigation tasks will be conducted in a phased approach which will consist of the following:

- Phase I: Initial Source Characterization to confirm sources of contamination and identify/verify contaminants of concern.

- Phase II: Discrete soil sampling to evaluate extent of surface soil contamination and potential groundwater contamination. Investigation of deeper groundwater zones to determine vertical and horizontal extent of groundwater contamination.

- Phase III: Installation and sampling of monitor wells to evaluate degree of groundwater contamination and to provide for hydrogeologic characterization. Additional well installation and sampling for delineation of contaminant plume(s) and for aquifer testing.

A project management chart is shown on Figure 2 which depicts various responsibilities for the implementation of the project.

4.0
SAMPLING EQUIPMENT, PROCEDURES, AND MEASUREMENTS

The sampling locations, depths, type (grab vs. composite), number of samples, and analytical parameters were discussed in the RFI Workplan approach and scope of work. The procedures and equipment to perform the sampling for the RFI were discussed only in general terms in that document and are presented in more detail herein. In addition, procedures for monitor well installation and aquifer testing are presented. The sampling procedures presented below will be implemented along the RFI Workplan approach and scope of work as appropriate. As discussed, the RFI will be conducted in phases for all SWMUs and AOCs requiring further investigation. Minor changes in the procedures discussed here in will be documented and included in the interim reports. Significant changes which may affect the data quality objectives will be subject to approval by U.S. EPA. Additional specifications with respect to documentation, equipment, and procedures as required by CCC standard policies and manuals which do not affect data quality objectives may be incorporated into the workplan as appropriate.

4.1 SUBSURFACE SOIL SAMPLING

Subsurface soil sampling will be performed to characterize the wastes and to evaluate the extent of subsurface soil contamination, if any. A series of shallow borings will be drilled as discussed in previous sections to evaluate the contamination and determine locations for discrete sampling (Phase 2) as well as for shallow monitoring wells (Phase 3). As part of monitor well installation activities, other borings will be drilled with continuous soil sampling to confirm the absence or presence of contamination in the selected well location and to select appropriate screen intervals. The equipment and methods are discussed below along with an alternative method.

4.1.1 Equipment

Subsurface sampling will be performed by rotary auger drilling methods. The drilling apparatus will consist of a truck mounted rotary drilling rig. Samples will be obtained

by rotary drilling using a 3-inch diameter Shelby tube, or 2-inch diameter split spoon sampler.

Only petroleum jelly, teflon tape, lithium grease, or vegetable-based lubricants shall be used on the threads of downhole drilling equipment. Additives containing lead or copper shall not be used. Any hydraulic or other fluids used in the drilling rig, pumps, or other field equipment/vehicles shall not contain any polychlorinated biphenyls (PCBs).

If antifreeze is added to any pump, hose, etc., in an area in contact with drilling fluids, this antifreeze shall be completely purged prior to the equipment's use in drilling, mud mixing, or any other part of the overall drilling operation. Only antifreeze without rust inhibitors and/or sealants may be used.

Drilling equipment that has a visible loss of grease, hydraulic fluids, oils, fuels and/or transmission oil to drilling fluids to the borehole will not be allowed for borings and/or well installation until the problem is corrected.

Hydraulic rotary drilling operations will use portable recirculation tanks/pans for the "mud pit" and for mixing grout. Dug pits or sumps will not be used.

4.1.2 Procedure

The borings shall be continuously sampled with a thin-walled Shelby tube sampler or split-spoon sampler, extruded in the field and described or logged, following the guidelines of the appropriate and most current American Society for Testing and Materials (ASTM) Standards:

- D 1452 Practice for Soil Investigation and Sampling by Auger Borings,
- D 1586 Method for Penetration Test and Split-Barrel Sampling of Soils,
- D 1587 Practice for Thin-Walled Tube Sampling of Soils,
- D 2487 Test Method for Classification of Soils for Engineering Purposes, and

- D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure).

All borings shall be sampled and described by a qualified WCC representative. The qualified WCC representative is to be on-site during all boring and sampling operations. Samples taken from borings will be handled as described later in this section.

All soil borings will be advanced with rotary drilling techniques with continuous soil sampling techniques unless it is determined to be unnecessary for strata identification and sample collection by the qualified WCC representative based on consistent site conditions. If the borehole becomes unstable and caving or sloughing of the walls develop, temporary surface casing may be used in the drilling operations. Dry rotary auger techniques will utilize an auger and cut and clear the borehole for sampling. Rotary wash will utilize potable water that is recirculated through the borehole to remove cuttings. Bentonite drilling mud (organic free) will be used only if required to maintain borehole stability.

Selected soil samples obtained during drilling will be tested to characterize soils from a lithology type encountered. The qualified WCC representative or an assistant will prepare the selected soil samples for geotechnical analyses. Cohesive soil samples obtained for geotechnical testing with Shelby tubes shall be wrapped in foil. Non cohesive soils will be obtained using a split spoon sampler and shall be placed in a clean jar or plastic bag. The boring number, depth, date, and project number shall be written in indelible marker on the foil on cores or on labels for jars or bags. Chain-of-Custody and sample analysis request forms will accompany the samples to the lab.

The data generated from this testing shall be reported on the soil boring log or attached to the soil boring log.

The samples obtained from the borings will be screened in the field for head-space analysis using an onsite OVA. Immediately upon removal of the soil sample from the Shelby tube or split spoon, the field geologist will visually log it. The visual logging will describe soil type and secondary color, penetration resistance and inclusions as described above. A portion of the sample will then be shaved with a clean knife or spatula to

remove at a minimum the outer approximately one-fourth inch which may have come in contact with the downhole fluids. This shaved sample will then be divided into two parts, each of which will be labeled based on boring number and sample depth. One portion of the sample will be placed in a glass jar, labeled, and placed on ice. The other portion will be placed in a wide mouth glass jar covered with aluminum foil and capped. The headspace will be sampled by inserting the probe of the OVA into a predrilled hole in the cap through the aluminum foil. The OVA reading will be made immediately and the reading recorded on the boring log.

A soil sample for each boring will be selected for chemical analysis and will consist of the duplicate of the sample from the boring demonstrating the highest OVA reading and/or is visually contaminated. The OVA readings will be recorded on the boring logs as will the soil classification based on the field visual logging. Additionally, one in every ten samples demonstrating non-detected readings from the OVA screening will also be analyzed to evaluate potential false negatives.

Based on the OVA readings or visible contamination, the qualified WCC representative will select samples for chemical analysis (as described above) to consist of TCL and, TAL constituents. The testing protocols to be followed are discussed in the Data Management Plan. Soil samples obtained from the shallow monitor well borings will be sampled and screened and a confirmation sample will be selected from each boring based on the highest OVA reading to confirm that there is no soil contamination in the boring. Samples will be retained on ice or refrigerated until delivery to the laboratory. One sample in 20 will be split to provide field duplicate samples for analysis and one rinsate blank will be collected for analysis from each drilling rig decontamination during drilling.

Shallow rotary borings will be drilled to the water table and will be advanced by dry-auger methods until free water is encountered. For borings drilled for shallow monitor well installation, drilling operations will be stopped for ten minutes when water is encountered to allow the water level to rise. Both the initial and second water level will be measured and recorded. Drilling will then resume by rotary wash methods to the completion depth. Borings drilled for shallow well installation will be drilled to the base of the first water-bearing zone encountered.

Exploratory borings drilled prior to deep well installation will be drilled to the base of the deep water-bearing zone. The borings will be drilled in a manner similar to that previously described. The boring will be advanced by dry auger methods to the water table. Drilling will be stopped for approximately 10 minutes to allow the water level to rise. Both the initial and second water level will be measured and recorded. Drilling will resume using rotary wash methods to the boring completion depth. Rotary wash methods will be performed using potable water and, if required to maintain borehole stability, a bentonite drilling mud may be used.

The exploratory borings will be continuously sampled and field screened with an OVA (as described previously). The boring will be cased to a depth to be determined in the field based upon the OVA screening (to a non-detectable level) or the shallow water-bearing zone, whichever is deeper. Drilling will resume through the casing to the boring completion depth. Upon completion of drilling, the casing will be pulled and the borehole will be grouted as the casing is advanced out of the hole from the base of the borehole to ground surface. Grouting will be performed as described later in this section.

Borings drilled for the deeper monitor wells will be drilled within 10 to 15 feet of the corresponding exploratory borings in the same manner as described above except that a 12-inch diameter shallow PVC casing will be grouted in place to seal off the shallow water-bearing zone to the depth determined by the corresponding exploratory boring. The boring will first be drilled to the depth for the 12-inch casing. The hole will then be reamed to provide a minimum 14-inch diameter bore hole. The 12-inch diameter casing will be placed in the hole and grouted (as described later in this section) between the borehole and casing outer wall. The grout will be allowed to set for at least 24 hours. Drilling will then resume through the shallow casing to the completion depth.

Following completion of each borehole used for screening, the borehole will be grouted with a cement/bentonite (6 to 8 percent bentonite by dry weight per sack of cement) grout. The grout shall consist of Portland cement and powdered sodium bentonite. The grout mix will consist of a pumpable cement/bentonite slurry. The grout shall be mixed in clean, above ground, rigid containers with an appropriate quantity of water. The mixing of each component will be achieved by a mechanical paddle device or

recirculation with a grout pump. Mixing activities will continue until a smooth, lump free consistency is achieved.

The grout mixture shall be pumped through a rigid, side discharge tremie pipe placed approximately 6 inches above the bentonite seal for monitor well installation or on the bottom of the hole for plugging and abandonment of soil borings. The grout mixture shall be pumped until undiluted grout flows from the annulus at the ground surface. The tremie pipe may be slowly withdrawn during grouting operations. The estimated volume of grout will be computed for each boring or well, based upon borehole dimensions and well dimensions. If actual grout placed is less than or exceeds 50 percent of the computed volume, the grouting for that boring or well will be evaluated to determine if grouting problems are present (i.e. caving or excessive grout takes).

After a 24-hour period, the boring or well will be inspected for settlement of the grout and more grout will be added as needed. This process shall be repeated until firm grout is at or within one foot of the ground surface.

The specifications for the materials making up the grout are:

- Bentonite will be powdered, granular or chipped sodium montmorillonite furnished in moisture resistant sacks and without additives.
- Cement will be a low-alkaline Portland Cement, Type I in conformance with ASTM C-150 and without additives.

4.1.3 Documentation

Subsurface soil sampling will be documented in the filed log book as well as on a boring log form for each boring drilled. The boring log will be of a form equal to or similar to Figures 5. Pertinent information will, at a minimum, include boring number, date, logger, lithologic description, core recover, OVA or HNu readings, depth of water table and boring completion data.

The following information shall be routinely entered or attached to the soil boring log:

- Depths/heights shall be recorded in feet and fractions thereof (tenths).
- Soil classifications shall be in accordance with the Unified Soil Classification System (equivalent to ASTM D 2487 and 2488).
- Soil classifications which have been prepared in the field at the time of sampling by a WCC representative and are subject to change based upon laboratory tests and/or subsequent review. Factors to consider before changing a field determination include the expertise of the field geologist and laboratory personnel, representative character of the tested sample, labeling errors, etc.

Each soil sample taken shall be fully described in the log. The descriptions of intact samples shall include the following parameters:

- Lithologic Classification and Unified Soil Classification
- Color
- Plasticity
- Consistency (cohesive soil)
- Density (non-cohesive soil)
- Moisture Content. Use relative term.

Other information to be placed on the soil boring logs, as appropriate, include:

- The drilling equipment used will be generally described either on each log or in a general legend.
- Each log will record the drilling sequence.
- All special problems and their resolution will be recorded on the log; e.g., hole caving, recurring problems at a particular depth, sudden tool drops, excessive grout takes, drilling fluid losses, unrecovered tools in hole, lost casing, etc.
- The dates for the start and completion of borings shall be recorded on the log.
- Each sequential boundary between the various soils and individual lithologies shall be noted on the log by depth. When depths are estimated, the estimated range shall be noted along the boundary.

- The depth of first encountered free water shall be indicated along with the method of determination. In addition, when free water is first encountered the following procedure will be followed; Allow the first encountered water to partially stabilize (10 to 15 minutes) and record this secondary level and time between measurements before proceeding.
- The estimated depth interval for each soil sample taken, classified, and/or retained shall be noted on the log. For each driven (split spoon), thin wall (shelby), and cored sample, the length of sample recovery and the sampler type and size (diameter and length) will be recorded.
- For thin wall samplers it should be indicated whether the sampler was pushed or driven. Blow counts shall be recorded in half foot increments when standard (1 3/8" ID by 2" OD) samplers are used. For penetration of less than a half foot, it will be noted in the log along with the blow count and the distance over which the count was taken.
- Special abbreviations used on a soil boring log and/or well diagram will be defined either in the log/diagram where used, or in a general legend.

4.1.4 Alternative Method

The hollow-stem drill and sampling methods described above may be deemed inadequate under certain field conditions. Potential problems may include the following:

- Collapse of borehole upon reversing hollow-stem auger out of the borehole.
- Significant hydraulic head from groundwater zones affecting hollow-stem drilling and sampling procedures.
- Larger diameter borehole requirements for setting multiple strings of casing that are not possible with hollow stem drilling capabilities.

If such conditions occur, rotary-wash drilling methods will be implemented to rectify these potential problems. Rotary wash will utilize only potable water that is recirculated through the borehole to remove cuttings. Bentonite drilling mud (organic free) will be used only if required to maintain borehole fluid stability for investigations below the upper pervious zone. Dry auger techniques will be utilized to the top of the uppermost

water bearing zone. Hydraulic rotary drilling operations will use portable recirculation tanks/pans for the "mud pit" and for mixing grouting. Dug pits or sumps will not be used.

Sampling will be taken continuously from undisturbed strata by using either Shelby types or split spoons ahead of the bit, similar to that for hollow stem methods.

4.2 SURFACE SOIL SAMPLING

Surface soil samples will be obtained from areas that are potential pathways for surficial contaminant migration. The samples will be collected in areas as discussed in the RFI Field Investigation Workplan.

4.2.1 Equipment

Sampling equipment will consist of hand sampling tools such as trowels, shovels, or a drive tube sampler. Stainless steel sampling tools will be used if possible.

4.2.2 Procedure

The sample locations will be referenced to site coordinates. The sampling area will be first cleared of vegetation and/or debris. The sample will be collected to a depth of 12 inches such that minimal volatilization is allowed and then transferred in the appropriate container. The hole will be backfilled with native soils and vegetation.

4.2.3 Documentation

As previously stated, the sampling point will be referenced to the site coordinate system and ,if taken with an areal grid, the node number will be recorded. Visual classification and other observations will also be noted in the field log book along with sample number, time, date, and other pertinent information.

4.3 GROUNDWATER SAMPLING

4.3.1 WATER LEVEL MEASUREMENT

4.3.1.1 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:

4.3.1.1.1 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 a 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.

4.3.1.1.2 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 a 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.

4.3.1.2 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.

4.3.1.3 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. Form 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.

Casing Diameter	Casing Volume
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.

4.3.1.4 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 a logbook as described in SOP 3.4.

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 that ± 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:

4.3.2.1 Bailer Purging

Bailers can be used to evacuate shallow wells, and through 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.

4.3.2.2 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.

4.3.2.3 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 liens, 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.

4.3.2.4 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.

4.3.2.5 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.

4.3.3 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.

4.3.3.1 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 monitor well cap of each well will be removed carefully to avoid the incorporation of any contaminants in the well. Any plants or small trees that will be close to the well will also be removed, if possible. Prior to sampling, the initial static water elevation will be measured and recorded. The water level will be measured from the top of the riser piper to the nearest 0.01 foot using a calibrated electronic probe water level sensor (M-scope) or weighted tape (with sounder). Three replicate measurements will be made to verify accuracy. The probe or tape will be cleaned with deionized water after each use.

Following water level measurements, the well will be purged to remove stagnant water which would otherwise bias a representative sample. The purging will be performed using a dedicated bailer. The well will be purged until water parameters of pH, specific conductance, and temperature have stabilized and at least three well volumes or the well is purged to dryness. Purged water will be containerized for treatment. Measurements of pH, specific conductance, and temperature will be taken and recorded during the purging.

Vehicles or any other equipment that might be a potential source of contamination will be placed at a distance far enough from the wells during purging or sampling.

After purging, the well will be sampled with a dedicated or clean bailer. Clean plastic sheeting will be placed on the ground around each well to prevent contamination of the ground or any sampling equipment which is dropped. Care will be taken so that the sample is taken from the screened interval of the well. Samples will be retained in appropriately preserved laboratory containers. No head space will be allowed in VOA vials.

Samples will be collected and containerized in the order of the parameters volatilization sensitivity. Samples for organic compounds should be collected initially. Care will be taken not to allow the bailer to come into contact with the container while pouring the samples.

The following are potential sampling methods:

4.3.3.1.1 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 no 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.

4.3.3.1.2 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.

4.3.3.2 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.

4.3.3.3 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.

4.3.3.4 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.

4.3.3.5 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.

4.4 QUALITY CONTROL SAMPLES

To attain the project quality assurance objectives discussed in this document, certain Quality Control (QC) samples need to be collected and sent to the laboratory. The following is a discussion of those samples:

4.4.1 Trip Blanks

These samples consist of laboratory-prepared VOA vials, filled with volatile organic-free water which are shipped with the sample containers. These vials remain in the sample cooler and are not to be opened. They will be analyzed in the same manner as the collected samples, and are used to monitor volatile organic compounds due to container contributions or contamination during shipment. A trip blank shall accompany each sampling event (defined as the duration of the sampling of the wells in the plant) for which sample for volatile organic analysis are being collected.

4.4.2 Rinsate Blanks

These samples are used to monitor contamination resulting from the sampling equipment and also to monitor the effectiveness of equipment decontamination procedures. Rinsate samples are collected by pouring reagent grade water over decontaminated sampling equipment, in such a manner as to contact the same surfaces

as the samples and collecting that water for analysis. Rinsate blanks will be collected at a minimum of one per sampling event. If there is more than one type of parameter being monitored in that sampling event, the rinsate blank will be analyzed for only the organic constituents (volatile and semivolatile, if applicable).

4.4.3 Sample Preservation and Shipment

The appropriate preservative will be added to each sample bottle by the laboratory prior to being taken into the field. Table 8 lists containers, preservatives, and holding times for the parameters being analyzed in this program.

Once the sample is placed in the bottle, a label should be affixed to the bottle. The label shall contain the following information: plant area, sample number (monitor well number), date, time of sample collection, parameter for analysis, preservative (if any), and the collector's name. The samples shall be placed in an ice chest containing an adequate volume of ice to maintain samples at 4°C. The ice chest should be sealed for shipment.

All samples will be continuously tracked in the field and while in transit. A chain-of-custody form shall accompany the samples at all times. The sample custody procedures are further described in Section 4.4 of this document.

4.5 GROUTING

Following completion of each borehole, the borehole will be grouted with a cement/bentonite grout (4 to 8 percent bentonite by dry weight). The grout shall consist of Portland cement and powdered sodium bentonite. The grout mix will consist of a pumpable cement/bentonite slurry. The grout shall be mixed in clean, above ground, rigid containers with an appropriate quantity of water. The mixing of each component will be achieved by a mechanical paddle device or recirculation with a grout pump. Mixing activities will continue until a smooth, lump free consistency is achieved.

The grout mixture shall be pumped through a rigid, side discharge tremie pipe placed approximately 6 inches above the bentonite seal for monitor well installation or on the

bottom of the hole for plugging and abandonment of soil borings. The grout mixture shall be pumped until undiluted grout flows from the annulus at the ground surface. The tremie pipe may be slowly withdrawn during grouting operations. The estimated volume of grout will be computed for each boring or well, based upon borehole dimensions and well dimensions. If actual grout placed is less than or exceeds 50 percent of the computed volume, the grouting for that boring or well will be evaluated to determine if grouting problems are present (i.e. caving or excessive grout takes).

After a minimum 24-hour period, the boring or well will be inspected for settlement of the grout and more grout will be added as needed. This process shall be repeated until firm grout is at or within one foot of the ground surface.

The specifications for the materials making up the grout are:

- Bentonite will be powdered, granular, or chipped sodium montmorillonite furnished in moisture resistant sacks and without additives.
- Cement will be a low-alkaline Portland Cement, Type I in conformance with ASTM C-150 and without additives.

4.6 AQUIFER TESTING

Single well tests are referred to as slug tests. These tests are performed by suddenly adding or removing a slug (known volume) of water from a monitor well and observing the recovery of the water surface to its original level. In systems where the entire depth of the aquifer formation is screened, such tests provide information on the horizontal component of hydraulic conductivity. When only a portion of the aquifer depth is screened, the slug test results give a hydraulic conductivity containing both horizontal and vertical components. Most of the pressure loss (head loss) is dissipated in a horizontal direction, therefore, the value of hydraulic conductivity evaluated is assumed to be most horizontal. Bower (1978) discusses a slug-test procedure applicable to fully or partially penetrating wells in unconfined aquifers. He discusses the use of dimensionless solutions of the Thiem equation to determine the hydraulic conductivity from observed values of water level and elapsed time.

4.6.1 Equipment

Slug testing equipment will consist of:

- Pressure transducer(s)
- Suspended weight of known volume (slug).
- Electric water level probe and/or steel tape.
- Data logger (recorder)
- Field data printer.

Since the pumping test program will be developed after performing the slug testing, it is not possible to identify equipment to be used in conducting the pumping test(s) at this time. A listing of such equipment will be compiled when the pumping test program has been developed and will be approved by EPA.

4.6.2 Procedure

The specific slug test performed will be a falling head test followed by a rising head test. Measurements of the behavior of the monitor well system as it returns to equilibrium are then made and used for analysis. The test will be run until the system has achieved 90 percent equalization. Field procedures for slug testing are as follows:

1. The magnitude of instantaneous head change resulting from introduction or removal of the slug shall not cause water to overflow the well casing. To assure meeting these requirements, magnitude of head change shall be determined prior to introduction of the slug. The magnitude determination shall be based on the calculated volume of the slug and the inside diameter of the casing. The test shall proceed only when these requirement are met.

2. All equipment entering the well shall be decontaminated prior to placing into the well. Decontamination shall consist of triple rinsing with deionized water.

3. The static water level shall be measured using an electronic water level sensor or weighted tape.

4. When the transducer is lowered into the well and in place, the slug shall be introduced to the well as rapidly as possible without causing undue splashing or turbulence so as to produce an instantaneous head increase. The instant the slug is set in place, the reference time will be time zero.

5. Water levels shall be measured continuously (millisecond intervals) with the transducer and recorded with the data logger unit. Measurements shall be terminated when the water level stabilizes or when the water level has reached a level within 10 percent of static level.

6. Water level measurements recorded shall be checked for credibility before proceeding to the next testing stage (removal of the slug).

7. When checking of data has been completed and the previous testing has been determined to be acceptable, the slug shall be removed from the well as rapidly as possible to produce an instantaneous head reduction . The instant the slug is removed from the water, the reference time will be time zero.

8. Water levels shall be measured continuously (as in the previous testing stage) using the transducer and shall be recorded using the data logger unit. Measurements shall be terminated when the water level stabilizes or reaches a level within 10 percent of initial static water level.

9. When measurements are terminated, the transducer shall be removed from the well.

10. Water level measurements recorded shall be checked for credibility before proceeding to the next we..

11. Any test or test stage shall be repeated if review of the recorded data indicates questionable validity.

The data from the slug test will be reduced to evaluated time versus change in water level using the methods of Cooper, et al. (1967) or Bower and Rice (1976). Upon evaluating the results of the slug test, a pumping test plan will be developed and presented to the EPA for approval.

4.6.3 Documentation

Water level data shall be recorded with the data logger and preserved for offloading at the Woodward-Clyde Consultants office in Baton Rouge, Louisiana. To the extent possible, print outs shall be obtained for each set of tests during the data checking phase of testing. Printouts obtained shall be properly labelled to indicated the following and shall be preserved as raw field data:

- Monitor Well location
- Monitor Well number
- Date of Test
- Elevation of Base of Test Section
- Elevation of Top of Test Section
- Testing Stage (i.e., slug-in or slug-out)

If a printout cannot be obtained, the data shall be hand recorded in the field log book, if possible or the well will be retested at a later date.

5.0

MONITOR WELL INSTALLATION

Upon completion of the drilling and sampling as described above for borings designated for monitor well installation, shallow and/or deep monitor wells may be installed at locations as determined by the Interim Measures piezometer and expanded groundwater testing data.

5.1 EQUIPMENT

In addition to drilling and sampling equipment described in Section 1.1, the material required for well installation will consist of:

- A screen to allow entry of ground water.
- A bentonite pellet seal above the filter pack to prevent downward migration into the filter media.
- A filter pack to fill the space between the borehole and the screen with a stable material and to limit entry of fine materials into the well.
- Blank pipe or casing connecting the screen to the ground surface.
- A low permeability grout seal between the casing and the borehole to isolate the screened interval from the ground surface.
- Intermediate casings to seal off permeable zones above the target stratum, as needed.
- A protective casing at the surface.
- A surface slab.
- Protective posts.

5.1.1 Procedure

The monitor well style construction for wells involves drilling of a 10-inch minimum diameter borehole to the total well depth and backfilling the hole in succession with the well screen (with a cap and sump on the bottom), the blank pipe above the screen, a filter pack around the screen, a bentonite pellet layer and cement bentonite grout to the surface.

In the event that it is necessary to "case off" contamination from being carried further subsurface, the following procedure may be followed. (This procedure may be necessary if monitor wells are installed in the landfill area. Such monitor wells will be constructed by drilling a borehole of at least 14-inch diameter through the base of the upper permeable zone and one to three feet, at the discretion of the qualified WCC representative, into the underlying clay. A 12-inch diameter Schedule 40 PVC casing is lowered into the borehole and pushed about one foot into the clay at the base of the

boring. The casing is then grouted in place by pumping a cement bentonite grout through a tremie pipe into the borehole between the outer casing wall and borehole wall. At completion of the grouting, the grout is allowed to cure for 24 hours and the downhole drilling equipment is decontaminated. During the grout set period the casing will be capped to prevent tampering until well installation is resumed. After the grout has set, the inside of the 12 inch casing is thoroughly flushed with clean water. The borehole and well installation are then completed through the casing. Wells will be surveyed upon completion prior to sampling.

Well Screen.

Well screens will be 4-inch diameter Schedule 40 PVC with No. 10 slot size. Connections between the screen and the casing will be threaded. No glues, solvents, epoxies, thermal processes (except welding) or rivets will be used.

A direct measurement of borehole depth by the use of a clean, chemically inert, weighted measuring tape shall be made before screen placement. The depth, to the nearest tenth of a foot shall be recorded on the well construction log.

The borehole shall be purged or flushed with water, to the extent practical of drill cuttings and any bentonite drilling mud used during construction. If during construction unstable soils or other factors resulting in side wall caving or "blow-in", were encountered, the use of temporary casing will be required. The temporary casing shall be steam cleaned and free of coatings and rinsed with water prior to use.

The screen shall be new, commercially fabricated continuously wound or slotted screen with a four-inch nominal diameter. No fittings shall obstruct the inside diameter. The screen will be free of foreign matter and steam cleaned prior to use.

Screens shall be 0.01 inch slot and no longer than 10 feet in length nor shorter than five feet. Screens will be placed based on the qualified WCC representative's description of formation materials.

Filter Pack.

After the screen is placed in the borehole the filter pack will be placed around it. The filter pack material will consist of a clean graded sand (typically 20-40 mesh sand).

None of the filter pack aggregate is to come in contact with the ground surface. Any aggregate that comes in contact with the ground surface or is otherwise contaminated shall not be introduced into the well. Filter aggregate may be placed directly from the bag; however, care will be exercised not to include the dust and fines from the bottom of the sack.

The filter pack is to be placed in the well by either tremie pipe or poured down and around the annulus in such a manner as to be distributed around the screen at a uniform height and density.

If temporary casing is used, the filter pack will be placed first and then the casing partially withdrawn to allow the filter pack to slump against the side walls of the boring. Additional filter aggregate will be added to allow for the slight increase in volume.

The filter pack will extend 1 to 2 feet above the top of the screen unless this height prevents proper placement of the bentonite seal. Placement of an adequate bentonite seal shall override the filter pack thickness except that the filter pack will come at least one foot over the top of screen. In no case shall the filter pack extend such that separate permeable zones are connected.

Pipe and Casing.

Blank pipe or casing made of 4-inch diameter Schedule 40 PVC will extend from the top of the screen to between three and four feet above ground surface. This blank pipe will be attached to the screen by a threaded connection. The well casing will be capped with a vented top cap.

Grout Seals.

A bentonite pellet seal shall be 2 or 3 feet in thickness and will be placed in such a manner as to be uniform in thickness around the casing. In placing the bentonite pellets, care will be exercised so as not to incorporate any of the accumulated bentonite fines from the bottom of the packaging container into the annulus.

However, if the soils in this area are unstable to the degree that slumping or collapse of these soils against the permanent wall casing is highly probable, then the bentonite pellet seal shall be placed first and the temporary casing withdrawn as expeditiously as practical. After placement of the bentonite seal, the seal will be given adequate time to hydrate as determined by the qualified WCC representative. After the hydration period, the top of the bentonite seal shall be determined by direct measurement and recorded on the well construction log.

The annular space above the bentonite seal will be grouted. All grout materials shall be placed by pumping through rigid, side discharge tremie pipe. Grouting will be as previously described in Section 1.1.2.

Development.

The newly installed wells will be developed in order to: (1) restore the natural permeability of the formation screened, (2) to remove clay, silt, and other fines from the filter pack and well screen so that subsequent water samples will not be abnormally turbid or contain undue suspended matter, and (3) to remove remnant drilling fluids from the well, filter pack, formation and potential contaminants introduced during the time of drilling.

The development process is best accomplished by causing the natural formation water collected inside the well screen to be moved in through the screen in order to agitate the clay and silt and move these fines into the well where they can be removed. Use of water, other than the natural formation water will not be used due to the possibility of introducing contaminant or atypical water quality to the ground water. Any equipment

used for development will be thoroughly cleaned prior to use within a well to prevent cross-contamination.

Development will be accomplished by bailing with a stainless steel or teflon bailer. The development shall be accomplished in such a manner as not to damage the well screen, or disturb the filter pack. No additional water, dispersing agents, acids, disinfectants, or other additives shall be used during development. A minimum of three volumes of standing water shall be purged during development. Development shall proceed until the following criteria are met:

- The well water is clear (or clear as possible under the limits of possible suspended colloids).
- Three well volumes (minimum) have been removed.
- The specific conductance and/or pH measurements approach a constant value.

All water removed from the wells during development will be containerized and transported to the onsite wastewater treatment facility. Following development the well will be allowed to stand for a minimum of 48 hours before sampling occurs.

Protective Casing

A 8-inch locking protective casing shall be placed around the PVC riser pipe as soon as possible after grout inspection has been completed. The protective casing shall be provided with a threaded, 1/4-inch hole and drain plug at a base of the exposed portion of the protective casing. The protective casing shall fit over the well such that there is sufficient clearance for the well cap accessibility.

The inside of the locking cover of the protective casing shall have the following inscribed, stamped or otherwise permanently affixed:

- Well identification number
- Top of casing elevation
- Well depth

- Screen length
- Date of well installation
- Well construction contractor's name

The locking protective casing, at a minimum, shall be five feet in length and extend just over the riser pipe, and be manufactured of new black iron, steel, or stainless steel pipe or will be protective covers commercially manufactured for that purpose. Prior to placement, the casing shall be steam cleaned and free of any asphaltic or resinous coatings except paint or primer applied by the manufacturer. The casing shall be provided with a locking cap that telescopes or in some similar manner extends over and down the casing to prevent the entrance of rainwater, wind-blown dust particles, or insects into the casing. All protective casings shall be provided with a padlock, which shall be locked until the time of sampling.

Surface Slab.

A concrete slab will be poured at the ground surface around each well after installation. The slab will be at least four inches thick and five feet square and sloped gently away from the well in all directions.

Protective Posts.

Wells located in areas of traffic will be further protected by the erection of four steel posts, or approved alternate, each radially located 4 feet from each well, placed 2 to 3 feet below ground surface, having 3 feet minimally above ground surface. Guard posts shall not be made a part of any protective slab constructed around the well.

5.1.2 Documentation

Each installed well shall be depicted in a well installation report. This report shall be attached to the boring log for that installation and shall graphically denote, by depth from ground surface (unless otherwise specified):

- The bottom of the boring (that part of the boring most deeply penetrated by drilling and/or sampling) and borehole diameter;
- Screen location;
- Granular filter pack;
- Bentonite pellet seal;
- Grout;
- Cave-in(s);
- Height of riser (without cap/plug) above ground surface;
- Protective casing detail;
  -height of protective casing without cap/cover
  -base of protective casing
  -drainage port location and size
  -guard post configuration

The construction report will include:

- The actual quantity and composition of the grout, seals, and granular filter pack used for each well.
- The screen slot size (in inches), outside diameter, schedule/thickness, composition, and manufacturer.
- The outside diameter, schedule/thickness, composition, and manufacturer of the well casing.
- The joint design and composition.
- Location of placement of bentonite pellet seal.
- Location of placement of annular grout.
- Protective casing composition and nominal inside diameter.
- Special problems and their resolutions; e.g., grout in wells, lost casing and/or screens, bridging, etc.
- Dates and times for the start and completion of well installation.

All abbreviations used on the boring logs/well diagrams shall be designated on the log-diagram or in an attached general legend.

6.0 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.

6.1 BORING LOGS

Field boring logs of a type similar to that presented in Figure 5 will include at a minimum the following information for each boring location:

- Project name and number
- Boring number
- Location of boring (including measured offset and reason for offset)
- Drilling method

- Name of WCC representative

Each log will also include:

- Sample location number and depth
- Water levels and the respective times of each reading
- Description of subsurface materials using the Unified Soil Classification System (USCS) including classification, consistency, texture, plasticity, moisture content, color, stratification, etc.
- Sample recovery in inches
- Results of organic vapor monitoring, if required
- Sample interval

6.2 MONITOR WELL INSTALLATION/DEVELOPMENT REPORTS

A monitor well installation report will be completed for each newly installed monitor well at the site. Information on these reports shall include the screening interval, depth to sand pack and bentonite seal, and grout backfill. The report will be documented using a well development form as shown on Figure 9.

6.3 GROUNDWATER SAMPLING REPORT

A sample collection log specific to groundwater sampling will be completed for each monitor well sampled at the site. These reports shall include static groundwater elevation, volumes purged, weather conditions, etc. The report will be on a form similar to Figure 10.

6.4 SAMPLE CUSTODY DOCUMENTATION

Chain-of-custody will be maintained for each sample collected. The chain-of-custody will provide an accurate written record which can be used to trace the possession and holding of samples from the time of collection through data analysis and reporting. The following information will be specified for each sample on the chain-of-custody form:

- Sample number
- Sample date
- Sample time
- Sample location and depth where appropriate
- Analyses to be performed

The chain-of-custody form will be signed by the sample custodian. It will be placed in a water-tight plastic bag and taped to the underside of the lid of the cooler containing the samples designated on the form. The lid of the cooler will be securely taped shut and signed custody seals will be placed on the opening of the cooler lid to allow detection of any possible tampering. Upon arrival in the laboratory, samples will be received by the analytical laboratory representative. Samples contained in the shipment will be compared of the chain-of-custody form to verify that all samples designated have been received. Sample custody within the laboratory will be maintained on internal tracking forms.

The chain-of-custody procedures document sample possession from the time of collection to final disposition. A Sample Analysis Request Form will accompany the Chain-of-Custody form and will document the requested sample analysis.

For the purpose of these procedures, a sample is considered in custody if it is:

- In one's actual possession
- In view, after being in physical possession
- Locked so that no one can tamper with it, after having been in physical custody
- In a secured area, restricted to authorized personnel

A chain-of-custody record will be initiated in the field, and the original will accompany the samples with copies retained at intermediate steps.

Each time responsibility for custody of the sample changes, the new custodian will sign the record and denote the date. A copy of the signed record will be made and retained

by the immediately previous custodian to allow tracking of sample possession. All changes of custody of samples must be a person-to-person change of physical possession.

6.5 ANALYSIS REQUEST

Analysis of the samples collected shall be in accordance with the EPA CLP protocol. All samples shipped for analytical testing shall be accompanied by a Chain-of-Custody form and Sample Analysis Request form for document requested analyses, a copy of which is presented as Figures 11 and 12, respectively.

7.0
DECONTAMINATION

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.

7.1 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.

To prevent contamination prior to drilling operations, the following will be applied:

- Only new materials will be used. Only bagged cement, powdered bentonite in bags or bentonite pellets in well protectors will be used.
- PVC pipe for riser and well screen will be cured and free of plasticizers and oils.

- Workers will wear clean cotton or surgical gloves when handling riser and well screen.
- Electrical tape will not be used to band pumps.

7.2 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 particular 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 HCl 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 well be collected as indicated in the Quality Assurance Plan.

7.3 Pump Decontamination

If a monitor well has been purged or sampled using any of the pumps as discussed, 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.

7.4 Downhole Equipment Decontamination

The drilling rig with associated tools and all sampling equipment will be decontaminated before entering the site and leaving the site. Downhole equipment (i.e., augers, bits, samplers, etc.) will be cleaned between boring or other sampling locations at a decontamination/washdown pad. Wash water will be containerized or transported to the wastewater treatment facility.

The equipment will be cleaned as described below:

- The drill rig, all auger flights, auger bits, drilling rods, drill bits, core barrel samplers, Shelby tubes, or other parts of the drilling and well development equipment that will contact the soil or groundwater should be cleaned with a steam cleaner or hand washed with a brush and detergent to remove oil, grease, and any contamination that has accumulated on the equipment.
- Any sampling equipment which can be safely steam cleaned shall be decontaminated as described above.
- These units should then be rinsed thoroughly with potable water

8.1 ANALYTICAL PROCEDURES

Analytical methods to be used in the investigation will be in accordance with CLP procedures utilizing the following statements of work:

- SOW February 1988 (or more recent) for organics
- SOW July 1988 (or more recent) for inorganics
- SOW September 1986 (or more recent) for 2,3,7,8-TCDD

CLP procedures provide step be step guidelines and requirements for the analysis of TCL and TAL constituents, including detection limits as shown in Tables 2 and 3.

The laboratory selected to analyze the samples for this project will submit a QA plan for review and approval by U.S. EPA prior to initiating project.

In the second phase of the investigation, specific constituents of concern identified from the Phase 1 investigation will be analyzed for utilizing the procedures described above.

8.2 CALIBRATION PROCEDURES AND FREQUENCY

Measuring and test equipment used in the field and laboratory shall be controlled by a formal calibration program. The program shall provide 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.

8.2.1 Calibration Procedures

Documented and approved procedures shall be used for calibrating measuring and test equipment. Whenever possible, widely accepted procedures, such as those published by the ASTI or U.S. EPA, or procedures provided by manufacturers in equipment manuals, shall be adopted.

Calibrated equipment shall be uniquely identified by using either the manufacturer's serial number, an 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), shall be attached to the equipment. If this is not possible, records traceable to the equipment shall be readily available for reference. It is the responsibility of all personnel to check the calibration status from the due date labels or records prior to using the equipment.

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

Reference standards (physical and chemical) shall be used only for calibration. Physical standards shall be stored separately from working measuring and test equipment. Equipment that fails calibration or becomes inoperable during use shall be removed from service and segregated to prevent inadvertent use and shall be tagged to indicate it is out of calibration.

Records shall be prepared and maintained for each piece of calibrated measuring and test equipment to indicate that established calibration procedures have been followed. Laboratory calibration records shall be maintained by the laboratory.

8.2.2 Field Equipment Calibration

Field calibration procedures will be performed on field instrumentation as follows:

- pH Meter - Premeasurement calibration and post-measurement verification using at least two standard buffer solutions for each sample tested. The buffer solutions should bracket the sample pH. The two measurements must be within ± 0.05 standard unit of buffer solution values.

- Conductivity Meter - Daily calibration using potassium chloride (KCl) standard solution. The meter measurement must read ± 10 percent of the standard to be considered in control.

- Temperature - Temperature is measured using a thermostat built into the conductivity meter. The readings will be checked at least once at the start of the field use of the instrument using a quality grade thermometer.

- OVA - The instrument will be calibrated daily to a methane in air standard.

Calibration of field equipment shall be documented in the field log book for reference and maintained in the project files.

8.2.3 Laboratory Equipment Calibration

Laboratory calibration procedures for analytical testing will be performed in accordance with SW-846, 3rd Edition and EPA CLP protocols, as appropriate.

9.0
DATA REDUCTION, REPORTING, AND VALIDATION

Data reduction, validation and reporting will follow strict guidelines as presented in this section. The only data that will be reported will be data that meet the record keeping, quality assurance/quality control criteria and reporting formats as defined in this QA Protocol. Laboratory data review will follow documented data validation procedures. Data will be classified as accepted (quantified), estimated (qualified), or rejected based upon the validation procedures. For samples where the analytical data have been rejected, a decision will be made as to whether the results are critical and resampling is required. Only data that are classified as quantified or qualified will be reported.

The following sections describe the procedures to be used in data reduction, validation and reporting of analytical data. All analytical concentration reports will be reported unambiguously as concentration in μg/L or mg/L for aqueous samples.

9.1 Data Reduction

All concentration 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 both the volatile and semivolatile base/neutral/acid compounds and following an external calibration for both the pesticide and herbicide compounds.

9.2 Data Reporting

The intention of these sampling data reporting procedures is to maintain accurate records of all samples taken and to follow the status of the sample location and analytical results, while minimizing the duplication of record keeping activities and the possibilities for errors.

The tabulation and flow of all data reporting information can be broken down into the following activities:

- Assignment of sample numbers, sample label preparation, and initial permanent record keeping,
- Preparation and labeling of all sample bottles,
- Sampling and in-the-field record keeping,
- Sample receiving and preparation for shipping, and
- Complete sample record book.

9.2.1 Sampling Record Keeping Prior to collecting a group of samples, a sample coordinator will assign a sample number and a description to all samples to be collected within the group. Sample numbers will be assigned to all divisions of the original sample, all of which have the same identification number with letters denoting subset containers. The sample number and corresponding description will be entered into a permanent record book. The information in the record book will then be written onto the appropriate sample label. When written, the sample labels will be given to the individual responsible for preparing the sample bottles.

The typed/printed labels for a group of sequentially numbered samples and a copy of the data book pages that include these numbers will be given to the sample bottle preparer and/or the sampler. This individual is responsible for applying all labels on the appropriate types of bottles. The sample preparer may also be the person who will be doing the sampling. A copy of the data book pages that include information about the samples will also be given to the person doing the sampling in order to provide a list of samples to check off during the sampling activity.

The individual(s) doing the sampling is (are) responsible for verifying that each sample is put in the appropriate sample bottle. At the time of sampling this person must fill in the time sampled, the date sampled, and sign and complete the sample's label. By the end of the sampling day, the sampler must return all samples to the geologist or engineer, who will oversee preparation of the samples for shipment (i.e., review chain-of-custody formes, inspect packaging, etc.

The person responsible for shipping the full sample bottles will compare the sample bottles with the appropriate sample data book pages. This person will then prepare the samples for shipping. Chain-of-custody forms must be completed for each sample; the originals must be sent with the samples, and copies will be sent to the sample coordinator to include in the appropriate project files.

9.2.2 Sample Custody and Shipment When the samples are ready to be sent to the laboratory, the sample coordinator will examine the samples and note their condition. Information including the date sampled, time sampled, and method of preservation,for each sample will be entered in the sample record book.

At the time the samples are shipped, the sample coordinator will have a copy of the pages in the sample record book that include information on the sample numbers and the corresponding information on the date sampled, time sampled, and the date shipped.

The chain-of-custody record will document the fact that the evidentiary integrity of the samples was maintained.

9.2.3 Laboratory Response The laboratory will be responsible for reviewing all sample analyses according to their internal QA/QC procedures. Data validation will be completed by the laboratory prior to the delivery of the data package. Completed data packages will be available for review by the project data validation coordinator and the project QA officer who will also evaluate the laboratory's checks. Any problems will be resolved and all data will be validated before the data are reported.

Laboratory data for all CLP TCL and TAL parameters will be maintained sufficient to be able to generate the standard CLP forms, if necessary at a later date. The quality control data and sample data results will be presented in a concise and convenient tabulated summary. 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. In addition, routine laboratory reports will include the following:

- Chain-of-Custody Records
- Quality Control Summary

- Sample Data Results

When generated, each hard copy CLP data package will provide thorough coverage according to the following areas:

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

The case narrative will provide the following information:

- Sample Identification
- Parameters Characterized
- Analytical Methods Employed
- Any Deviation from the Project Work Plan
- All Problems Encountered
- Any Corrective Actions Taken

9.3 Data Validation

Data validation, according to Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-0050/80, Office of Monitoring System sand 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 purpose of data validation is to determine if the data conform to specifications and are suitable for the intended project usage. Therefore, all data will be subjected to

screening in terms of conformance to project specifications and suitability for use. After completing a sampling program, the field data package (calibration records, chain-of-custody, field logs, etc), will be reviewed for completeness and accuracy. Data validation of analytical data will be completed before any of the results are released. The validation process described below will be done separately from the laboratory performing the analytical work as a separate process from internal laboratory data validation.

The following is a brief description of the methods that will be used during validation of the CLP laboratory data. These data will be reported in a summary data package and evaluated for conformance to the analytical limits set forth in 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). These checks will be performed on all samples analyzed, and the results will be summarized in a report for each lot of reported sample data. Qualified data will be reported as such and the appropriate qualifiers will be used for reporting. Non-CLP data and CLP data reported without the CLP summary data packages will be reviewed with respect to holding times, initial and continuing calibrations, method blanks, laboratory control samples, samples, matrix spikes and matrix spike duplicates or duplicates.

If problems occur which would reject data, the following procedures should detect these problems and the problem data will not be reported. However, rejected data will be addressed in the validation report to evaluate completeness goals.

1) Compile a list of all investigative samples.

2) Compile a list of all QC samples, including but not limited to:
   - -Trip blanks
   - -Laboratory blanks
   - -Laboratory duplicates
   - -Performance samples
   - -Matrix spikes

-Matrix spike duplicates
-Laboratory control spikes
-Laboratory control spike duplicate

3) Review chain-of-custody documents for completeness and correctness.

4) Review laboratory analytical procedures and instrument performance criteria.
   -Sample media identification
   -Sample location and descriptions
   -Proper concentration units
   -Proper significant figures

5) This data summary will be reviewed for potential data quality problems including:
   -Unexpected results
   -Common laboratory contaminants
   -Unusual spacial concentration/identification relationships
   -Samples in which dilution was necessary
   -Samples which may have exhibited "carry over"

6) A sample summary will be prepared to access precision, accuracy and completeness of the analytical data.

7) Laboratory records and data package requirements will be checked to access completeness of the data package.

Laboratory performance results will be documented from the validation procedures or from precision or accuracy evaluations. The validation personnel will provide a means to notify the laboratory and initiate the appropriate corrective actions.

Despite all efforts to achieve the objectives of the laboratory QA/QC plan, the potential for error exists in laboratory chemical analyses and in the data reporting process. Every reasonable effort will be made to compare and double-check data reported from the

laboratory, data entered into the data management system and data subsequently reported in accordance with the procedures described herein.

All analytical results are to be classified as quantified, qualified or rejected through data validation activities. Quantified data are to be used in laboratory reports at the numerical value identified. Qualified data are to be used as an estimate and are not to be used as a quantitative measurement. Rejected data are not to be included in the analytical report. No further use for design or other activities is to be made on the basis of rejected data.

10.0
INTERNAL QUALITY CONTROL

10.1 DATA TRANSCRIPTION

All data transcriptions for final reports will be reviewed before reporting. Data transcription requirements may vary, but should be monitored in accordance with requirements for accuracy and legibility.

10.2 FIELD SAMPLING QUALITY CONTROL

Quality control for field sampling includes duplicate samples, field blanks and rinsate blanks. Steps and checks used to validate precision and accuracy of the measured parameters and to support the representativeness, comparability, and completeness of the work include:

- Description of the calibration of methods and instruments,
- Description of routine instrument checks (noise levels, drift, linearity, etc).,
- Documentation of traceability of instrument standards, samples and data,
- Documentation on analytical methodology and QC methodology,
- Description of applicable performance audits with appropriate audit materials,
- Description of controls for interference contaminants in analytical methods (use of reference blanks and check standards for method accuracy and precision),
- Description of levels of routine maintenance to verify analytical reliability, and
- Documentation of sample preservation and transport.

10.3 VERIFICATION AND REVIEW

The laboratory analyst should review data to verify that where appropriate, the laboratory:

- Calculates the recoveries of surrogate spikes,
- Verifies that there are no contaminants in all associated blanks,
- Compares samples and duplicates for matches in data results,
- Reviews surrogate and spike recovery data to make sure they are within quality acceptance limits,
- Verifies calibration performance for acceptability,
- Reviews and verifies instrument tuning,
- Reviews internal areas of response for acceptability.

Upon meeting all technical criteria, the sample folder will then be review to:

- Make sure the surrogate recovery section has been completed
- Make sure that all analyzed compounds have been properly recorded
- Confirm identified sample spectra with standard spectra
- Verify accuracy of calculations on compound quantities.

The supervisor examines the entire sample folder to verify that all data transcriptions and documentation included meets wcc requirements. The supervisor also reviews all data enclosed to verify that the data transcriptions are error free and that all documents are legible and in contractual order.

The laboratory QA department performs the review of completed folders on a percent complete basis to verify that the data is present so the WCC can evaluate data quality.

11.0
PERFORMANCE AND SYSTEM AUDITS

In order to verity that procedures outlined in the Quality Assurance Plan and the Sampling Plan, performance and system audits should be conducted. Such audits help to verify that the integrity of the data and related information is maintained.

11.1 FIELD ACTIVITY AUDITS

A senior project personnel or designee should periodically conduct audits of the collection activities to verify that proper sampling protocol is being followed. Some of the items to evaluate include (but are not limited to): sampling operations, sampling labelling, sample handling, field notes, decontamination procedures, and chain-of-custody. The auditor will prepare a summary audit report containing the result of the evaluation and recommendations for any corrective actions.

At a minimum, the auditor will check the following items to determine the completeness and accuracy of field activities:

1. Sample Labels: A selected number of sample labels will be examined to determine if they were filled out properly and completely.

2. Chain-of-Custody Procedures: Several chain-of-custody records will be examined to determine if they were properly filled out; if parameters for analysis were properly identified; all custody transfers were documented; and date and time of transfer were recorded.

3. Field Notebooks: The notebooks will be examined to determine if proper recording format is being followed; if al insitu measurements and filed observations are being documented suitably to explain and reconstruct field activities.

Intermittent audits may be performed by members of the sampling team for each filed sampling task. one independent team member may audit other members who are performing a separate task (i.e., sample handling member may audit sample collection). Results of audits will be included as part of the interim progress reports to the U.S. EPA.

11.2 LABORATORY PERFORMANCE AUDITS

The performance of laboratories in the U.S. EPA Contract Laboratory Program is monitored by the agency by using quarterly blind performance samples. Should the laboratory employed to analyze groundwater samples be in the CLP, then acceptable results on the most recent quarterly blind performance evaluation sample will be accepted as demonstrating laboratory capability to perform volatile, semivolatile and pesticide/PCB analyses. Performance evaluation samples should be obtained from a commercial supplier for laboratories that are not part of the EPA Contract Laboratory Program.

An onsite laboratory evaluation helps to verify that all the necessary quality control is being applied by the laboratory in order to deliver a high quality product. One laboratory audit of each laboratory used for sample analysis may be performed during the program. An internal laboratory audit by the respective laboratory QA officer will be performed during the program.

Quality assurance evaluations allow the evaluators to determine that:

- The organization and personnel are qualified to perform assigned tasks.
- Adequate facilities and equipment are available.
- Complete documentation, including chain-of-custody of samples, is being implemented
- Required analytical methodology is being used.
- Adequate analytical quality control, calibration including reference samples, control charts, and documented corrective action measures, is being provided.

- Acceptable data handling, documentation techniques, and data review are being used.

As described above, audit results will be transmitted to the U.S. EPA in the interim progress reports.

12.0
PREVENTIVE MAINTENANCE

In order to timely and effectively complete a measurement effort, an attempt should be made to minimize downtime of all instrumentation. This is achieved by regular inspections of equipment and the availability of spare parts or supplemental instrumentation should the equipment fail.

WCC's preventative maintenance program is designed to minimize the down time of crucial sampling and/or analytical equipment due to expected or unexpected 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.

12.1 Field Instrumentation

All instrumentation to be used in collecting or testing the groundwater samples will be regularly serviced and at a minimum, inspected prior to going out in the field to collect samples.

When laboratory or field equipment is damaged or it cannot be verified that it will produce acceptable data, the equipment will be removed from service to be repaired or replaced. The equipment will not be returned to service until it has been verified that it is capable of producing acceptable data. Acceptable data as referenced here is data which meets quality assurance criteria for precision, accuracy, and representativeness. Equipment leased or purchased to replace damage equipment shall be capable of producing equivalent data. The WCC site managers will be responsible for the repair

and/or replacement of damaged field equipment and filed equipment provided by its subcontractors.

If non-analytical type field equipment is damaged, it will be repaired immediately such that work may progress, or be replaced with similar or equivalent equipment such that the project objectives and the approved work plan will be met. The laboratory manager and site manager will retain documentation for the repair and/or replacement of laboratory and field equipment, respectively. All notable problems with equipment will be included in the interim progress reports to the U.S. EPA.

12.2 Analytical Instrumentation

The laboratory is expected to maintain and inspect their equipment. Instrument redundance, to the extent possible, coupled with an extensive stock of spare parts and expendable materials onsite will serve to minimize downtime.

Subcontract laboratories are inspected to verify that similar preventive maintenance programs are in operation, and are properly documented including the following:

- Accepting data with an acknowledged level of uncertainty.
- Resampling and analyzing.
- Recalibration of instruments using freshly prepared calibration standards.
- Replacement of solvent or other reagents that give unacceptable blank values.
- Additional training of laboratory personnel in correct implementation of sample preparation and analysis methods.

The laboratory manager will be responsible for the repair and/or replacement of damaged laboratory equipment.

13.0
CORRECTIVE ACTION

During the course of this investigation, it will be the responsibility of the supervisor and the sampling team members to see that all measurement and sampling procedures are followed as specified and that measurement data meet the prescribed acceptance criteria. In the event a problem is discovered, it is imperative that prompt and prescribed action to be taken to correct the problem. Corrective action will be initiated, for instance, if QC data are found to exceed acceptability limits.

Whenever corrective action is necessary to eliminate the cause of nonconformance, a closed-loop corrective action system will be used. As appropriate, the sample coordinator, analysis coordinator, or the program manager will verify that all of these steps are followed:

- The problem will be defined,
- Responsibility for investigating the problem will be assigned,
- The cause of the problem will be investigated and determined,
- A corrective action to eliminate the problem will be determined,
- Responsibility for implementing the corrective action will be assigned and accepted,
- The effectiveness of the corrective action will be established, and
- The fact that the corrective action has eliminated the problem will be verified.

13.1 Corrective Action for Field Situations

The need for corrective action will be identified as a result of the field audits previously described as well as by other means (e.g., equipment malfunction). If problems become apparent that are identified as originating in the field, corrective action will take place. If corrective action does not resolve the problem, appropriate personnel will be assigned to investigate and evaluate the cause of the problem. Once a corrective action is implemented, the effectiveness of the action will be verified.

13.2 Corrective Action for Laboratory Situations

The need for corrective action resulting from QA audits will be initiated by the environmental programs coordinator in consultation with the environmental lab personnel. Corrective Action may include, but is not limited to :

- Accepting data with an acknowledged level of uncertainty,
- Resampling and analyzing,
- Recalibration of instruments using freshly prepared calibration standards,
- Replacement of solvent or other reagents that give unacceptable blank values,
- Additional training of laboratory personnel in correct implementation of sample preparation and analysis methods.

14.0
QUALITY ASSURANCE REPORTS TO MANAGEMENT

Quality Assurance reports will include a tabulation of the analytical data and an explanation of any sampling conditions or QA/QC problems and their possible effects on data quality. In addition, audit reports will be issued as appropriate

14.1 ANALYTICAL QA REPORTS

The laboratory analytical program manager, laboratory QA coordinators, QA officer, and the data validation coordinator will communicate as needed to verify that all QA/QC practices are being carried out and to review possible or potential problem areas. Data anomalies are to be investigated to assess whether they are a result of operator or instrument deviation, or if they are a true reflection of the site or task function.

Final analytical reports will contain a discussion of QA/QC evaluations summarizing the quality of the data collected an/or used as appropriate to each phase of the project. The objective of the project QA/QC summary will be to ensure that the data are sufficient in quality and quantity to support the remedial alternative. The QA/QC summary will include:

1. Tabulated results of the analytical data.
2. A report from the QA officer evaluating the results of field and laboratory audits as described in Section 11.0.
3. As tabulation of the data validation work sheets for each batch analysis from the data validation personnel evaluating the validity of the analytical data with respect to accuracy, precision, and completeness.
4. A summary of significant QA problems with the corrective actions taken to rectify the situation.
5. A report by the QA officer summarizing the validity of the analytical data with respect to accuracy, precision, completeness, representativeness, and comparability.

14.2 AUDIT REPORTS

Audit reports will be issued upon completion of any audits. These reports will describe the person involved with audits, what was being audited, and the findings of the audit. Any follow-up or repeat audit to verify corrective action will also be reported.

14.3 PROGRESS REPORTS

As described in the RFI Workplan approach, interim progress reports are to be submitted to the EPA on RFI activities at the end of each phase. Included in these reports will be a summary of any significant QA related information during that period following the guidelines presented above.

APPENDIX E

DATA MANAGEMENT PLAN

(From RFI Workplan to be used as
Guidance for Closure Plan
where Parameters are Applicable)

RCRA FACILITY INVESTIGATION
DATA MANAGEMENT PLAN

VICKSBURG CHEMICAL DIVISION
CEDAR CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI

for:

Cedar Chemical Corporation
Memphis, Tennessee

June 1992

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1.1 INTRODUCTION

During the RCRA Facility Investigation (RFI), various types of data will be generated. At a minimum, data gathered as a part of the RFI will consist of field data sheets, field log books, boring logs, chemical data from analysis of soil and groundwater, field parameter measurements, maps and drawings. This Data Management Plan describes procedures that will be used to physically manage project related information. The Data Management Plan addresses:

- Project organization and responsibilities
- Technical approach to data management
- Flow of data (tracking)
- Data validation and reduction
- Data presentation

A description of primary project personnel and their responsibilities is presented below. Changes in personnel will be reported to U. S. EPA as soon as they become known. Minor changes in procedures presented below will be documented and discussed in the interim reports. Significant changes which may affect data quality will be subject to U. S. EPA approval.

2.1 AUTHORITY AND RESPONSIBILITIES

2.1.1 Project Manager

Richard D. Karkkainen, Vice President and Principal, will serve as Woodward-Clyde Consultants Project Manager. The Project Manager will be the prime contact with the Cedar concerning all the work that is done by Woodward-Clyde Consultants (WCC). Project organization and management procedures will be established by the Project Manager, including reviews and approval of work scope, budget, schedules and reports. The Project Manager will also direct financial reporting and subcontractor recommendations for Cedar's approval.

2.1.2 Site Manager

A Site Manager will be designated for this project. The Site Manager's primary responsibility is to oversee all field phases of the RFI activities under the direction of the Project Manager. Additionally, the Site Manager will manage onsite files and monitor quality assurance in the field.

2.1.3 Task Leaders

The task leader for data management is David O'Brien and the task leader for analytical services is Kathy Burns.

2.1.4 Records Administrator

This project will require the administration of onsite and office central project record files. The records systems managed by the Project Administrator shall provide adequate control, confidentiality, and retention for project-related information. Record control shall include receipt from external sources, transmittal, transfer to storage, and indication of record status. Retention shall include receipt at storage areas, indexing and filing, maintenance, and retrieval. All project files will be secured.

2.2 PROJECT COMMUNICATIONS

2.2.1 Record Control

The control of records provides for the flow of information both internal and external to WCC.

Following receipt of information from external sources, completion of analyses, and issuance of reports or other transmittals; associated records shall be submitted to the WCC office central project files. This shall include any records generated for WCC by subcontractors. Records shall be legible and easily identifiable. In addition, field records and records transmitted between WCC and contractor offices shall be adequately protected from damage and loss during transfer (e.g., hand carrying or making copies prior to shipment).

Field records, laboratory data summaries, numerical calculations, reports and other data transmittals, copies of proposals, purchase orders, contracts, correspondence, memorandums, telephone records, photographs, and reference material shall be transferred to the project central file.

Records submitted to the project central file, with the exception of correspondence, should be bound, placed in folders or binders, or otherwise secured for filing.

2.2.2 Record Status

All individuals on the Project Staff shall be responsible for reporting obsolete or superseded project-related information to the Project Manager on a periodic basis. In turn, the Project Manager shall notify the Project, Laboratory Staff, and Quality Assurance personnel of the resulting status change in project documents, such as drawings and project procedures. Notification of personnel of status changes in quality assurance procedures shall be the responsibility of the Project Manager.

In general, outdated drawings and other documents shall be marked "void." Any copy of void documents maintained for the project files shall state the reasons for and date of voiding.

To denote that calculations, drawings, and other material which have not been formally checked are preliminary, they shall be marked "preliminary".

2.2.3 Record Retention

Information associated with the project shall be retained in the WCC office central project files.
These files will include the following:

- Project central file (project material except drawing originals, records related to laboratory analysis
- Original drawing file
- Generic quality assurance file

Project records shall be received at the various storage areas by designated personnel. Designated personnel shall check that incoming records have proper identification for filing, are legible, and are in suitable condition for storage. Indexing and filing of records shall be performed only by the designated personnel.

For the project central file, the individual file folders shall be divided into appropriate categories based on content and numbered and filed sequentially within each category.

A numbered index for the project central file shall list the individual file folders and identify the records therein to facilitate locating the records. The index shall be kept in a separate folder at the front of the project file. If appropriate, information on project material not stored in the project central file should be included with the index.

For the original drawing and quality assurance files, all material shall be filed only by project number.

The record storage in the central files shall utilize facilities that provide a suitable environment to minimize deterioration or damage and that prevent loss. The facilities shall, where possible, have controlled access and shall provide protection from excess moisture and temperature extremes. Records shall be secured in binders, placed in folders or envelopes, or otherwise secured for storage in containers (e.g., steel file cabinets).

Storage systems shall provide for the prompt retrieval of information for reference or use outside the storage areas. For the project central file, sign out sheets shall be maintained so that a record of files removed is available.

2.2.4 Onsite Records

Appropriate requirements for the field control and retention of records generated as a result of site investigation, sampling, and testing shall be followed. A file, similar to the project central file, will be established and maintained by the field personnel under the direction of the WCC Site Manager.

Upon completion of the field program or program phase, the onsite file will be transferred to, and integrated with, the WCC office central project files.

2.2.5 Change Control

It is imperative that the status of work items be up-to-date. A status system includes:

- Formal document and design drawing revision
- Nonconformance identification, documentation, and reporting
- Change documentation and approval

Change from original design documents, procedures, and specifications must be expected. Change does not imply a nonconformance to the work, but simply means that original plans must be altered because of information or events that occur during the work.

Change must be documented, evaluated, and reported as necessary. It is necessary to manage change so that the actual course of the project, not the original plan, can be demonstrated and justified. Changes must be documented so that the actual course of work is known and the effect of the change upon the course of work can be evaluated.

It is the responsibility of project personnel to appropriately record the change and to make the documentation available as appropriate to project or laboratory management. The effect of the change upon the project shall be evaluated by the project or laboratory management, quality assurance personnel, and/or subcontractor management. Approval and signatures documenting the approval will be obtained prior to implement changes to the scope by project management and the reviewing agency (U.S. EPA).

Review and written approval for changes which affect the project activities should be provided by the Project Manager. Following the review and approval process, notification of the change should be made to appropriate personnel and affected documents revised as necessary to reflect the work as actually performed.

Project documents and design drawings (as discussed below) must be reviewed, approved, distributed, and revised as necessary. This control will provide approved, up-to-date information and drawings.

3.1 GENERAL PRINCIPLES

Three major approaches to database design are the Network, the Hierarchial and the Relational approaches. These three approaches have their respective strengths and weaknesses and in some applications, one approach is more suited than the others. Of the three methods, the relational approach is gaining momentum in the database market and is used in various applications. Because of its popularity, versatility, ease of use and the availability of many commercial relational database packages, WCC has chosen the relational approach for its design of the Cedar database.

In the relational approach, the information is stored in tables and columns. A table is called a relation and columns are the attributes of the relation. A good relational design of a database management system minimizes data redundancy, maintains data consistency and ensures data integrity. Data redundancy refers to the storing of the same information in multiple tables. Redundancy can rarely be totally eliminated but can be reduced. Data consistency refers to maintaining redundant data in the same form at all locations in the system. That is, if data is changed at one location, the system should propagate similar changes in that data in other related tables. This action ensures the integrity of the data in the database.

3.2 OBJECTIVES OF THE SYSTEM

The data management, as defined herein for this project, refers to the actual management of the data, but also includes data validation. Quality Assurance/Quality Control (QA/QC) deals with data validation procedures. WCC has identified the following objectives for effectively managing the field data and the laboratory results data from the Cedar site:

1. Store and organize all field, analytical and other data.
2. Track the samples for extraction and analysis holding time deadlines.
3. Validate the analytical results.
4. Make provisions for transmission of data to Cedar.

The above objectives are accomplished through a data management task leader and a data validation task leader.

4.1 DATA MANAGEMENT TEAM

The task leader is responsible for the following:

1. Design and develop a system to store and organize all field and analytical data.
2. Establish procedures to follow as the data arrives from the field and the laboratory.
3. Interface with WCC's technical staff and provide the information they request.
4. Produce tables for reports to Cedar, regulatory agencies and other appropriate groups.
5. Maintain and administer the system developed.

The need for an organized system which facilitates easy and instant access to the information desired, is obvious because of the volume of the data generated by this project. Without such a system, the process to organize the data in the desired manner will be very time consuming and labor intensive. Establishment of proper procedures will streamline the operation of data collection, organization and presentation. Once the system is established, maintenance and administration is essential for its continued success.

4.2 DATA VALIDATION TEAM

The task leader is responsible for the following:

1. Review the QA/QC information for the samples.
2. Validate the analytical results.
3. Contact the laboratory, if inconsistencies exist.
4. Interface with the data management team to insure the validity of analytical results in the data management system.
5. Maintain records of the validation of analytical data.

Validation of analytical results is essential to determine the quality of the analytical data received from the laboratories and assure quality data in the system. The Data Collection Quality Assurance Plan details the method of validation for organic and inorganic analyses.

5.1 ENVIRONMENTAL DATA SYSTEM

To achieve the objectives outlined in section 4.0, data management utilizes an Environmental Data System (EDS) to store and organize all field and analytical data. ORACLE, a commercial relational database system was used to develop EDS. EDS consists of the following modules:

1. Sample General Information
2. Sample Analysis Information
3. Sample Tracking Information
4. Site, Well Information
5. Export - Import

5.1.1 Sample General Information.

This module tracks sample information such as sample number, sample location, date collected, time collected, number of containers used, the type of analysis requested, the person collecting, and so forth. This module has the options for adding, editing, browsing, querying, and printing information.

5.1.2 Sample Analysis Information.

This module tracks analytical results received from the laboratories. It stores the date extracted, date analyzed, concentration and all pertinent information for each sample. It has the same options as before for adding, editing, deleting, browsing, querying, and printing analytical results information.

5.1.3 Sample Tracking Information

This module provides the sample extraction and analysis holding time deadlines for each sample. Reports of extraction and analysis holding time deadlines can be printed for any sample. This kind of reporting will help with data validation.

5.1.4 Site, Well Information

This module tracks site, monitoring well, and other support information required for the project. The system provides add, edit, delete, browse, query, and print options for each entity for this module.

5.1.5 Export - Import

This module provides the mechanism to both export and import data from laboratories and other consultants on the project. The import facility is laboratory specific. The export facility can provide the data requested by the analytical laboratory and others.

The following are procedures to be followed to effectively manage project data:

1. All field and analytical data should be sent to a designated person.
2. The field personnel will send a copy of the Chain-of-Custody (COC) form to the Baton Rouge Office via facsimile after sending a batch of samples to the laboratory for analysis.
3. When the preliminary analytical results arrive, the results are verified with COC, assuring that samples are identified with correct sample numbers.
4. The data management task leader informs the data validation leader, if any discrepancies are found in the data. The coordinator, in turn, notifies the project manager so that discrepancies can be rectified.
5. When the final analytical results arrive, the data package is routed to the data validation task leader for validation.

5.2 DATA REDUCTION AND VALIDATION

Data reduction, validation, and reporting will follow strict guidelines as presented in this section. The only data that will be reported by WCC will be data that meet the record keeping, quality assurance/quality control criteria, and reporting formats as defined in the Data Collection Quality Assurance Plan.

The following sections describe the procedures to be used in data reduction, validation and reporting of analytical data.

5.2.1 Sampling Data

The intention of these sampling data management procedures is to maintain accurate records of all samples taken and to follow the status of the sample location and analytical results, while minimizing the duplication of record keeping activities and the possibilities for errors.

The tabulation and flow of all data management information can be broken down into the following activities:

- Assignment of sample numbers, sample label preparation, and initial permanent record keeping,
- Preparation and labeling of all sample bottles,
- Sampling and in-the-field record keeping,
- Sample receiving and preparation for shipping, and
- Complete sample record book.

5.2.1.1 Sampling Record Keeping

Prior to collecting a group of samples, a sample coordinator will assign a sample number and a description to all samples to be collected within the group. Sample numbers will be assigned to all divisions of the original sample, all of which have the same identification number with letters denoting subset containers. The sample number

and corresponding description will be entered into a permanent record book. The information in the record book will then be written onto the appropriate sample label. When written, the sample labels will be given to the individual responsible for preparing the sample bottles.

The typed/printed labels for a group of sequentially numbered samples and a copy of the data book pages that include these numbers will be given to the sample bottle preparer and/or the sampler. This individual is responsible for applying all labels on the appropriate types of bottles. The sample preparer may also be the person who will be doing the sampling. A copy of the data book pages that include information about the samples will also be given to the person doing the sampling in order to provide a list of samples to check off during the sampling activity.

The individual(s) doing the sampling is (are) responsible for verifying that each sample is put in the appropriate sample bottle. At the time of sampling this person must fill in the time sampled, the date sampled, and sign and complete the sample's label. By the end of the sampling day, the sampler must return all samples to the geologist or engineer who will oversee preparation of the samples for shipment (i.e., review chain-of-custody formes, inspect packaging, etc.

The person responsible for shipping the full sample bottles will compare the sample bottles with the appropriate sample data book pages. This person will then prepare the samples for shipping. Chain-of-custody forms must be completed for each sample; the originals must be sent with the samples, and copies will be sent to the sample coordinator to include in the appropriate project files.

5.2.1.2 Sample Data Management

When the samples are ready to be sent to the laboratory, the sample coordinator will examine the samples and note their condition. Information including the date sampled, time sampled, and method of preservation,for each sample will be entered in the sample record book.

At the time the samples are shipped, the sample coordinator will have a copy of the pages in the sample record book that include information on the sample numbers and the corresponding information on the date sampled, time sampled, and the date shipped.

5.2.2 Analytical Data

5.2.2.1 Data Flow

The laboratory will be responsible for reviewing all sample analyses according to their internal QA/QC procedures. Data validation will be completed by the laboratory prior to the delivery of the data package. Completed data packages will be available for review by the project data validation coordinator and the project QA officer who will also evaluate the laboratory's checks. Any problems will be resolved and all data will be validated before the data are reported. Following satisfactory completion of all QA/QC checks by the laboratory and the project data validation coordinator, the data will be available for external reporting.

5.2.2.2 Data Management

A data validation report will be provided in a timely manner following the completion of the laboratory analytical report. Only data that has been validated are to be released. Data that has been validated will be logged into a data base in which validated results are stored.

5.2.2.3 Data Validation

Data Validation, according to Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-0050/80, Office of Monitoring System 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 purpose of data validation is to determine if the data conform to specifications and are suitable for the intended project usage. Therefore, all data will be subjected to screening in terms of conformance to project specifications and suitability for use. After completing a sampling program, the field data package (calibration records, chain-of-custody, field logs, etc.) will be reviewed for completeness and accuracy. Data validation of analytical data will be completed before any of the results are released. The validation process described below will be done separately from the laboratory performing internal laboratory data validation.

The following is a brief description of the methods that will be used during validation of the CLP laboratory data. These data will be reported in a summary data package and evaluated for conformance to the analytical limits set forth in 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). These checks will be performed on all samples analyzed, and the results will be summarized in a report for each lot of reported sample data. Qualified data will be reported as such and the appropriate qualifiers will be used for reporting. Non-CLP data and CLP data reported without the CLP summary data packages will be reviewed with respect to holding times, initial and continuing calibrations, method blanks, laboratory control samples, samples, matrix spikes and matrix spike duplicates or duplicates.

If problems occur which would reject data, the following procedures should detect these problems and the problem data will not be reported. However, rejected data will be addressed in the validation report to evaluate completeness goals.

1. Compile a list of all investigative samples.

2. Compile a list of all QC samples, including but not limited to:
   - -Field blanks
   - -Trip blanks
   - -Laboratory blanks

-Laboratory duplicates
-Performance samples
-Matrix spikes
-Matrix spike duplicates
-Laboratory control spikes
-Laboratory control spike duplicate

3. Review chain-of-custody documents for completeness and correctness.

4. Review laboratory analytical procedures and instrument performance criteria.

-Sample media identification
-Sample location and descriptions
-Proper concentration units
-Proper significant figures

5. This data summary will be reviewed for potential data quality problems including:

-Unexpected results
-Common laboratory contaminants
-Unusual spacial concentration/identification relationships
-Samples in which dilution was necessary
-Samples which may have exhibited "carry over"

6. A sample summary will be prepared to access precision, accuracy, and completeness of the analytical data.

7. Laboratory records and data package requirements will be checked to access completeness of the data package.

Laboratory performance results will be documented from the validation procedures or from precision or accuracy evaluations. The validation personnel will provide a means to notify the laboratory and initiate the appropriate corrective actions.

Despite all efforts to achieve the objectives of the laboratory QA/QC plan, the potential for error exists in laboratory chemical analyses and in the data reporting process. Every reasonable effort will be made to compare and double-check data reported from the laboratory, data entered into the data management system and data subsequently reported in accordance with the procedures described herein.

All analytical results are to be classified as quantified, qualified or rejected through data validation activities. Quantified data are to be used in laboratory reports at the numerical value identified. Qualified data are to be used as an estimate and are not to be used as a quantitative measurement. Rejected data are not to be included in the analytical report. No further use for design or other activities is to be made on the basis of rejected data.

5.3 OTHER DATA (CALCULATION, LOGS, COMPUTER PROGRAMS, DRAWINGS) REDUCTION AND VALIDATION

During RFI activities, calculations, logs, drawings, and computer programs may be generated as part of some of the RFI tasks (site characterization, risk assessment, etc.) in the form of potentiometric interpretations, calculations for cancer risk, quantity calculations of contaminants, etc. In order to maintain consistency in the development of the data, the following verification procedures are presented.

Numerical analysis, risk assessment, and environmental modeling, if performed, will be subjected to strict controls. Any changes to final analysis, assessments, and modeling will be subject to the same level of control used for the original task.

Analysis, assessment, and modeling activities shall be performed in a planned and controlled manner. Performance responsibility rests with the Project Manager. Prior to initiating the activities, the Project Manager shall discuss the scope of the work, contractual and regulatory requirements, and applicable quality assurance/quality control procedures with assigned personnel. At the request of the Project Manager, this task may be done by Quality Assurance personnel.

5.3.1 Procedures

To provide evidence of satisfactory work performance, analyses, assessments, modeling, and their results shall be completely documented. Documentation may include calculations, computer programs, logs, drawings, and tables.

Calculations

Calculations shall be legible and in a form suitable for reproduction, filing, and retrieval. Documentation shall be sufficient to permit a technically qualified individual to review and understand the calculations and verify the results.

Calculations shall be performed on standard WCC calculation paper whenever possible. All calculations will proved the originator's name and date of work, the checker's name and date, calculation subject, project number, and page number. All of this information shall be completed for each page. For extra pages, such as large graphs, this information shall also be included.

Calculations should, as appropriate, include a statement of calculation intent, description of methodology used, assumptions and their justification, input data and equation references, numerical calculations including unites, and results. Input data may include:

- Regulatory requirements,
- Performance and operational requirements under various conditions,
- Material, geological, environmental, and geotechnical requirements,
- Results of field and laboratory testing or calculations, and
- Information obtained from external personnel or literature and site data surveys.

Computer printouts that becomes an integral part of the calculations shall be referenced in the calculations by run number or other unique means of identification.

At the end of calculations, the results should be summarized if this will provide clarity.

Computer Programs

Computer output shall be dated and clearly identified as to contents. Large sets of output shall be labeled with project name and number, program used, analysis title, and the user's name.

Logs, Drawings, and Tables

The results of analysis, assessment, and modeling activities may be presented in logs, drawing, and tables of various forms. The format of logs and tables shall be governed by the information to be presented. Drawings shall be uniquely identified by drawing or figure number and appropriate title. Standardized symbols and nationally accepted drafting standards shall be used. References to other drawings and sources of information shall be provided, as necessary.

Drawings shall be signed and dated by the draftsperson performing the work and the project task leader or Project Manager who has checked the drawing.

Revisions shall be noted on the drawing original with a revision number and a brief note describing each revision. The note shall be signed and dated by the draftsperson performing the work and the project task leader or Project Manager who has checked the revision.

Indication of final drawing and revision approval shall be through signing and dating the drawings by the project task leader or Project Manager.

5.3.2 Verification

Calculations, computer program input, logs, drawings, and tables shall be formally checked using the process outlined in the following paragraphs.

Calculations

Verification of calculations shall be performed by an individual(s) other than the persons who performed the original work, or specified the method or input parameters to used. The individual(s) selected shall have technical expertise in the calculation subject.

It is emphasized that a numerical check is not sufficient. The checker is responsible for every item on every sheet-including the completion of the title block and page numbers.

To properly check calculations:

- The originator supplies the designated checker with a machine copy of the calculations. Originals should not leave the originator's possession until they are ready for final checker *signing*,
- The checker marks the calculation copy with a highlighter for all items he approves,
- The checker marks the calculation copy with a highlighter for all items he approves,
- If the checker disagrees, for any reason, the checker crosses through the item with different colored markers and writes the recommended correction or comment above it,
- The checker initials and dates all pages of the checkprints,

- The checker returns the checkprints to the originator who, in turn, reviews all recommended changes. If a disagreement exists, the originator adds comments to the checkprints using a third color and then confers with the checker until all differences are resolved,

- The originator corrects, or "scrubs," the calculation originals so they agree with the checkprints. A one-to-one correspondence between the originals and checkprints must exist,

- The originator gives the originals the checkprints to the checker who compares them to verify agreed-to-corrections have been made, and

- When the checker is satisfied, he signs and dates the originals.

Computer Program Input

Computer input shall be formally checked using the process outlined above. A single exception to this process is that the checking may be performed on the input originals. The verification shall include a conceptual review of the program itself based on the problem being solved, a review of the computer model employed, a check that the program has been verified, and a formal check of the input data.

Drawings

Drawings shall be checked like calculations using different colored markers. Checkprints of the same drawing shall be marked CP1, CP2, etc., to show progression of the checking process.

If a drawing is revised, the entire checking process shall be repeated for the revised areas only. A new checkprint shall be prepared.

Logs and Tables

Final subsurface logs shall be verified by the responsible member of the Site Characterization Team. The verification shall provide that changes from the original field representative's logs to the final log sheets are consistent with the results of other investigations. The final log sheets shall be checked in the same manner as all calculations or drawings, with the checker signing and dating all checkprints.

In addition, all final tables presenting information, data, or the results shall be checked using the process previously described. Checkprints of the same table shall be marked CL1, CL2, etc., to show progression of the checking process.

5.4 DATA PRESENTATION

AutoCAD, a computer aided design program is used for drawing maps and various figures. A base map will be used to produce the site map for field personnel and to produce maps of contaminant concentrations.

5.5 DATA MEASUREMENT ASSESSMENT PROCEDURES

This section summarizes QA/QC procedures for assessing the chemical data derived from the sampling and chemical analysis tasks. This same information is found in the Data Collection Quality Assurance Plan.

The data validation procedures will be used by the QA officer and the data validation coordinator for assessing duplicate and spike samples and checking blank samples that are submitted to the analytical laboratory from the field or generated internally by the laboratory. The purpose of implementing these procedures is to verify that the chemical data generated during the project are accurate, precise, complete, and representative of site conditions.

Detailed discussions of the procedures for data validation are presented in Section 5.2.3. The format for QC data assessment reporting is presented below.

5.5.1 Procedures for Assessing Data Accuracy, Precision, and Completeness

Chemical data derived from the project will be assessed for accuracy and precision for both the analytical laboratory and field sample collection programs. The primary goal of the program is to verify that the data reported during the project are representative of conditions in the local study area. To meet this goal, a combination of procedures and qualitative evaluations will be used to check the quality of the data. Sample recollection and analysis will be used only if the data are rejected and sample results are deemed to be critical to the determination of a project objective.

The QA/QC assessment program will evaluate the project's data based on the types of quality control samples described in the Data Collection Quality Assurance Plan. The procedures for evaluating both the project and laboratory QA/QC data are the same and are presented below for QA/QC spikes, blanks, and duplicate and/or replicate samples.

5.5.2 Blanks

The evaluation procedure for blanks is a qualitative review of the chemical analysis data reported by the laboratories. The procedure for assessing blank samples will be as follows:

1. Tabulation of the data from the blank samples,
2. Identification of any blank samples that have chemicals detected in the sample,
3. If no chemicals are detected in the blank samples, the tables are ready for entry into the appropriate report,
4. If any chemicals are found in blank samples, the compound(s) and concentration(s) will be reported and the field data for that period of time will be assessed for potential problems with data interpretation. Data may be removed from the data base on the basis of chemicals being detected in blank samples. Appropriate notations, however, will be made in the data base reports,

5. Quality control records will be maintained for each source of water which is used. These records shall demonstrate over time the presence/absence and level of contaminants found.

5.5.3 Spikes

The procedure for assessing spike samples will be as follows:

Tabulate spike sample data and calculate the Spiked Sample Recovery (SSR) percent as shown below for each sample.

$$SSR\ (\%) = \frac{(T-X)}{A} \times 100$$

where:
T = total concentration found in spiked sample
X - original concentration in sample prior to spiking
A - actual spike concentration added to sample

A comparison of the spiked sample calculated recoveries will be made to the percent recovery for each spiked analyte as specified within U.S. EPA CLP, as appropriate.

5.5.4 Duplicates

The procedure for assessing duplicate and replicate samples will be as follows:

Tabulate duplicate data and calculate the Relative Percent Difference (RPD) as shown below for each duplicate pair:

$$RPD\ (\%) = \frac{(X1 - X2)}{X} \times 100\%$$

where:
X1 = concentration for Sample 1 of duplicate
X2 = concentration for Sample 2 of duplicate
X = average of Samples 1 and 2

The calculated relative percent difference will be compared to the control limit values given in the EPA CLP, as appropriate for each of the spiked analytes to qualitatively

evaluate the significance of the data. The evaluation will focus on historic variations in concentrations, whether problems arise for one particular compound or random compounds and whether the problem is limited to one sampling location, sample homogeneity, the amount of the spike, etc. If data quality problems arise, the analytical data will be annotated, and the laboratory will be notified for corrective action, as appropriate. Data will be reported only if approved by data validation coordinator or the QA officer. The laboratory and the data validation personnel must review the analytical data in a timely fashion for an effective data evaluation process.

The laboratory data verification and review process includes a review of the data file for completeness, the results, and includes a preliminary QA/QC review. The laboratory data package (or report) is reviewed to locate and check the following, where appropriate.

- Laboratory and field blanks for verification of frequency and that there are no contaminants in the associated blanks and, if present, assess their impact on interpretation of the data.
- Field and laboratory duplicates to determine if the data results match adequately and if the frequencies are acceptable.
- Spike recovery data to assure they are within quality acceptance limits and frequencies are acceptable.
- Calibration documentation to verify equipment performance is acceptable.
- Accuracy and precision of Laboratory Control Samples.
- Instrument tuning documentation to verify successful completion.
- Holding time evaluation.

5.5.5 Identification of Outliers

A reported concentration value that is much different from most other values in a data set for the same group is referred to as an "outlier." The reasons for outliers can include:

- Inconsistent sampling or analytical chemistry methodology
- Errors in transcription of data values or decimal points
- Actual but extreme concentration values
- Amended errors in analytical methodologies

The procedures described for data validation and review will identify any outliers that are due to the first two causes mentioned above. Any outlier not attributable to these two causes may be due to actual but extreme concentration values. The data point in question will then be compared to data from similar settings. For example, a reported high concentration of one compound in ground water from a well will be compared to previous data from the same well, if available, and/or compared to data from nearby wells. Also, other aspects of the reported data will be examined to determine if a high reported concentration of a single constituent occurs in other samples but cannot be duplicated in replicate or QC samples. Sample results designated as "outliers" may be resampled and analyzed if deemed to be necessary by WCC.

APPENDIX F

TRUST AGREEMENT

THIS AGREEMENT, entered into as of the ___ day of _____, 1992, by and between **CEDAR CHEMICAL CORPORATION**, a Delaware corporation (the "Grantor"), and **FIRST NATIONAL BANK**, Vicksburg, Mississippi (the "Trustee").

WHEREAS, pursuant to the provisions of Paragraphs V and VI of that certain Consent Decree entered in United States of America v. Cedar Chemical Corporation, Civil Action No. W92-0008(B), in the United States District Court for the Southern District of Mississippi (the "Consent Decree"), the Grantor is required to provide financial assurance for the closure of a container management area located on Grantor's Plant referred to in Exhibit A attached hereto in accordance with certain regulations of the Mississippi Department of Environmental Quality ("MSDEQ"), an agency of the State of Mississippi, and, in the event that said container management area cannot be "clean closed", to provide financial assurance for post-closure care of such area; and

WHEREAS, the Grantor has elected to establish a Trust to provide all or part of such financial assurance in accordance with regulations of the MSDEQ equivalent to 40 CFR §264.151 (a) (1), as required under the Consent Decree; and

WHEREAS, the Grantor, acting through its duly authorized officers, has selected the Trustee to be the Trustee under this Agreement and the Trustee is willing to act as Trustee hereunder.

NOW, THEREFORE, the Grantor and the Trustee agree as follows:

Section 1. Definitions. As used in this Agreement:

(a) The term "Grantor" means the owner or operator who enters into this Agreement and any successors or assigns of the Grantor.

(b) The term "Trustee" means the Trustee who enters into this Agreement and any successor Trustee.

Section 2. Identification of Facilities and Cost Estimates. This agreement pertains to the facilities and closure cost estimates identified in attached Schedule A. In the event that this Trust shall also be intended to provide financial assurance for post-closure care of the said facilities, the Grantor will amend Schedule A by including a post-closure care cost estimate which shall be submitted to the Trustee along with additional funds in such amount as shall provide assurance of such post-closure care, which amount the Grantor shall then add to the trust fund created hereby.

Section 3. Establishment of Fund. The Grantor and the Trustee hereby establish a trust fund (the "Fund") for the benefit of MSDEQ. The Grantor and the Trustee intend that no third party have access to the Fund except as herein provided or as required hereafter pursuant to the Consent Decree. The Fund is established initially by the Grantor by the payment, in immediately available funds, of that sum specified in Schedule A attached hereto. Such property and any other property subsequently transferred to the Trustee is referred to as the Fund, together with all earnings and profits thereon, less any payments or distributions made by the Trustee pursuant to this Agreement. The fund shall be held by the Trustee, IN TRUST, as hereinafter provided. The Trustee shall not be responsible nor shall it undertake any responsibility for the amount of adequacy of, nor any duty to collect from the Grantor, any payments necessary to discharge any liabilities of the Grantor under the Consent Decree.

Section 4. Payment for Closure and Post-Closure Care. The Trustee shall make payments from the Fund as the Executive Director of MSDEQ shall direct, in writing, to provide for the payment of the costs of closure and, if applicable, of post-closure care of the facilities covered by this Agreement. The Trustee shall reimburse the Grantor or other persons as specified by the Executive Director of MSDEQ from the Fund for closure and post-closure expenditures in such amounts as said Executive Director shall direct in writing. In addition, the Trustee shall refund to the Grantor such amounts as said Executive Director specifies in writing. Upon refund, such funds shall no longer constitute part of the Fund as defined herein.

Section 5. Payments Comprising the Fund. Payments made to the Trustee for the Fund shall consist of cash or securities acceptable to the Trustee.

Section 6. Trustee Management. The Trustee shall invest and reinvest the principal and income of the Fund and keep the Fund invested as a single fund, without distinction between principal and income, in accordance with general investment policies and guidelines which the Grantor may communicate in writing to the Trustee from time to time, subject, however, to the provisions of this section. In investing, reinvesting, exchanging, selling, and managing the Fund, the Trustee shall discharge its duties with respect to the trust fund solely in the interest of the beneficiary and with the care, skill, prudence, and diligence under the circumstances then prevailing which persons of prudence, acting in a like capacity and familiar with such matters, would use in the conduct of an enterprise of a like character and with like aims; except that:

(i) Securities or other obligations of the Grantor, or any other owner or operator of the facilities, or any of their affiliates as defined in the Investment Company Act of 1940, as amended 15 U.S.C. § 80a-s. (a), shall not be acquired or held, unless they are securities or other obligation of the Federal or State government;

(ii) The Trustee is authorized to invest the Fund in time or demand deposits of the Trustee, to the extent insured by an agency of the Federal or State government; and

(iii) The Trustee is authorized to hold cash awaiting investment or distribution uninvested for a reasonable time and without liability for the payment of interest thereon.

Section 7. Commingling and Investment. The trustee is expressly authorized in its discretion:

(a) To transfer from time to time any or all of the assets of the Fund to any common, commingled, or collective trust fund created by the Trustee in which the Fund is eligible to participate, subject to all of the provisions thereof, to be commingled with the assets of other trusts participating therein; and

(b) To purchase shares in any investment company registered under the Investment Company Act of 1940, 15 U.S.C. § 80 a-1 et seq., including one which may be created, managed, underwritten, or to which investment advice is rendered or the shares of which are sold by the Trustee. The Trustee may vote such shares in its discretion.

Section 8. Express Powers of Trustee. Without in any way limiting the powers and discretion conferred upon the Trustee by the other provisions of this Agreement or by law, the Trustee is expressly authorized and empowered:

(a) To sell, exchange, convey, transfer, or otherwise dispose of any property held by it, by public or private sale. No person dealing with the Trustee shall be bound to see to the application of the purchase money or to inquire into the validity or expediency of any such sale or other disposition;

(b) To make, execute, acknowledge, and deliver any and all documents of transfer and conveyance and any and all other instruments that may be necessary or appropriate to carry out the powers herein granted;

(c) To register any securities held in the Fund in its own name or in the name of a nominee and to hold any security in bearer form or in book entry, or to combine certificates representing such securities with certificates of the same issue held

by the Trustee in other fiduciary capacities, or to deposit or arrange for the deposit of such securities in a qualified central depository even though, when so deposited, such securities may be merged and held in bulk in the name of the nominee of such depository with other securities deposited therein by another person, or to deposit or arrange for the deposit of any securities issued by the United States Government, or any agency or instrumentality thereof, with a Federal Reserve Bank, but the books and records of the Trustee shall at all times show that all such securities are part of the Fund;

(d) To deposit any cash in the Fund in interest-bearing accounts maintained or savings certificates issued by the Trustee, in its separate corporate capacity, or in any other banking institution affiliated with the Trustee, to the extent insured by an agency of the Federal or State government; and

(e) To compromise or otherwise adjust all claims in favor of or against the Fund.

Section 9. **Taxes and Expenses.** All taxes of any kind that may be assessed or levied against or in respect of the Fund that all brokerage commissions incurred by the Fund shall be paid from the Fund. All other expenses incurred by the Trustee in connection with the administration of this Trust, including fees for legal services rendered to the Trustee, the compensation of the Trustee to the extent not paid directly by the Grantor, and all other proper charges and disbursements of the Trustee shall be paid from the Fund.

Section 10. **Annual Valuation.** The Trustee shall annually, at least 30 days prior to the anniversary date of establishment of the Fund, furnish to the Grantor a statement confirming the value of the Trust. Any securities in the Fund shall be valued at market value as of no more than 60 days prior to the anniversary date of establishment of the Fund. The failure of the Grantor to object in writing to the Trustee within 90 days after the statement has been furnished to the Grantor shall constitute a conclusively binding assent by the Grantor, barring the Grantor from asserting any claim or liability against the Trustee with respect to matters disclosed in the statement.

Section 11. **Advise of Counsel.** The Trustee may from time to time consult with counsel, who may be counsel to the Grantor, with respect to any question arising as to the construction of this Agreement or any action to be taken hereunder. The Trustee shall be fully protected, to the extent permitted by law, in acting upon the advice of counsel.

Section 12. Trustee Compensation. The Trustee shall be entitled to reasonable compensation for its services as agreed upon in writing from time to time with the Grantor.

Section 13. Successor Trustee. The Trustee may resign or the Grantor may replace the Trustee, but such resignation or replacement shall not be effective until the Grantor has appointed a successor trustee and such successor accepts the appointment. The successor trustee shall have the same powers and duties as those conferred upon the Trustee hereunder. Upon the successor trustee's acceptance of the appointment, the Trustee shall assign, transfer, and pay over to the successor trustee the funds and properties then constituting the Fund. If for any reason the Grantor cannot or does not act in the event of the resignation of the Trustee, the Trustee may apply to a court of competent jurisdiction for the appointment of successor trustee or for instructions. The successor trustee shall specify the date on which it assumes administration of the trust in a writing sent to the Grantor, the Executive Director of MSDEQ, and the present Trustee by certified mail 10 days before such change becomes effective. Any expenses incurred by the Trustee as a result of any of the acts contemplated by this Section shall be paid as provided in Section 9.

Section 14. Instructions to the Trustee. All orders, requests, and instructions by the Grantor to the Trustee shall be in writing, signed by Grantor's Secretary of Treasurer. The Trustee shall be fully protected in acting without inquiry in accordance with the Grantor's orders, requests, and instructions. All orders, requests, and instructions by the Executive Director of MSDEQ to the Trustee shall be in writing, signed by the said Executive Director or his designee, and the Trustee shall act and shall be fully protected in acting in accordance with such orders, requests, and instructions. The Trustee shall have the right to assume, in the absence of written notice to the contrary, that no event constituting a change or a termination of the authority of any person to act on behalf of the Grantor or MSDEQ hereunder has occurred. The Trustee shall have no duty to act in the absence of such orders, requests, and instructions from the Grantor and/or MSDEQ, except as provided herein.

Section 15. Amendment of Agreement. This Agreement may be amended by an instrument in writing executed by the Grantor, the Trustee, and the Executive Director of MSDEQ, or by the Trustee and the Executive Director of MSDEQ, if the Grantor ceases to exist.

Section 16. Irrevocability and Termination. Subject to the right of the parties to amend this Agreement as provided in Section 16, this Trust shall be irrevocable and shall continue until terminated at the written agreement of the Grantor, the Trustee, and the Executive Director of MSDEQ, or by the Trustee and the said Executive Director, if the Grantor ceases to exist. Upon termination of the Trust, all remaining trust property, less final trust administration expenses, shall be delivered to the Grantor.

Section 17. Immunity and Indemnification. The Trustee shall not incur personal liability of any nature in connection with any act or omission, made in good faith, in the administration of this Trust, or in carrying out any directions by the Grantor or the Executive Director of MSDEQ issued in accordance with this Agreement. The Trustee shall be indemnified and saved harmless by the Grantor or from the Trust Fund, or both, from and against any personal liability to which the Trustee may be subjected by reason of any act or conduct in its official capacity, including all expenses reasonably incurred in its defense in the event that the Grantor fails to provide such defense.

Section 18. Interpretation. As used in this Agreement, words in the singular include the plural and words in the plural and words in the singular. The descriptive headings for each Section of this Agreement shall not affect the interpretation or the legal efficacy of this Agreement.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed by their respective officers duly authorized and their corporate seals to be hereunto affixed and attested as of the date first above written.

ATTEST:

CEDAR CHEMICAL CORPORATION

BY: _____

BY: _____

TITLE: _____

TITLE: _____
GRANTOR

[Seal]

ATTEST:

FIRST NATIONAL BANK,
Vicksburg, Mississippi

BY: _____

BY: _____

TITLE: _____

TITLE: _____

[Seal]

STATE OF TENNESSEE
COUNTY OF SHELBY

Before me, a Notary Public in and for said State and County, duly commissioned and qualified, personally appeared John C. Bumpers, with whom I am personally acquainted and who, upon oath, acknowledged himself to be the Senior Vice President/Finance and Administration of Cedar Chemical Corporation, and within named bargainor, a corporation, and that he, as such Senior Vice President/Finance and Administration, being authorized so to do, executed the foregoing instrument for the purposes herein contained by signing the name of the corporation by himself as such Vice President and Secretary.

WITNESS my hand and Notarial Seal at office this ___ day of _____, 1992.

_____
NOTARY PUBLIC

My Commission Expires:

_____

STATE OF MISSISSIPPI
COUNTY OF WARREN

Before me, a Notary Public in and for said State and County, duly commissioned and qualified, personally appeared _____, with whom I am personally acquainted and who, upon oath, acknowledged himself to be the _____ _____, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing the name of the corporation by himself as such officer.

WITNESS my hand and Notarial Seal at office this ___ day of _____, 1992.

_____
NOTARY PUBLIC

My Commission Expires:

_____

EXHIBIT A

Facilities and Cost Estimates

Cedar Chemical Corporation
Vicksburg Plant
Post Office Box 3
Vicksburg, Mississippi 39180

EPA ID# MSD 990714081

Closure (Container Storage Area)	$24,500

CLOSURE PLAN

HAZARDOUS WASTE CONTAINER STORAGE AREA
OFF-SPECIFICATION PRODUCT STORAGE AREA

SOUTH PLANT

CEDAR CHEMICAL CORPORATION
VICKSBURG CHEMICAL DIVISION

for:

Cedar Chemical Corporation
Memphis, Tennessee

October 1991

Woodward-Clyde Consultants

Consulting Engineers, Geologists, and Environmental Scientists
2822 O'Neal Lane, Baton Rouge, LA 70896

ADDENDUM TO CLOSURE PLAN

HAZARDOUS WASTE CONTAINER STORAGE AREA

CEDAR CHEMICAL CORPORATION

VICKSBURG, MISSISSIPPI

MSD 990 714 081

APPLICABLE REGULATIONS: MHWMR PART 265 SUBPART G

INTRODUCTION

The following Addendum requirements are regulatory changes to the attached Closure Plan, dated October, 1991 (Revised December 3, 1991). These requirements have been agreed upon by the Mississippi Department of Environmental Quality (MDEQ) and the United States Environmental Protection Agency (EPA). They were derived due to certain inadequacies of the submitted Closure Plan and are to be incorporated into the subject plan. These inadequacies are thoroughly explained in EPA's letter, dated February 7, 1992, to Mr. Steve Spengler of the MDEQ (Attached). This new draft Closure Plan with the new incorporated requirements will be submitted to Public Notice for thirty (30) days as required by the Mississippi Hazardous Waste Management Regulations (MHWMR) Part 265.112 (d)(4). Subsequently the subject plan may or may not be approved depending on the comments that are received.

ADDENDUM REQUIREMENTS

1. Page 4 and Appendix C (page 8) - The closure standard will be based on health based soil concentrations which do not result in a cumulative carcinogenic risk greater than 1×10^{-6} using the most current Carcinogen Slope Factors (which are not necessarily the same as those from the RFI Guidance or the proposed Subpart S Rule), and standard exposure assumptions which are provided in the RFI Guidance. These standard exposure assumptions will also be used when calculating the hazard index for systemic toxicants.

   Health Based Closure Standards for Soils:

Constituent	Concentration	Reference
Dinoseb	80 mg/kg	RFI Guidance Doc. Table 8-7
Arsenic	24 mg/kg	Based on Chronic Oral RfD of 3×10^{-4} mg/kg/day (IRIS)
Toxaphene	0.64 mg/kg	Calculated using 1×10^{-6} risk factor, 70 kg adult, intake of 1×10^{-4} kg/day and a slope factor of $1.1((mg/kg/day)^{-1})$
Atrazine	3.2 mg/kg	Calculated using 1×10^{-6} risk factor, 70 kg adult, intake of 1×10^{-4} kg/day and a slope factor of $.22((mg/kg/day)^{-1})$
Toluene	16,000 mg/kg	Based on Chronic Oral RfD of 2×10^{-1} mg/kg/day, 16 kg child and 2×10^{-4} kg/day

   To achieve clean closure, hazardous waste and waste residue must be removed or decontaminated. To make this demonstration, concentrations of hazardous contituents remaining in the storage area must be below health based levels, since these levels are used to indicate whether or not hazardous waste is still present in the unit.

2. Page 5 "Closure Performance Standard" - The analysis of hydroblast water cannot be substituted for direct sampling and analysis of the concrete to be left in place. However, any solids derived from the hydroblasting process must meet the health based closure standards for soils before disposal into a commercial solid waste disposal facility. To adequately determine clean closure of the concrete to be left in place a more direct method of testing the concrete surface should be used. Therefore the following recommendation is made to wipe-test the surface of the concrete using the random sampling guidelines of Chapter 9 of SW 846 "Test Methods for Evaluating Solid Waste", Third Edition. The basic procedure is to wipe the specified area with a cotton gauze - one to analyze for the organic constituents and one to analyze for the inorganic constituents. Each gauze wipe would be saturated with the appropriate preservative. Blanks would need to be run also to verify the results. The closure standards for this process would need to be based on detection limits since oral exposure routes are highly improbable in this case. If this recommendation is not followed then Cedar Chemical must select some other adequate method for the direct determination that clean closure has been established. This must be done before certification of closure will be accepted.

   Primary Drinking Water Standards to be met by Hydroblast Water:

Constituent	Concentration	Reference
Dinoseb	0.007 mg/l	Proposed MCL FR, July 25, 1990
Arsenic	0.05 mg/l	MCL
Toxaphene	0.003 mg/l	MCL FR, Jan. 30, 1991
Atrazine	0.003 mg/l	MCL FR, Jan. 30 1991
Toluene	1.0 mg/l	MCL FR, Jan. 30, 1991

   These standards must be met before the hydroblast water can be wasted to the environment.

3. Page 6 "Pad and Equipment Decontamination" - Toxaphene was omitted from the list of constituents to be analyzed for in the third paragraph. This sentence shall now read "A representative composite containing bits of plastic sheeting, dislodged concrete, and any other solids generated during the decontamination operations will be sent to a offsite laboratory to test for Toxaphene, Dinoseb, Arsenic, Atrazine, and Toluene."

4. Page 8 "Soil Sampling" - It is stated "In the event that clean closure criteria are not met, soil removal and additional sampling would be required." It must be understood that for clean closure to be certified and verified the health based closure standards for soils and the concrete must be met. If at a point during closure work Cedar Chemical determines that physical excavation is no longer feasible to meet clean closure standards then at that time the MDEQ must be notified and a post-closure plan be submitted as required by MHWMR Part 265 Subpart G.

5. Page 8 "Soil Sampling" - Since sample points have been selected to be collected from areas where the concrete pad is cracked, consideration must be given as to whether or not sample points should also be located around the perimeter of the unit where there may have been contaminated runoff from the pad, or where curbing may have been breached. Therefore it is required that sample points be located adjacent to each evident crack or fissure of the drainage curb of the concrete pad.

6. Page 8 "Soil Sampling" - Although the closure plan states that the "mobility of pesticides in soil underneath the concrete will be limited," specifications from some of the formulations indicate that some of the products stored in these areas were infinitely soluble in water, and as such have the potential to be more mobile than some of the pesticides in their pure form. Based on this observation, it appears that a six-inch sampling depth would be insufficient, especially since the units were in operation for 10 years. Therefore the six-inch proposed sampling depth will be the initial depth that is sampled.

7. Page 9 "Soil Sampling" - The following statement is made: "The Data Collection Plan and Data Management Plan are attached as Appendix D and E." It is not clear that Cedar intends to follow these plans, especially since they are stamped "Draft", and are not referenced in any other manner. Outside of these plans, no information is provided with regard to quality assurance sampling, such as collection and analysis of rinsate blanks, trip blanks, etc. Therefore a rigorous quality assurance/quality control program must be followed while sampling, transporting the samples and analyzing the samples. Refer to Chapter 4 of the RCRA Ground-Water Monitoring Technical Enforcement Guidance Document and SW 846 "Test Methods for Evaluating Solid Waste", Third Edition, for guidance while proceeding in this matter during work.

8. Page 11 "Analytical Methods and Parameters" - It is stated that Cedar will use its onsite laboratory when possible for screening, but no mention is made anywhere else with regard to the purpose of such screening. Such screening does not appear to be necessary for the purpose of demonstrating clean closure.

9. Page 13 "Contingent Closure Plan" - The proposed "flexible

9. continued

cleanup" alternatives based on a site-specific risk assessment and installation of a RCRA cap is not allowed under RCRA regulations. All hazardous constituents in and around the unit must either be removed to achieve the cleanup levels discussed above, or the unit must be redefined as a landfill, undergo post-closure, and obtain a post-closure permit. In this case, installation of a groundwater monitoring system for the unit would also be required.

10. What is the intended future use of the storage areas? If the existing sumps are going to be active after closure, every effort should be made to ensure that any holes in the concrete are properly sealed so that future contaminant migration is minimized. This situation can be avoided if angle borings are taken to collect samples from under the sumps, rather than drilling through the sumps.

11. It is required that Cedar Chemical give ten (10) days notice to the MDEQ prior to commencement of the work activities so that split samples may be taken to help verify the results.

ATTACHMENT

EPA's FINAL COMMENTS TO CLOSURE PLAN

CLOSURE PLAN

HAZARDOUS WASTE CONTAINER STORAGE AREA
OFF-SPECIFICATION PRODUCT STORAGE AREA

SOUTH PLANT

CEDAR CHEMICAL CORPORATION
VICKSBURG CHEMICAL DIVISION

for:

Cedar Chemical Corporation
Memphis, Tennessee

October 1991

Woodward-Clyde Consultants

Consulting Engineers, Geologists, and Environmental Scientists
2822 O'Neal Lane, Baton Rouge, LA 70896

2822 O'Neal Lane
Post Office Box 66317
Baton Rouge, Louisiana 70896
(504) 751-1873
FAX (504) 753-3616

Woodward-Clyde Consultants

December 3, 1991

Mr. Steve Boswell
Director, Environmental Affairs
Cedar Chemical Corporation
Post Office Box 3
Rifle Range Road
Vicksburg, Mississippi 39180

Re: WCC File Number 90B451C

Dear Steve:

The attached closure plan for the drum storage areas has been revised to reflect the comments of the U.S. EPA submitted to Cedar on August 19, 1991 and comments of the MDEQ submitted to Cedar on November 7, 1991. The comments were in reference the closure plan submitted by Cedar to the MDEQ on May 15, 1991.

The following are the U.S. EPA comments and summary of the response:

U.S. EPA Comment:

1.	Page 2 (cover letter)	Response to Comments Comment 2. Facility should have added a sample point rather than relocating from the side to the bottom of the sump.

RESPONSE:

The sample points will be revised such that at each of the two sumps there will be a sample point adjacent to the sump as well as through the bottom of the sump.

U.S. EPA Comment:

2. Page 3

1.1 Description of Wastes Stored
This section should include an estimate of the maximum inventory of hazardous wastes ever onsite over the active life of the facility in accordance with 40 CFR 265.112 (b)(3).

RESPONSE:

The maximum inventory of hazardous wastes is estimated to be 50 drums in the hazardous waste container storage area. The contents of drums stored in the off-specification product storage area were for the most part recycled. It is estimated that at most 10 drums stored at one time were not suitable for recycle and therefore became classified as hazardous waste.

U.S. EPA Comment:

3. Page 4

2.0 Closure Performance Standard
The reference used in obtaining the performance standard for Atrazine should be documented in a manner similar to that used for the other constituents. According to the HEAST tables, Atrazine is a carcinogen in addition to being a systemic toxicant. The Carcinogenic Slope Factor is 2.2 10^{-1} $(mg/kg\text{-}day)^{-1}$. A MSDS for Atrazine should also be included with the plan.

RESPONSE:

Atrazine is categorized as a Group C Carcinogen, that is, a possible human carcinogen. The Carcinogenic Slope Factor is listed in Health Effects Assessments Summary Table B as 2.2×10^{-1} $(mg/kg\text{-}day)^{-1}$.

A MSDS for Atrazine is included with the plan in Appendix B. Additionally a discussion on methodology for calculation of clean up criteria and specific calculations for atrazine are attached in Appendix C. Within Appendix C, it is explained that a target potential cancer risk 1×10^{-4} has been selected for the site. This level of potential risk has been selected based on the following:

- The areas are currently inactive process areas and access is restricted.
- Future site use will be industrial/commercial.
- Potential future exposures will be transient and related primarily to the duration and frequency with which workers are on-site.
- The potential carcinogens identified on-site have not been demonstrated to be carcinogenic in humans thereby further reducing the likelihood that the target level of potential risk can be reached.
- EPA guidelines state that for the calculation of cleanup goals for known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifeline cancer risk to an individual of 10^{-4} (EPA OSWER Directive 9355.0-30).

On the basis of the calculation a cleanup level of 300 ppm atrazine is recommended.

U. S. EPA Comment:

4. In order to demonstrate that the storage areas are clean, the facility must show through direct sampling, that each concrete surface has been decontaminated to health-based levels for each hazardous constituent present in any hazardous waste ever managed in the unit. Analysis of the hydroblast water is not sufficient, due to the potential for dilution and volatilization of hazardous constituents in the waste.

RESPONSE:

Cedar will directly sample and analyze the concrete. In order to qualify for clean closure, concentrations would have to be less than the following health based levels:

- Dinoseb 80 mg/kg
- Arsenic 80 mg/kg
- Toxaphene 60 mg/kg
- Atrazine 300 mg/kg

Additionally there may be instances where analysis of hydroblast water is indicative of residual concentrations. In this event clean closure will be judged to have been obtained if the above chemicals are not detected or are less than the following health based levels in water:

- Dinoseb 0.04 mg/l
- Arsenic 0.05 mg/l
- Toxaphene 0.005 mg/l
- Atrazine 0.175 mg/l

U.S. EPA Comment:

5. According to the MSDS for "Potato Top Killer 300", toluene is present in the material, in addition to Dinoseb. Therefore, toluene should be addressed in all of the sampling and analysis sections of the plan.

RESPONSE:

Toluene is now so addressed. Clean up criteria calculation for toluene are attached. The clean up level calculated is 48,780 ppm. Toluene will not likely be the determining constituent for level of cleanup.

U.S. EPA Comment:

6. 3.2 Pad and Equipment Decontamination
Since listed waste was stored on the storage pads, any residue or debris removed from the pad is considered to contain listed waste, and must be managed as hazardous waste, unless sampling shows that all hazardous constituents, for which the wastes are listed, are present below health-based levels. TC testing is not sufficient for material that contains listed hazardous waste.

The plan has been appropriately modified.

U.S. EPA Comment:

7. Page 6

3.3 Contaminated Soil Removal
This section should be expanded to address how Cedar will determine when enough contaminated soil has been removed from a given area. Some allowance should be made for such areas to be resampled to verify that remaining soil is not contaminated above health-based levels. Additional soil should be excavated and re-sampled until the areas are shown to be clean.

RESPONSE:

The section had been expanded to acknowledge the resampling intended by Cedar.

U.S. EPA Comment:

8. Page 6-7

3.4.1 Water Sampling (Comment from ESD)
Sampling procedures in this section, and in the following section on Soil Sampling, sample preservation procedures and holding times should be included.

RESPONSE:

The Data Collection Plan and Data Management Plan intended for use in the RFI Workplan has been appended to the Closure Plan.

U.S. EPA Comment:

9. Pages 7-8

3.4.2 Soil Sampling
A rationale for determining proposed sample locations should be provided in the plan to show that the number and depths of samples will be sufficient to demonstrate clean closure.

RESPONSE:

Sample points were chosen at locations of joints and/or cracks where contamination could most likely accumulate if released. According to OSWER 9476-00-8.C a clean closure demonstration may be made with one sample per 2500 ft^2; the aerial locations meet that criterion.

The mobility of pesticides in soil underneath the concrete will be limited; therefore, the highest concentrations would be found in areas where there are cracks just below the concrete/soil interface. In the event that clean closure criteria are not met soil removal and additional sampling would be required. The Data Collection Plan and Data Management Plan intended for use in the RFI Workplan has been appended to the Closure Plan.

U.S. EPA Comment:

10. Decontamination procedures in the Athens SOP has been revised. There are separate procedures for initial decontamination prior to sampling and decontamination in the field. Copies of the relevant pages from the manual are enclosed with these comments.

RESPONSE:

The new decontamination procedures have been adopted.

U.S. EPA Comment:

11. Page 11 3.5.4 Analytical Methods and Parameters (Comments from EDS)
There is a method in SW-846 for Dinoseb; it is 8150. The Cedar Chemical method in Exhibit A appears to be a semi-quantitative screen procedure; it is suggested that 8150 be used.

12. Method 625 is not sensitive enough for toxaphene at the action level (.005 mg/L). Method 608 or 8080 is recommended.

13. No reference is given for Atrazine. EPA Methods 505, 507, or 525 (drinking water methods) are suggested.

14. What laboratory, besides Cedar Chemical, will be used? Where will the split samples be analyzed --ESD?

RESPONSE:

The methods specified are adopted. The laboratory used by Cedar will likely be Analytical Technologies, Inc. in Pensacola, Florida.

U.S. EPA Comment:

15. Page 12 7.0 Contingent Closure plan
It is unclear as to why a contingent closure plan was provided for a storage area, since it is not required under §264.110(b) or 265.110(b). Normally, the unit would be redesignated as a land unit and subject to all post-closure requirements listed under 265, as well as post-closure permitting. Cedar should be required to prepare and submit a post-closure plan after a determination has been made that the unit cannot be certified clean closed. The contingent closure plan provided

is not acceptable, and Cedar should not be led to believe that this plan alone will suffice in the event that the units cannot be clean-closed.

RESPONSE:

It is Cedar's clear intention to achieve clean closure. In the event that Cedar is unable to practically achieve clean closure Cedar would prepare a flexible cleanup based on actual exposure and actual intended land use based on results of data obtained by sampling and analysis. Both the plan for cleanup and request for a closure plan modification would be submitted to the USEPA and MDEQ within 60 days of the occurrence of the unexpected event. Details on the closure plan would be submitted at the time. Very likely in that event the site will be backfilled with clean fill and covered with a RCRA cap. The fill will be compacted to 90 to 95 percent compaction in lifts.

Class a → Toxaphene = $\frac{1 \times 10^{-6} \quad 70\,kg}{1.1\,(mg/kg/day)^{-1} \times 0.0001\,kg/l}$

$= 0.64\ mg/kg$

MDEQ Comment:

$\frac{(1 \times 10^{-6})\ 70}{1.1\ (2\ell/d)} = 3.2 \times 10^{-5}$

Also, all closure standards have been recalculated and are now as follows:

		Soil	Hydroblast
•	Dinoseb	80 mg/kg	0.008 mg/l
•	Arsenic	80 mg/kg	0.050 mg/l
•	Toxaphene	0.6 mg/kg ✓	3.2×10^{-5} mg/l
•	Atrazine	3.2 mg/kg ✓	1.6×10^{-4} mg/l

Class c →

$3.2\ mg/kg = \frac{(10^{-6})(70\,kg)}{0.22\,(mg/kg/day)^{-1}\,(.0001\,kg/l)}$

↳ 8/91 HEAST

$\frac{(0.001)(70)}{2\ell} = .035\ mg/l$

= .04

RESPONSE:

Health based closure standards for soils, as presented in the closure plan are:

Constituent	Concentration	Reference
• Dinoseb	80 mg/kg	RFI guidance document, Table 8-7
• Arsenic	80 mg/kg	55 FR 30798 July 27, 1990, Proposed Corrective Action Rule for Solid Waste Management Units - Appendix A
• Toxaphene	60 mg/kg	55 FR 30798 July 27, 1991, Proposed Corrective Action Rule for Solid Waste Management Units - Appendix C
• Atrazine	300 mg/kg	Health Based Cleanup Criteria Calculations - See Appendix C this report.

Health based closure standards for water, if applicable, are non detected or:

Constituent	Concentration	Reference
• Dinoseb	0.04 mg/l	RFI guidance document, Table 8-7
• Arsenic	0.05 mg/l	55 FR 30798 July 27, 1990, Proposed Corrective Action Rule for Solid Waste Management units - Appendix B - MCLs
• Toxaphene	0.005 mg/l	55 FR 30798 July 27, 1991, Proposed Corrective Action Rule for Solid Waste Management units - Appendix B - MCLs
• Atrazine	0.175 mg/l	Health Based Cleanup Criteria Calculations - See Appendix C - this report

If you have any questions, please call.

Very truly yours,

Dick Karkkainen

RDK/lb

cc: Fred Ahlers
Dave Madsen
Randal Tomblin
Allen T. Malone

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A	Cedar Chemical Dinoseb Test Method
B	Material Safety Data Sheets for Products
C	Methodology for Calculation of Cleanup Criteria
D	Data Collection Plan
E	Data Management Plan

1.0 INTRODUCTION

This workplan defines the activities to be executed by Cedar Chemical Corporation at its facility in Vicksburg, Mississippi pursuant to closure of a container storage area. The workplan or closure plan is consistent with RCRA rules and regulations.

1.1 Description of the South Plant

The Vicksburg Chemical Division of Cedar Chemical Corporation is located in Warren County, Mississippi along the Mississippi River immediately on the south limits of the City of Vicksburg. (See Figure 1). The address is:

Cedar Chemical Corporation

Vicksburg Chemical Division

Post Office Box 3

Rifle Range Road

Vicksburg, Mississippi 39180

The facility is a manufacturer of chemicals. The plant site is divided physically and functionally into a "north plant" and a "south plant". The north plant is primarily a manufacturer of potassium nitrate and additionally manufactures by-products chlorine and nitrogen tetroxide. The south plant formerly manufactured chlorinated pesticides and nitrogen based herbicides. The South Plant presently manufacturers nitric acid, which is used entirely as a raw material in the north plant.

The south plant contained the manufacturing operations for production of the following products:

- o Atrazine
- o Toxaphene
- o Dinitrobutyl phenol (dinoseb)
- o Monosodium methane arsenate

1.2 History of the South Plant

All pesticide plants were shut down by 1986 and have been partially dismantled. Any non-deminimus spills from toxaphene would have been handled as a hazardous waste (P123). The monosodium methane arsenate plant generated listed RCRA waste K031, a by-product salt. The by-product salt cake was directly discharged into a "roll-off sludge container". When the container was full (2-4 days) it was transported by a hazardous waste transporter to a hazardous waste landfill. The plant was designed such that there was intended to be no effluent with all spills, etc. retained and recycled to the process.

The dinitrobutyl phenol (Dinoseb) plant produced process wastewater that was hazardous by virtue of characteristic (D002). The waste was pumped to 1-3 day storage and was transported by a hazardous waste transporter to off-site disposal by hazardous waste deep well injection. At times the manufactured process wastewater was neutralized with ammonia and pumped to a 1.6 million gallon storage tank. The water did not exhibit the characteristic of a hazardous waste at this time and was pumped through activated carbon prior to discharged to the 3 million gallon surface impoundment.

The hazardous waste container storage area and off-specification product storage area were in operation from 1976 to 1986 (Figure 2). The hazardous waste container storage area stored contaminated debris, trash and waste product material in 55-gallon drums. The off-

specification product storage area stored 55-gallon drums and 5-gallon pails of product returned from clients which could be put back into the manufacturing process and recovered.

1.3 Description of the Container Storage Area's

The two container storage areas which are to be closed are two distinct sections or area's of a continuous concrete area in the South Plant. This area is a six-inch (minimum) poured 3,000 psi reinforced concrete slab with sumps, curbs, containment areas (See Figure 2).

The hazardous waste container storage stored trash and debris contaminated with products or byproducts produced at the South Plant. This area also stored off-specification product which could not be reclaimed or recycled into new product. These wastes were typically stored in 55-gallon drums. The area is trapezoid in shape, approximately 30 feet by 46 feet by 14 feet by 40 feet. Photographs and maps of the area have been included as Figures 3, 4 and 5.

The off-specification product storage area is a covered area immediately adjacent to the hazardous waste storage area but separated by curbs. This is a 2,000 Square Foot area roughly 28 feet by 70 feet which stored off-specification product until it could be returned to the manufacturing process and recycled into new product. This area stored an assortment of 55-gallon drums, and 5-gallon pails and 1 gallon containers. Photographs and maps of the area have been included as Figures 3 through 7.

1.4 Description of Wastes Stored

The container storage area's stored off-specification products, products, waste products or trash and debris contaminated with the following chemical compounds:

Toxaphene	(P123)
Dinitrobutyl phenol (dinoseb)	(P020)
Monosodium Methane Arsenate (MSMA)	(K031)
Atrazine	
Toluene contained in pesticide formulations	

The maximum inventory of hazardous wastes is estimated to be 50 drums in the hazardous waste container storage area. The contents of drums stored in the off-specification product storage area were for the most part recycled. It is estimated that at most 10 drums stored at one time were not suitable for recycle and therefore became classified as hazardous waste.

2.0 CLOSURE PERFORMANCE STANDARD

This closure plan is based upon closure of both container storage area's with no wastes or contamination remaining in place above the health based action levels published by the EPA for corrective action at hazardous waste management facilities. These health based clean-up action levels are described in the Friday, July 27, 1990 Federal Register for toxaphene and arsenic. From "Appendix C- Range of Concentrations for Establishing Media Protection Standards for Carcinogens", the range for toxaphene is soil is from 0.6 ppm to 60.0 ppm. From "Appendix A - Examples of Concentrations Meeting Criteria for Action Levels", the reading for arsenic in soils is 80.0 ppm. Health based clean-up action levels are also described in Volume 1 of the RCRA Facility Investigation Guidance Document. From Table 8-7 "Health Based Criteria for Systemic Toxicants", the reading for Dinoseb in soil in 80.0 ppm. Appropriate tables from these documents are attached to this plan. Atrazine is categorized as a Group C Carcinogen, that is, a possible human carcinogen. The Carcinogenic Slope Factor is listed in Health Effects Assessments Summary Table B as 2.2 x 10^{-1}. A MSDS for Atrazine is included in Appendix B. A discussion on methodology for calculation of clean up criteria and specific calculations for atrazine are attached in

Appendix C. A cleanup level of 300 ppm atrazine is recommended.

This closure plan is intended to result in a "clean" closure which will eliminate the need for post-closure maintenance and care. The levels of clean-up will be used for the soils underneath the concrete pad and immediately adjacent to the pad.

This closure plan calls for concrete surface to be hydroblasted, after which the concrete will be analyzed. The analyses of the concrete will have to meet the same health based criteria required of soil in order to be judged clean closed. There may be instances where analysis of hydroblast water is indicative of residual concentrations. One of the secondary criterion by which concrete may be judged to be clean is when the concentrations of arsenic and toxaphene in the water are less than the primary drinking water standards. The standard for arsenic is 0.05 ppm and the standard for toxaphene is 0.005 ppm. Since Dinoseb is not a parameter in the primary drinking water standards the Table 8-7 "Health Based Criteria for Systemic Toxicants" and the reading for Dinoseb in water will be used; that concentration is 0.040 ppm. The standard for atrazine in the hydroblast water is 0.175 mg/l based on a RFD of 0.005 mg/kg-d.

3.0 CLOSURE ACTIVITIES

3.1 Waste Inventory Removal

No waste is stored for more than 90 days. There is very little use of the site at present.

3.2 Pad and Equipment Decontamination

Decontamination of the container storage area will be performed in the manner that is described below.

All surfaces, the pad surface and containment curbing, will be cleaned utilizing a hydroblaster. Heavy duty plastic sheeting will be wrapped around the outside of the section of the container storage area being hydroblasted by attaching the plastic sheeting to supports temporarily assembled for the purpose. A barrier, covered by heavy-duty plastic sheeting, will also be placed across the open end of the container storage area to confine the water that will be generated. The pad will be cleaned three times and vacuumed up by a shop vacuum or equivalent.

The water from the cleaning operations will be disposed of onsite. The water will be transported by truck to the Cedar activated carbon wastewater treatment facility. The water will be pumped directly through the activated carbon and will not enter the surface impoundment. The treated water will be discharged to the Mississippi River under the Cedar NPDES permit.

A representative composite sample containing bits of plastic sheeting, dislodged concrete, and any other solids generated during the decontamination operations will be sent to a offsite laboratory to test for Dinoseb, Arsenic, Atrazine and Toluene. If the results of the analyses of the concrete plastic sheeting and generated solids samples performed as a part of clean closure are less than the action levels then the waste will be disposed in a commercial solid waste disposal facility that is permitted to accept industrial waste. Otherwise, the waste will be disposed in a hazardous waste facility.

Decontamination of the hydroblaster used in cleaning the container storage area will not be necessary because it will not come into contact with any waste since the waste has been contained in closed 55-gallon drums. The interior of the shop vacuum or equivalent equipment will be triple cleaned. The water will be collected and treated as described in the previous paragraph.

3.3 Contaminated Soil Removal

If soil field analysis indicates high levels of contamination then the concrete in the area of that sample will be removed. The contaminated soil will be exposed and excavated for offsite disposal. The remaining soil will then be resampled to ascertain whether health based criteria have been met.

3.4 Proof of Decontamination

3.4.1 Water Sample Collection Procedures. Samples of final hydroblast will be obtained by placing a sample bottle in the water and letting the bottle fill. Care will be taken to avoid disturbing the water by agitation which could introduce excess oxygen. The VOA bottles will be completely filled to eliminate any air space, and they will be immediately capped after filling. Each sample label will contain the following information:

- Sample number,
- Sample location,
- Sample depth (if applicable),
- Date/time of collection, and
- Sampler's initials.

3.4.2 Soil Sampling. To confirm that no leaks have occurred, the following procedures will be employed to sample the soil for contamination under the concrete pad. At each of the fourteen proposed sample locations eleven are located beneath cracks and beneath the sumps (See Figure 2) For those locations located beneath concrete, a concrete saw will be used to cut and remove a small section or plug of the concrete pad. Additionally, two samples of concrete from the concrete removed in the hazardous waste container storage area and two samples of concrete removed in the off-specification product storage area will be submitted for separate analysis with the soil samples.

Samples of soil underneath the concrete will be taken utilizing a 1-inch diameter stainless steel tube encased in a 2-foot long stainless steel soil probe. A stainless steel soil probe is attached to extension rods and will be driven six inches into the soil by a hammer attachment. Following the removal of the soil probe, the tube containing the sample will be extracted from the soil probe. The soil sample will be extruded and transferred to sample bottles, approximately labeled, and placed on ice for transport to the laboratory. If the soil probe is unable to obtain a representative sample then a hand auger will be employed. All equipment will be cleaned in accordance with decontamination procedures before collection each sample.

Sample points were chosen at locations of joints and/or cracks where contamination could most likely accumulate if released. According to OSWER 9476-00-8.C a clean closure demonstration may be made with one sample per 2500 ft^2; the aerial locations meet the criterion.

The mobility of pesticides in soil underneath the concrete will be limited; therefore, the highest concentrations would be found in areas where there are cracks just below the concrete/soil interface. In the event that clean closure criteria are not met, soil removal and additional sampling would be required.

All equipment will initially be decontamination before use and again after each sample is collected. The following decontamination procedures will be employed:

- Washing in tap water and a detergent (Alconox) solution. Brush, if necessary, to remove particulate matter and surface films.
- Rinsing thoroughly with tap water.
- Rinsing with distilled, deionized water.
- Rinsing twice with pesticide - grade solvent.
- Rinsing with organic - free water.

- o Allow to air dry as long as possible.

After decontaminating, the sample equipment will be wrapped in aluminum foil for protection until its subsequent use. All wash fluids will be containerized for later disposal by Cedar Chemical in their activated carbon wastewater treatment process as previously described.

The Data Collection Plan and Data Management Plan are attached as Appendix D and E.

3.5 Documentation of Sample Acquisition

Additionally, all information pertinent to field observations and sampling will be recorded in the logbook with consecutively numbered pages. Entries in the logbook will include at least the following:

- o Sketch of the container storage area with measurements
- o A grid of the site area
- o Purpose of Sampling
- o Number and approximate volume of samples taken
- o Exact location of sampling point on grid
- o Description of sampling point
- o Date and time of collection
- o Collector's sample identification number(s)
- o References, such as maps or photographs of the sampling site
- o Field observations
- o Weather conditions

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

Proper sample preservation is important in retaining the sample characteristics prior to analysis. Sample preservation is documented on the chain-of-custody form and also in the field logbook. The proposed analytical methods required that the sample be kept on ice until transferred to the laboratory.

Once the sample has been transferred to appropriate laboratory sample container, sample tags will be completed and affixed to the sample container.

3.5.1 Sample Tagging. Each sample will be tagged and sealed properly immediately after collection. Sample tags are necessary to prevent misidentification of samples. The tag will include at least the following information:

- Name of collection
- Date and time of collection
- Place of collection
- Collector's sample number, which uniquely identifies the sample

An example of a sample tag that will be used is shown in Figure 3.

3.5.2 Chain-of-custody. In addition in the field logbook, each sample will be recorded on a chain-of-custody record. An identifying code will be assigned to each sample and this code will be used on the chain-of-custody and in the logbook to ensure that the sample description is identifiable. A brief description of the sampling point will also be placed on the chain-of-custody form.

Chain-of-custody forms will become the permanent records of all sample handling and shipment. If standard sampling procedures are not used, a written justification of each deviation will be placed in the project file. Upon completion of sampling, the sample will be prepared for shipment in accordance with the applicable sampling instruction, including

preservation, labeling, and logging.

The person collecting a sample will initiate document(s) at the source of sample and start the chain-of-custody procedure.

The sample will be kept in limited access or locked storage at the proper temperature until custody is relinquished from the site and formal documentation of the transfer is completed.

Upon each transfer of custody, the person involved will verify sample numbers and condition and will document the sample acquisition and transfer. The field sampler will properly package the samples, indicate and shipping, obtain documentation of the shipment, such as certified mail receipt or bill of lading number, and sample identification records (one of each with the shipment, one of each by mail to the laboratory, and one of each returned with field records).

On transfer of custody of the samples to the transport agency, the field sample custodian will sign and retain a copy of the chain-of-custody, witness the transport company custody signature, and sent two copies of the chain-of-custody with the samples. On arrival at the laboratory, the sample custodian will sign for custody and return a copy of the completed chain-of-custody to Cedar Chemical. Custody procedures will then proceed according to the procedures of the selected testing laboratory.

3.5.3 Evaluation of Sampling Results. The analytical results from Cedar Chemical's sampling efforts will be summarized and evaluated. The raw data will be included as an appendix to the report submitted.

3.5.4 Analytical Methods and Parameters. Cedar Chemical proposes to use its onsite laboratory when possible for screening. This laboratory will analyze for Dinoseb, and arsenic. These parameters were chosen because these were the main products manufactured

at the south plant and arsenic is a toxic heavy metal which was part of monosodium methane arsenate. Copies of methods which Cedar Chemical intends to use for screening are included as Exhibit A. A summary of the parameter and methods to be employed by the offsite laboratory for verification sampling are:

Toxaphene	EPA SW-846, Method 608 or 8080
Dinitrobutyl Phenol (Dinoseb)	See Exhibit A for screening method. EPA SWA-846, Method 8150.
Arsenic	EPA SW-846, Method 7060
Atrazine	GC/ECD, GC/NPD or HPLC EPA 505, 507 or 525 (drinking water)

Cedar may use Analytical Technologies in Pensacola, Florida as the off site laboratory.

3.6 Equipment Decontamination

Any equipment that has come in direct contact with the material in the storage areas will be deemed contaminated. The waste materials handled are not corrosive, reactive or ignitable. However, special personnel protective equipment will be used and precautions taken when necessary. Product Material Safety Data Sheets are included as Exhibit B.

3.7 Site Restoration

Upon completion of the work the holes will be filled with concrete. The location of the holes will be marked on a map which will be included in the final report. Additionally the sample number will be imprinted in the concrete.

4.0 FINAL REPORT AND CERTIFICATION

After the container storage areas have been decontaminated and any contaminated soil removed Cedar Chemical will submit a final report to the MDEQ for review. This report will contain analytical results from sampling, site investigation information and a draft certification of closure.

Upon approval by the MDEQ that the closure is complete, Cedar Chemical will submit a certification of closure signed by an independent engineer registered in the State of Mississippi. This is a clean closure, therefore, no notice is required for the local land authority.

5.0 CLOSURE COST ESTIMATE

The proposed closure cost estimate provided in Table 1 is based on removal of any contamination in the concrete pad and removal of concrete at fourteen sampling locations for soil testing, then disposing these materials in a permitted offsite facility.

6.0 CLOSURE SCHEDULE

The "Clean Closure" will be accomplished within 180 days of the date of approval of this plan by the MDEQ. A detailed schedule is attached as Table 2.

7.0 CONTINGENT CLOSURE PLAN

It is Cedar's clear intention to achieve clean closure. In the event that Cedar is unable to practically achieve clean closure Cedar would prepare a flexible cleanup based on actual exposure and actual intended land use based on results of data obtained by sampling and analysis. Both the plan for cleanup and request for a post closure permit would be

submitted to the USEPA and MDEQ within 60 days of the occurrence of the unexpected event. Details on the closure plan would be submitted at the time. Very likely in that event concrete surfaces would be painted with concrete seal and perhaps the site will be backfilled with clean fill and covered with a RCRA cap. The fill will be compacted to 90 to 95 perent compaction in lifts.

TABLES

TABLE 1

PROPOSED CLOSURE COST ESTIMATE

Item	Unit Cost	Quantity	Subtotal
Concrete Pad Decontamination			
Mobilization			500.00
Temporary framing			1,000.00
Hydroblasting	2,000/day	2	4,000.00
Laboratory Analysis Onsite (1)	N/A	N/A	
Removal of Concrete Plugs	500/day	2	1,000.00
Transportation and Disposal	500/ton	1	500.00
Laboratory Analysis Offsite (2)	350	16	5,600.00
Site Restoration	500/day	1	500.00
Closure Report and Sampling Results and			---
Regulatory Liason and Certification by Registered Engineer	800/day	3	2,400.00
Project Management			
Subject contractor including site visits	800/day	3	2,400.00
Project Liason	800/day	2	1,600.00
Transportation and Expenses			2,000.00
15% Contingency			3,000.00
		(Estimated) TOTAL	24,500.00

(1) Cedar Chemical intends to use its onsite laboratory for rapid field analysis .

(2) Cedar will use an offsite laboratory for decontamination confirmatory analysis

TABLE 2

SCHEDULE OF CLOSURE

Submit Closure Plan to MSDEQ and EPA with modifications in response to March 28, 1991 MSDEQ letter	May 1, 1991
Receive approval to proceed with plan	Day 0
Issue request for quotation for contractor to do the hydroblasting and cut the concrete	Day 15
Receive bids	Day 30
Execute purchase order	Day 45
Start work	Day 75
Complete work and sampling	Day 90
Receive results of sampling	Day 120
Validate data	Day 150
Final Report	Day 180

Table 8-7. (continued)[1]

Constituent	CAS No.	RfD[2] (mg/kg/day)	Soil (mg/kg)	Water (ug/l)	Air (ug/m³)
Dichlorodifluoro-methane	75-71-8	2E-01	2E+04	7E+03	–
1,1-Dichloroethylene	75-35-4	9E-03	7E+02	See MCL	–
Dichloromethane (Methylene chloride)	75-09-2	6E-02	9E+03	2E+03	–
2,4-Dichlorophenol	120-83-2	3E-03	2E+02	1E+02	1E+01
1,3-Dichloropropene	26952-23-8	3E-04	2E+01	1E+01	–
Dieldrin	60-57-1	5E-05	4E+00	2E+00	–
Diethyl phthalate	84-66-2	8E-01	6E+04	3E+04	–
Dimethoate	60-51-5	2E-02	2E+03	7E+02	–
2,4-Dinitrophenol	51-28-5	2E-03	2E+02	7E+01	7E+00
Dinoseb	88-85-7	1E-03	8E+01	4E+01	–
Diphenylamine	127-39-4	3E-02	2E+03	1E+03	–
Disulfoton	298-04-4	4E-05	3E+00	1E+00	–
Endosulfan	115-29-7	5E-05	4E+00	2E+00	2E-01
Endothal	145-73-3	2E-02	2E+03	7E+02	–
Endrin	72-20-8	3E-04	2E+01	See MCL	1E+00
Ethylbenzene	100-41-4	1E-01	8E+03	4E+03	–
Heptachlor	76-44-8	5E-04	4E+01	2E+01	–
Heptachlor epoxide	1024-57-8	1E-05	8E-01	4E-01	–
Hexachlorobuta-diene	87-68-3	2E-03	2E+02	7E+01	–
Hexachlorocyclo-pentadiene	77-47-4	7E-03	6E+02	2E+02	–
Hexachloroethane	67-72-1	1E-03	8E+01	4E+01	–
Hydrogen cyanide	74-90-8	2E-02	2E+03	7E+02	–
Hydrogen sulfide	7783-06-4	3E-03	2E+02	1E+02	–
Isobutyl alcohol	78-83-1	3E-01	2E+04	1E+04	1E+03
Isophorone	78-59-1	2E-01	2E+04	7E+03	–
Lindane (hexa-chlorocyclohexane)	58-89-9	3E-04	2E+01	See MCL	–
Maleic hydrazide	108-31-6	5E-01	4E+04	2E+04	–
Methacrylonitrile	126-98-7	1E-04	8E+00	4E+00	–
Methomyl	16752-77-5	3E-02	2E+03	1E+03	–
Methyl ethyl ketone	78-93-3	5E-02	4E+03	2E+03	–
Methylisobutyl-ketone	108-10-01	5E-02	4E+03	2E+03	–

Note: These criteria are subject to change and will be confirmed by the regulatory agency prior to use.

APPENDIX C—RANGE OF CONCENTRATIONS FOR ESTABLISHING MEDIA PROTECTION STANDARDS FOR CARCINOGENS—Continued

Constituent name	Class	MaxAir (ug/m 3)	MinAir (ug/m 3)	Max-Water (mg/L)	MinWater (mg/L)	MaxSoil (mg/kg)	MinSoil (mg/kg)
Styrene	C						
1,1,1,2-Tetrachloroethane	C	1E+01	1E-01	1E-01	3E+03	3E+03	3E+01
1,2,4,5-Tetrachlorobenzene	D						
1,1,1,2-Tetrachloroethane	C	1E+01	1E-01	1E-01	1E-03	3E+03	3E+01
1,1,2,2-Tetrachloroethane	C	2E-00	2E-02	2E-02	2E-04	4E+02	4E-00
Tetrachloroethylene	B2	1E+02	1E-00	7E-02	7E-04	1E+03	1E+01
2,3,4,6-Tetrachlorophenol	D						
Tetraethyl lead	D						
Tetraethyldithiopyrophosphate	D						
Thallic oxide	D						
Thallium acetate	D						
Thallium carbonate	D						
Thallium chloride	D						
Thallium nitrate	D						
Thallium sulfate	D						
Thiosemicarbazide	D						
Thiram	D						
Toluene	B2	3E-01	3E-03	3E-03	3E-05	6E+01	6E-01
Toxaphene	D						
1,2,4-Trichlorobenzene	D						
1,1,1,Trichloroethane	C	6E-00	6E-02	6E-02	6E-04	1E+03	1E+01
1,1,2-Trichloroethane	B2			3E-01	3E-03	6E+03	6E+01
Trichloroethylene	D						
Trichloromonofluoromethane	D						
2,4,5-Trichlorophenol	B2	2E+01	2E-01	2E-01	2E-03	4E+03	4E+01
2,4,6-Trichlorophenol	D						
2,4,5-Trichlorophenoxyacetic acid	D						
1,2,3-Trichloropropane	D						
Vanadium pentoxide	D						
Xylenes	D						
Zinc cyanide	D						
Zinc phosphide	D						

Appendix D: Recommended Exposure Assumptions for Use in Deriving Action Levels

(Sections 264.521 (a)(2); (b); (c)(3); and (d))

1. In deriving action levels for hazardous constituents in ground-water, assume a water intake of 2 liters/day for 70 kg adult/70 year lifetime exposure period.

2. In deriving action levels for hazardous constituents in air, assume air intake of 20 cubic meters/day for 70 kg adult/70 year lifetime exposure period.

3. In deriving action levels for hazardous constituents in soil, which are known or suspected to be carcinogens, assume soil intake of 0.1 gram/day for 70 kg adult/70 year lifetime exposure period.

4. In deriving action levels for hazardous constituents in soil, other than those which are known or suspected to be carcinogens, assume soil intake of 0.2 gram/day for 16 kg child/5 year exposure period (age 1–6).*

5. In deriving action levels for hazardous constituents in surface water designated by the State for use as a drinking water source, assume a water intake of 2 liters/day for 70 kg adult/70 year lifetime exposure period, unless intake of aquatic organisms is also of concern.

*Not to be averaged over a 70-year lifetime.

Appendix E: Examples of Calculations of Action Levels

I. Governing Equations for Calculating Action Levels

A. *Systemic Toxicants*

$C_m = [RfD * W]/[I * A]$

where:

C_m = action level in medium (units are medium-dependent);
RfD = reference dose (mg/kg/day);
W = body weight (kg);
I = intake assumption (units are medium-dependent); and
A = absorption factor [1] (dimensionless).

B. *Carcinogenic Constituents*

$C_m = [R * W * LT]/[CSF * I * A * ED]$

where:

C_m = action level in medium (units are medium-dependent);
R = assumed risk level (dimensionless) (10^{-6} for class A & B; 10^{-5} for class C carcinogens);
W = body weight (kg);
LT = assumed lifetime (years);
CSF = carcinogenic slope factor $(mg/kg/day)^{-1}$;
I = intake assumption (units are medium-dependent);
A = absorption factor (dimensionless); and
ED = exposure duration (years).

[1] Assumed to be 1 for this appendix, based upon the assumption that the human absorption rate will be the same as the rate in the study upon which the RfD or CPF was developed.

II. Example Calculations for Hazardous Constituents in Air

A. *Systemic Toxicants*

Example calculation for 2,4-dinitrophenol:

$C_a = [0.002\ (mg/kg/d) * 1000\ (\mu g/mg) * 70(kg)]/[20\ (m^3/d) * 1] = 7.0\ \mu g/m^3$

where:

C_a = action level in air ($\mu g/m^3$)
RfD = 0.002 mg/kg/day
W = 70 kg adult
I = 20 m^3/day
A = 1

B. *Carcinogenic Constituents*

Example calculation for 1,1,2,2-tetrachloroethane:

$C_a = [10^{-5} * 1000\ (\mu g/mg) * 70\ (yrs) * 70\ (kg)]/[0.20\ (mg/kg/day)^{-1} * 20\ (m^3/day) * 1 * 70\ (yrs)] = .175\ \mu g/m$

where:

C_a = action level in air ($\mu g/m^3$)
R = 10^{-5} (1,1,2,2-Tetrachloroethane is a Class C carcinogen)
W = 70 kg adult
LT = 70 year lifetime
CSF = 0.20 $(mg/kg/day)^{-1}$
I = 20 m^3/day
A = 1
ED = 70 year exposure duration

III. Sample Calculation for Hazardous Constituents in Water

A. *Systemic Toxicants*

Sample calculation for toluene:

$C_w = [0.30\ (mg/kg/day) * 70\ (kg)]/[2\ (L/day) * 1] = 10.5\ mg/L$

where:

C_w = action level in water (mg/L)

develop and conduct these further Regulatory Impact Analyses.

The new analyses will be conducted in accordance with the existing Agency guidance on Regulatory Impact Analysis and the draft Regulatory Impact Analysis Guidance published in the 1988 Regulatory Program of the United States. The analyses will explicitly examine the costs, health and environmental benefits, and technological limitations for the key regulatory requirements contained in the proposal—especially for the several alternative approaches to ground water remediation outlined in the proposed rule. This analysis will also estimate the aggregate impacts, identified above, for sites eligible for remediation under this rule and for those sites which are listed on the NPL, and will, therefore, look to this rule as an ARAR, under the provisions of CERCLA. Upon completion of the revised analyses, EPA will solicit comment on the results of the analyses and the methodology used to derive them. The Agency will then assess these comments, along with comments which will have been received previously on the proposed rule. Through these actions EPA will ensure that the net social benefits (including environmental and health benefits) of the rule proposed today are maximized, taking into account costs, technological limitations, risks, and realistic assessments of both actual and reasonably expected uses of each site. If the revised RIA, together with the comments received, demonstrate that the rule proposed today does not achieve this outcome, the Agency will make appropriate modifications to the final rule, or if necessary, will repropose the rule.

B. Regulatory Flexibility Act

The Regulatory Flexibility Act requires Federal agencies to fully analyze the economic effects of regulations on small entities. The Agency analyzed the economic impacts for the regulatory options that are most similar to today's proposed rule (*i.e.*, "Immediate Cleanup to Health-Based Standards" and "Flexible Cleanup to Health-Based Standards").

The RIA assumes that a small business is significantly impacted if its excess of cash flow over ten percent of its total liabilities is insufficient to meet corrective action costs, or if its net income is insufficient to meet its corrective action costs.

For the alternative analyzed, it was found that small firms encounter more severe impacts from the corrective action requirements than large firms. The options most similar to the proposed rule result in incremental impacts (*i.e.*, relative to the baseline) on approximately 9 to 11 percent of small businesses owning RCRA facilities.

Based on the Agency's guidelines for implementing the Regulatory Feasibility Act, the results of the analysis as summarized above, suggest that the proposed rule does not impose significant impacts on small entities.

C. Paperwork Reduction Act

The information collection requirements in this proposed rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* Reporting and recordkeeping burden on the public for this collection is estimated at 42,497 hours for the 674 respondents, with an average of 1,151 hours per response. (Burden estimates should include all aspects of the collection effort and may include time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, completing and reviewing the collection of information, *etc.*)

If you wish to submit comments regarding any aspect of the collection of information, including suggestions for reducing the burden, or if you would like a copy of the information collection request (please reference ICR #1451), contact Rick Westlund, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460 (202-382-2745); and Tim Hunt, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

List of Subjects in 40 CFR Parts 264, 265, 270, and 271

Administrative practice and procedure, Corrective action, Hazardous waste; Insurance, Reporting and recordkeeping requirements.

Dated: July 5, 1990.

William Reilly,

Administrator.

XI. Supplementary Documents

APPENDIX A.—EXAMPLES OF CONCENTRATIONS MEETING CRITERIA FOR ACTION LEVELS

[Section 264.521(a)(2)(i-iv)]

Constituent name	Class	Air(ug/m^3)	Water (mg/L)	Soils (mg/kg)
	D		4E-00	8E+03
	D		2E-01	5E+02
Acetone	D	2E-01	4E-00	8E+03
Acetonitrile	B2	8E-04	8E-06	2E-01
Acetophenone	B1	1E-02	6E-05	1E-00
Acrylamide	D		5E-02	1E+02
Acrylonitrile	B2	2E-04	2E-06	4E-02
Aldicarb	D		2E-01	4E+02
Aldrin	D		1E-02	3E+01
Allyl alcohol	B2		6E-03	1E+02
Aluminum phosphide	D		1E-02	3E+01
Aniline	A	7E-05	(1)	8E+01
Antimony	A	2E-02		
Arsenic	D		2E-00	6E+03
Asbestos (2)	D	4E-01	(1)	4E+03
Barium cyanide	A	2E-05	2E-07	3E-03
Barium, ionic	B2	4E-04	8E-06	2E-01
Benzidine	B2		3E-03	5E+01
Beryllium	B2	3E-03	2E-05	6E-01
Bis(2-ethylhexyl)phthalate	B2		3E-05	5E-01
Bis(chloromethyl)ether	D		7E-01	2E+03
Bromochloromethane (3)	D	3E+01	5E-02	1E+02
Bromoform (3)	C		7E-00	2E+04
Bromomethane				
Butyl benzyl phthalate				

Woodward-Clyde Consultants

CHAIN-OF-CUSTODY-RECORD

COLLECTOR'S SAMPLE NUMBERS:

SAMPLE COLLECTION:

Location of Sample: _____

Project Number and Name: _____

Collector's Name: _____ Telephone: ( ) _____

Company Name: _____

Address: _____

Witness: _____ Company Name: _____

Date Sampled: _____ Time: _____

FIELD INFORMATION

Type of Sample: Liquid Gas Sludge Soil Other (Specify) _____

Container Size: _____ Container Type: _____

Field Notes: _____

_____

Transporter: _____ Airbill/Invoice: _____

SAMPLE TRANSFER (Original must be retained with sample at all times)

1.	Relinquished by:	(Name)	(Organization)	(Date/Time)
	Received by:	(Name)	(Organization)	(Date/Time)
2.	Relinquished by:	(Name)	(Organization)	(Date/Time)
	Received by:	(Name)	(Organization)	(Date/Time)
3.	Relinquished by:	(Name)	(Organization)	(Date/Time)
	Received by:	(Name)	(Organization)	(Date/Time)

TERMINATION OF CHAIN-OF-CUSTODY:

Authorized by: _____ Date: _____ Time: _____

Company Name: _____

Sample Disposition: Storage _____ Disposal _____ Other _____

FIGURE 4.

EXAMPLE OF SAMPLE TAG

SAMPLE I.D. [ ]

PROJECT NUMBER _____

PROJECT NAME _____

EXACT SAMPLING LOCATION _____

FIELD TESTS	MATERIAL SAMPLED		PRESERVATIVE	
OVA	SOLID WASTE	☐	NONE	☐
pH	LIQ. WASTE	☐	ICE	☐
SALINITY	SOIL	☐	H_2SO_4	☐
S. COND.	G. WATER	☐	HNO_3	☐
TEMP	S. WATER	☐	OTHER	☐
OTHER	OTHER	☐		

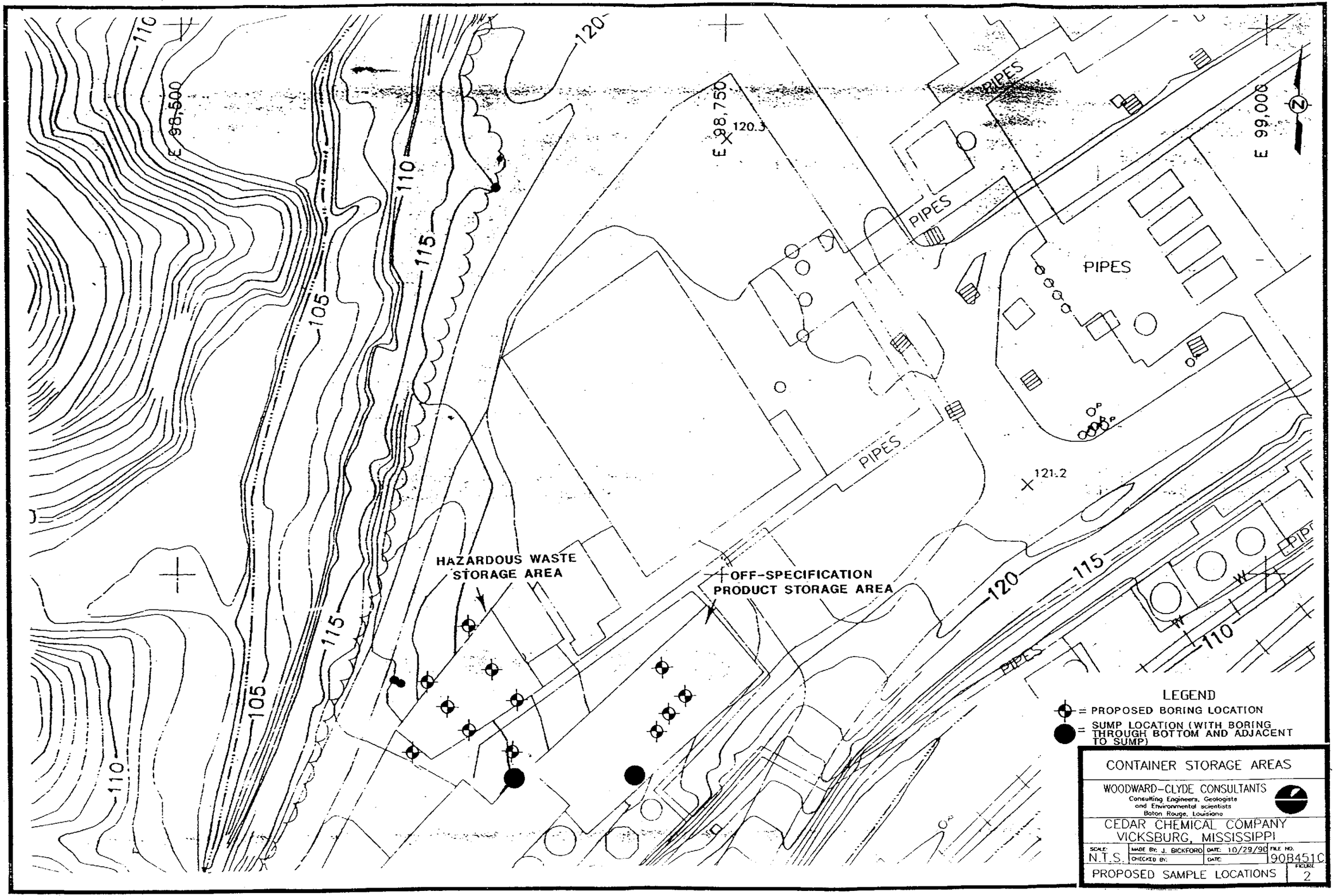
REMARKS _____

WEATHER _____ TIME _____

SIGNATURE _____ DATE _____

FIGURE 3.

FIGURES



CONTAINER STORAGE AREAS

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

CEDAR CHEMICAL COMPANY
VICKSBURG, MISSISSIPPI

SCALE:	MADE BY: J. BICKFORD	DATE: 10/29/90	FILE NO.
N.T.S.	CHECKED BY:	DATE:	90B451C

PROPOSED SAMPLE LOCATIONS — FIGURE 2

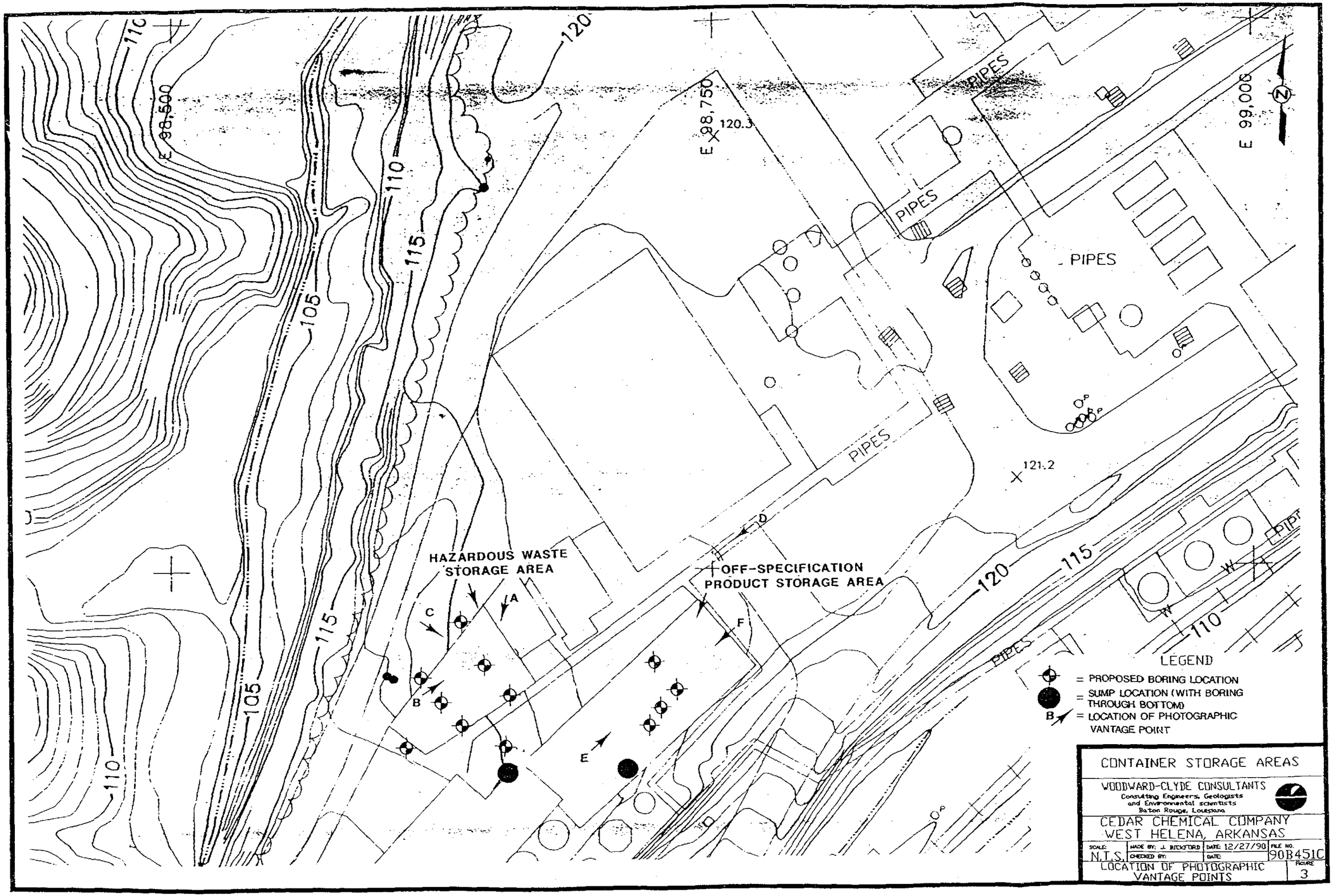
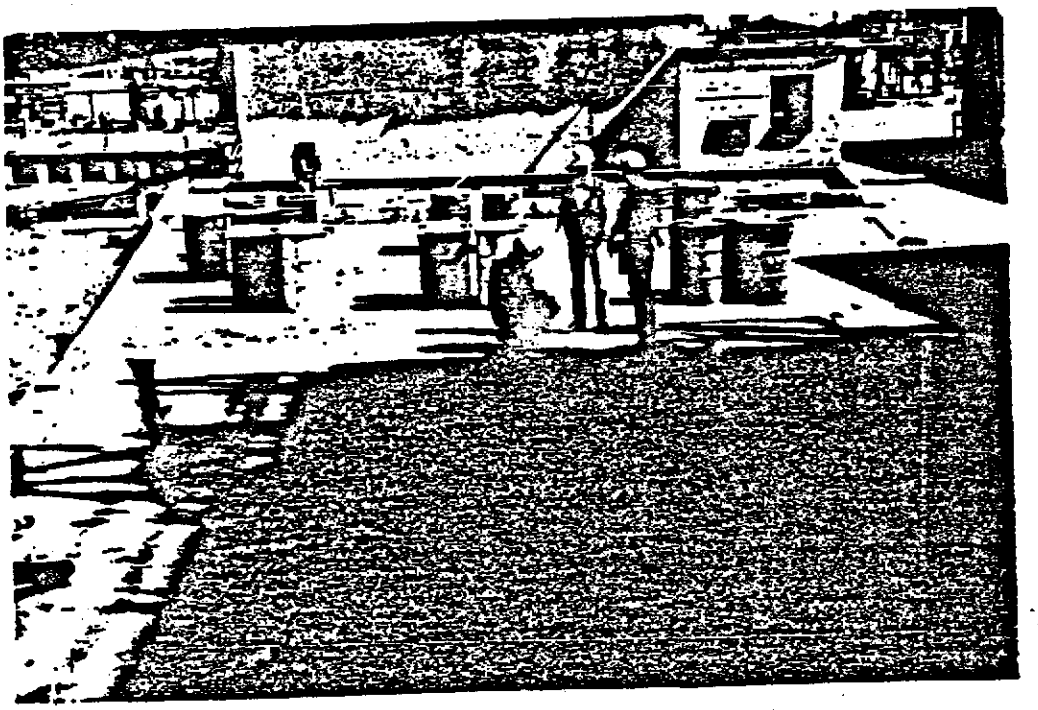

E 98,500
E 98,750
E 99,000
120.3
121.2
PIPES
PIPES
PIPES
PIPES
PIPES
PIPES
HAZARDOUS WASTE
STORAGE AREA
OFF-SPECIFICATION
PRODUCT STORAGE AREA
A
B
C
D
E
F
105
110
115
120
LEGEND
= PROPOSED BORING LOCATION
= SUMP LOCATION (WITH BORING THROUGH BOTTOM)
= LOCATION OF PHOTOGRAPHIC VANTAGE POINT
CONTAINER STORAGE AREAS
WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental scientists
Baton Rouge, Louisiana
CEDAR CHEMICAL COMPANY
WEST HELENA, ARKANSAS
SCALE: N.T.S.
MADE BY: J. BICKFORD
CHECKED BY:
DATE: 12/27/90
DATE:
FILE NO. 90B451C
LOCATION OF PHOTOGRAPHIC VANTAGE POINTS
FIGURE 3

FIGURE 4

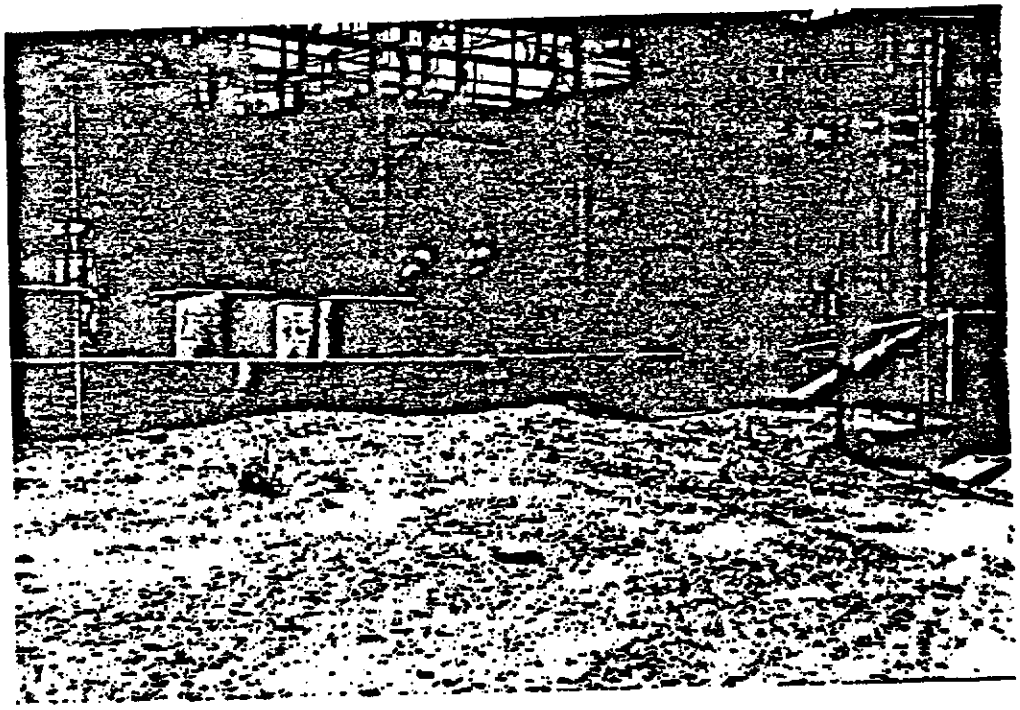
PHOTOGRAPHS OF HAZARDOUS WASTE STORAGE AREA
(REFER TO FIGURE 3 FOR VANTAGE POINTS)

A



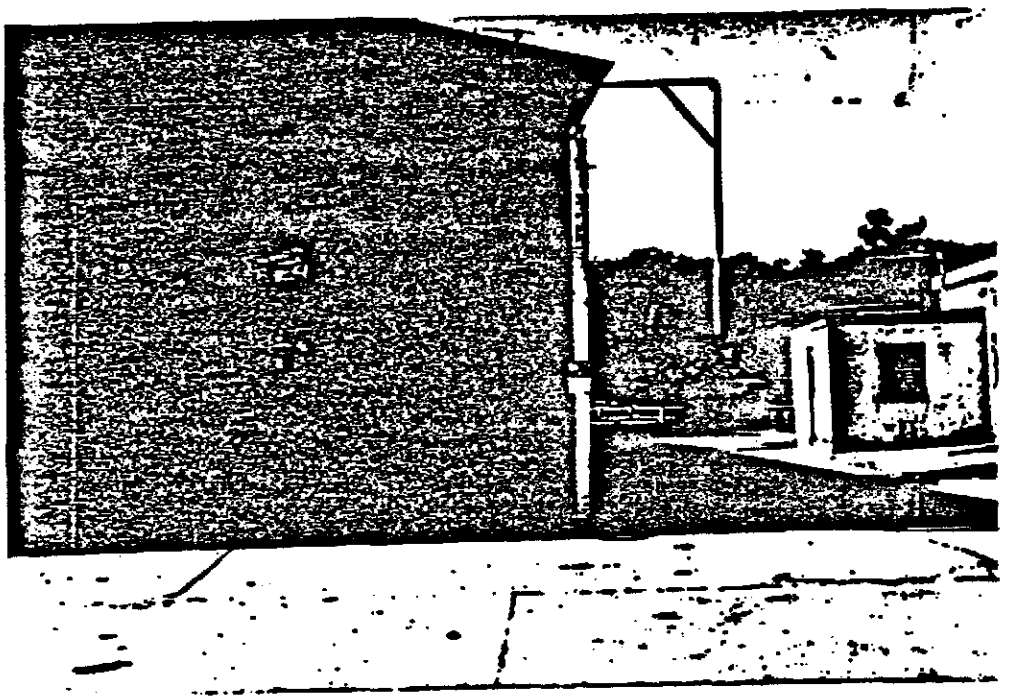
B

FIGURE 5
PHOTOGRAPHS OF HAZARDOUS WASTE STORAGE AREA
(REFER TO FIGURE 3 FOR VANTAGE POINTS)

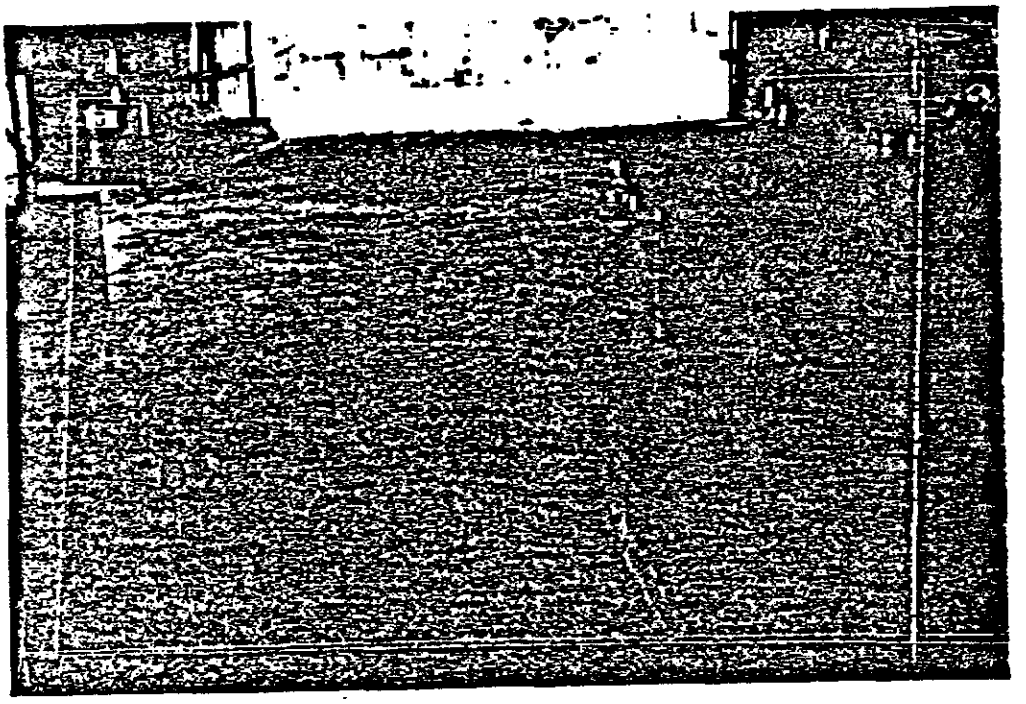


C

FIGURE 6
PHOTOGRAPHS OF OFF-SPECIFICATION PRODUCT STORAGE AREA
(REFER TO FIGURE 3 FOR VANTAGE POINTS)

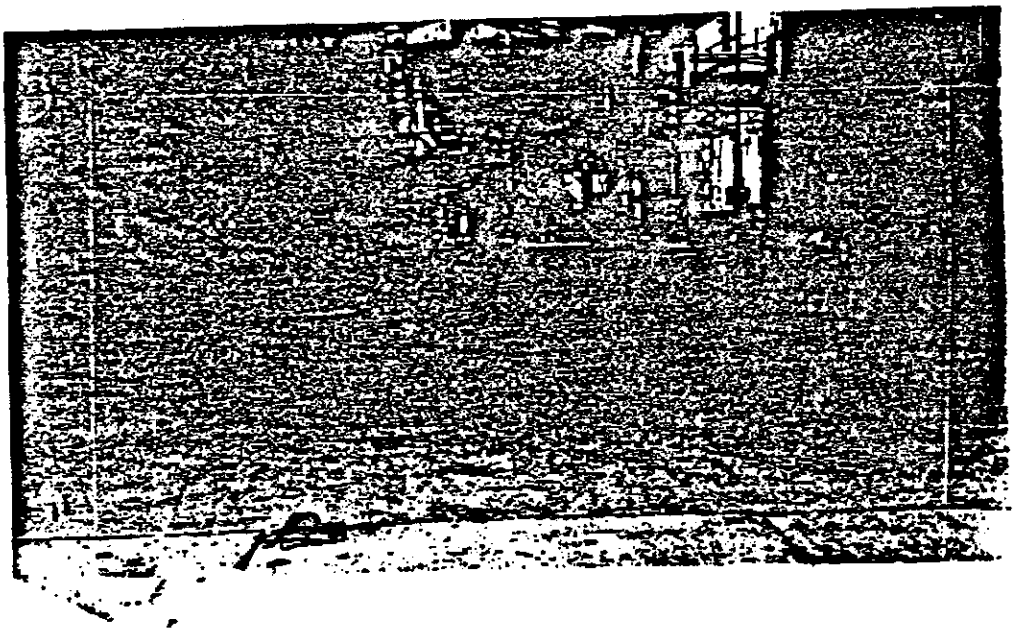


D



E

FIGURE 7
PHOTOGRAPHS OF OFF-SPECIFICATION
PRODUCT STORAGE AREA
(REFER TO FIGURE 3 FOR VANTAGE POINTS)



F

EXHIBIT A

CEDAR CHEMICAL DINOSEB TEST METHOD

Dinoseb in Soil - Spectrophotometric Method

A. Sample Preparation

1. Slurry 10 grams of soil in 100 mls of water in a 250 ml beaker.
2. Make alkaline to pH > 10 with NaOH.
3. Place stirring bar in beaker and stir for 15 minutes.
4. Filter slurry through glass fiber filter paper and wash with two successive 50 ml portions of water.
5. Make up to standard volume in volumetric flask.

B. Sample Analysis

1. Prepare a 10 ppm standard solution of Dinoseb from stock solution.
2. Dilute the 10 ppm standard 2:1 and 5:1 in clean volumetric glassware to give three concentrations for preparation of a standard curve.
3. Read the absorbances of the standards and plot the values to prepare the standard curve.
   a. Set the spectrophotometer at 380 nm wavelength.
   b. Prepare a blank by acidifying a portion of the unknown sample to pH 3 or less to remove color.
   c. Zero and span the instrument to 0 and 100 % transmittance with the blank and a light blocker.
   d. After reading the standards and preparing a standard curve, read the unknown sample. If the sample absorbance is too high, dilute a portion to a known volume and read again.
   e. Compare the absorbance of the unknown to the standards to determine the concentration of Dinoseb in extract from the soil sample. Adjust calculations for aliquoting.
   f. From the dry weight of the sample and the amount of Dinoseb in the extract, calculate the concentration in the soil sample.

This method is a suitable screen for the presence and general quantitation of Dinoseb. Interferences from other compounds having similar absorption curves is possible. More exact determinations should be made using gas-liquid chromatographic techniques.

EXHIBIT B

MATERIAL SAFETY DATA SHEETS FOR PRODUCTS

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

For latest data, consult manufacturer.

STREET ADDRESS: 2100 Poplar Avenue

Prepared by: M. S. Bernard

Date: 5/27/86

CITY, STATE, ZIP CODE: Memphis, TN 38137

CHEMICAL NAME, TRADE NAME AND SYNONYMS: toxaphene technical 90%

FORMULA OF PRIMARY COMPONENTS (STRUCTURAL)

$C_{10}H_{10}Cl_8$ 67-69% chlorine

Section 2 INGREDIENTS

	%	TLV (units)
Active Ingredient: chlorinated camphene	90.0	
Inert Ingredients: xylene type solvents	10.0	

Section 3 PHYSICAL DATA

BOILING POINT (°F)	212	SPECIFIC GRAVITY (H_2O = 1)	1.525
VAPOR PRESSURE (mmHg at 20° C)	1	% VOLATILE BY VOLUME	10 @ 100°C
VAPOR DENSITY (air = 1)	N/A	COLOR AND ODOR	brown, chlorine
SOLUBILITY IN WATER	1ppm	PHYSICAL STATE	thick liquid

Section 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) °F: 212°F. TCC

FLAMMABLE LIMITS STP: L.F.L. N/D U.F.L. N/D

EXTINGUISHING MEDIA: WATER FOG [X] FOAM [ ] ALCOHOL FOAM [X] CO_2 [X] DRY CHEMICAL [ ] OTHER

SPECIAL FIRE FIGHTING PROTECTIVE EQUIPMENT: self-contained air supply

UNUSUAL FIRE AND EXPLOSION HAZARDS: Noxious fumes (hydrogen chloride) produced under fire conditions.

Confine water used in fire fighting from entering water supplies.

Section 5 REACTIVITY DATA

STABILITY: Stable [X]; FIRE CONDITIONS [ ]

CONDITIONS TO AVOID: May burn under extreme heat.

INCOMPATIBILITY (Materials to avoid): [ ] WATER [ ] ACID [ ] BASE [ ] CORROSIVE [ ] OXIDIZING MATERIAL [ ] OTHER

HAZARDOUS DECOMPOSITION PRODUCTS: fire conditions. Hydrogen chloride and others.

10-22-80

Section 6 HEALTH HAZARD DATA

INGESTION
High single dose oral toxicity. LD50 male rats 69 mg/kg.

EYE CONTACT
Moderate irritation may occur.

SKIN CONTACT
May cause moderate irritation.

SKIN ABSORPTION
Absorbed through skin, high toxicity. LD50 rats 1075 mg/kg.

INHALATION (TLV OR SUGGESTED CONTROL FIGURE)
ACGIH TLV for toxaphene is 0.5mg/m³

EFFECTS OF OVEREXPOSURE
Nausea, depression, convulsions, and death.

FIRST AID PROCEDURES
Eyes:Flush with water 30 minutes. Consult physician. Skin:Wash with soap and water 15 minutes.

Ingestion:Toxic by ingestion. Induce vomiting if victim is alert. Clear airway. Control

convulsions. Contact physician immediately.

Section 7 SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Use proper safety equipment. Absorb spill with absorbent, inert material such as oil-sorb.

Dike area for large spills. Keep out of streams and water supplies.

DISPOSAL METHOD
Dispose of in non-crop areas away from water supplies or in an approved landfill

in accordance with State, Federal, and local regulations.

Section 8 SPECIAL PROTECTION INFORMATION

VENTILATION

LOCAL EXHAUST	SPECIAL
MECHANICAL (General)	OTHER
To control TLV of toxaphene	

Required

RESPIRATORY PROTECTION (Specify Type)
None normally needed with adequate ventilation. During spraying use organic vapor respirator.

PROTECTIVE CLOTHING
Impervious gloves, boots, and apron, and clean body-covering clothing.

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:

OTHER PROTECTIVE EQUIPMENT
Eye wash fountain and wash facilities at work area.

Section 9 SPECIAL PRECAUTIONS OR OTHER COMMENTS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Do not get in eyes, on skin or on clothing. Keep out of reach of children.

OTHER PRECAUTIONS
Avoid breathing spray mists or vapors. Keep away from heat or flame.

Extremely toxic to fish, keep out of streams, lakes, and other bodies of water.

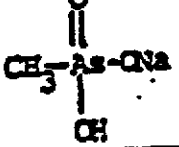
10-26-90 14:01

MATERIAL SAFETY DATA SHEET

VERTAC CHEMICAL CORPORATION

Section 1 NAME & PRODUCT

MANUFACTURER'S NAME: ac Chemical Corporation
ADDRESS: Poplar Avenue
CITY, STATE, ZIP CODE: is, TN 38137
IN CASE OF EMERGENCY TELEPHONE: 1-800-424-9300
For latest data, consult manufacturer.
Prepared by: M. S. Bernard
Date: 10/17/84
CHEMICAL NAME, TRADE NAME AND SYNONYMS: rtac MSMA 800, 8#/gal Monosodium Acid Methanearsonate, MSMA
FORMULA OF PRIMARY COMPONENTS (STRUCTURAL):



Section 2 INGREDIENTS

	%	TLV (units)
dium Acid Methane Arsonate	58.5	
Ingredients	41.5	

Section 3 PHYSICAL DATA

ING POINT (°F)		SPECIFIC GRAVITY (H_2O = 1)	1.648
OR PRESSURE (mmHg at 20° C)	Low	% VOLATILE BY VOLUME	40.7
VAPOR DENSITY (air = 1)	N/A	COLOR AND ODOR	Very light yellow
JBILITY IN WATER	Miscible	PHYSICAL STATE	Clear Liquid

Section 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED): Aqueous Solution - No Flash
FLAMMABLE LIMITS: L.F.L. U.F.L.

EXTINGUISHING MEDIA: WATER FOG [X] WATER [X] FOAM [X] ALCOHOL FOAM [X] CO_2 [X] DRY CHEMICAL [X] OTHER

SPECIAL FIRE FIGHTING PROTECTIVE EQUIPMENT: -contained breathing apparatus, chemical gloves and boots

UNUSUAL FIRE AND EXPLOSION HAZARDS: r EXTREME conditions such as strong acidic environment and strong heat, arsine gas poisonous gas) may be produced.

Section 5 REACTIVITY DATA

STABILITY: [ ]
CONDITIONS TO AVOID: Extreme heat and strong acid
FIRE CONDITIONS: [ ]

INCOMPATIBILITY: [ ] WATER [ ] ACID [ ] BASE [ ] CORROSIVE* [ ] OXIDIZING MATERIAL

Section 6 HEALTH HAZARD DATA

NGESTION Acute Oral LD50 Rats 1359mg/kg

ACT Mild Irritant

ACT Mild to none irritation, depending on individual's sensitivity.

SORPTION Not absorbed

NTITLV OR SUGGESTED CONTROL FIGURE)

Not normally a problem

OVEREXPOSURE Subacute: salty taste, burning in throat, colicky stomach pains. headache, vomiting, diarrhea, stupor, convulsions

PROCEDURES Eyes: flush with water. Consult physician if irritation persists. Wash with soap and water. Oral Ingestion: empty stomach by vomiting or ion. Lavage with 3 liters isotonic saline. BAL (Dimercaprol) is antidotal: er in 3mg/kg body weight every 4 hours.

Section 7 SPILL OR LEAK PROCEDURES

O BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Spill and transfer to suitable container. Absorb remaining free liquid with ant.

ETHOD

local pollution control authorities or EPA office.

Section 8 SPECIAL PROTECTION INFORMATION

ATION

LOCAL EXHAUST Not normally required

MECHANICAL (General)

SPECIAL

OTHER

IRY PROTECTION (Specify Type) ally required

IVE CLOTHING

loves, boots, chemical goggles

CTION NORMALLY ESSARY

☐ SAFETY GLASSES WITHOUT SIDE SHIELDS

☒ SAFETY GLASSES WITH SIDE SHIELDS OR

☐ CHEMICAL WORKERS GOGGLES

TIGHT GOGGLES EQUIVALENT

☐ OTHER:

OTECTIVE EQUIPMENT equired

Section 9 SPECIAL PRECAUTIONS OR OTHER COMMENTS

ONS TO BE TAKEN IN HANDLING AND STORING

dard procedures for chemical handling

ECAUTIONS

ay from foods, feeds, seeds, fertilizers, insecticides, and fungicides.

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

DATE: 08/15/86 PAGE 1

CODE NAME: TECHNICAL DINOSEB
EPA REG. NO.: 56077-3

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137
Emergency Phone Number: 1-800-424-9300
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 (2-sec-butyl-4,6-dinitrophenol)	n/d	0.3mg/m³	95.00
CAS # 88-85-7	n/d	n/d	5.00
Impurities			

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, CO_2, 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. LD_{50} 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. LD_{50} 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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CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

DATE: 4/20/89 PAGE 1

PRODUCT NAME: POTATO TOP KILLER 300

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137, USA

Information Phone No.: 1-601-636-1231
Emergency Phone No.: 1-800-424-9300
Prepared by: M. S. Barnard

SECTION II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

INGREDIENTS	OSHA PEL	ACGIH TLV	PERCENT
Dinoseb (2-sec-butyl-4,6-dinitrophenol)	n/d	0.3mg/m³	30.2
CAS # 88-85-78	200ppm	100ppm	
Toluene			
CAS # 108-88-3			

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	above 212	Specific Gravity	approx 0.990	Vapor Density(Air=1)	n/d
Vapor Pressure(mmHg.)	below 20	Evaporation Rate	n/d	Melting point	n/a
Solubility in Water:	Emulsifiable				
Appearance and Odor	Brown liquid. Organic acid odor.				

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 84°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media: Water Fog, Foam, CO_2, and Dry Chemical
Special Fire Fighting Procedures: Self contained air supply recommended. Confine water used in fire fighting.
Unusual Fire and Explosion Hazards: Noxious fumes (Oxides of Nitrogen) may form. Vapors may ignite. Dinoseb undergoes rapid exothermic decomposition at 190°C.

SECTION V REACTIVITY DATA

Stability: Stable in normal use and storage.
Conditions to Avoid: Heating above 100°C. Avoid ignition sources. Product undergoes rapid exothermic decomposition at 190°C.
Incompatibility: Strong Acids and Strong Oxidizers.
Hazardous Decomposition By-products: 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
[illegible]: Readily Absorbed

Health Hazards(Acute and Chronic): Oral Ingestion: High single dose toxicity. Acute Oral LD_{50} (rats) 58 mg/kg for Dinoseb.

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. Stains skin yellow.

Skin Absorption: Readily absorbed through skin. Highly toxic. Dermal LD_{50} (guinea pigs) 100-200 mg/kg for Dinoseb.

Inhalation: May be irritating. Control vapor or dust levels to recommended levels for Dinoseb and Toluene.

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

Signs and symptoms of Exposure: Yellow stained skin. Increased body temperature and metabolic rate. fatigue, sweating, and thirst.

Medical Conditions Generally Aggravated by Exposure: None known.

Emergency and First Aid Procedures:

Oral Ingestion: Toxic by ingestion. Induce vomiting then give 2 teaspoons of baking soda in water and seek medical help immediately.

Eye Contact: Flush immediately with continuous irrigation of water for at least 30 min. Seek medical consultation immediately. Stain for evidence of corneal injury. Treat if injuried by instilling antibotic steriod preparation frequently.

Skin Contact: Promptly wash skin with plenty of soap and water for a least 15 min. while removing contaminated clothing. Consult physician. Wash clothing before reuse.

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

NOTE TO PHYSICIAN: No known antidote. Treat symptomatically. Keep patient quient in cool place. If feverish, cool with cold compresses or by immersion in cool water.

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps To Be Taken In Case Material Is Released or Spilled:
Use proper safety equipment. Sweep-up material with the aid of an inert absorbant material such as oil-dry. Keep out of streams and water supplies. Contact Chemtrec for assistance.

Waste Disposal Method:
Incineration is recommended. Check with regulatory authorities for landfill disposal regulations.

Precautions To Be Taken in Handling and Storage:
Do not get on skin, on clothing, or in eyes. Keep out of reach of children.

Other Precautions:
Avoid breathing vapors. Keep away from flame.

SECTION VIII CONTROL MEASURES

Respiratory Protection: None normally needed. During use and handling use dust mask or respirator as conditions warrant.

Ventilation: Recommended to control TLV of Dinoseb and Toluene.

Protective Gloves: Impervious rubber gloves.

Eye Protection: Chemical worker's goggles or full face shield.

Other Protective Clothing or [illegible] body-covering clothing

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Chemical Name

Common Name

Manufacturer

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

DATE: 08/15/86 PAGE 1

PRODUCT NAME: PREMERGE 3
EPA REG. NO.: 56077-13

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137

Emergency Phone Number: 1-800-424-9300
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 Alkanolamine Salts Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	50.70
Methanol CAS # 67-56-1	200ppm	200ppm	15.00

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	above 212	Specific Gravity	1.130
Vapor Pressure(mm Hg.)	50	Melting Point(°F)	n/a
Vapor Density(Air=1)	n/a	Evaporation Rate	n/d

Solubility in Water: Infinite
Appearance and Odor: Brown liquid, sweet alcohol odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 85°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO_2, 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 Avoid ignition sources.
Incompatibility: Strong Acids 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: Moderate Single Dose Oral Toxicity. LD_{50} Male Rats 170 mg/kg, Female Rats 130 mg/kg. May be fatal if swallowed. May cause blindness.
Eye Contact: May cause severe irritation and corneal injury, possible permanent impairment of vision.
Skin Contact: May cause slight irritation, colors skin yellow.
Skin Absorption: Readily absorbed through skin, high toxicity.
Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m³. ACGIH TLV for methanol is 200ppm.

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

Signs and Symptoms of Exposure:
Fatigue, sweating, thirst, and fever (due to Dinoseb) plus optic nerve injury and blindness, CNS depression, drunkenness, nausea, anesthesia, and vomiting (due to methanol).

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 impairment of vision.
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 TLV of methanol.

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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Chemical Name

Common Name

Manufacturer

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

DATE: 08/15/86 PAGE 1

PRODUCT NAME: PREMERGE PLUS
EPA REG. NO.: 56077-16

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis. TN 38137

Emergency Phone Number: 1-800-424-9300
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 Sodium Salt (Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	11.50
Naptalam Sodium Salt (Naptalam (N-1-naphthylphthalamic acid) CAS # 132-66-1	n/d	n/d	22.30

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	188	Specific Gravity	1.150
Vapor Pressure(mm Hg.)	12	Melting Point(°F)	n/a
Vapor Density(Air=1)	n/a	Evaporation Rate	0.24
Solubility in Water:	Infinite		
Appearance and Odor:	Brown liquid, sweet odor		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): above 212°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO_2, 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. Dinoseb 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. Dinoseb undergoes rapid exothermic decomposition at 190°C. Avoid ignition sources.
Incompatibility: Strong Acids 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: Absorbed
Ingestion: Moderate Toxicity

Health Hazards (Acute and Chronic):
Oral Ingestion: Moderate Single Dose Oral Toxicity. LD_{50} Male Rats 232 mg/kg. May be fatal if swallowed.
Eye Contact: May cause moderate irritation and non-permanent corneal injury.
Skin Contact: May cause slight irritation. stains skin yellow.
Skin Absorption: Readily absorbed through skin. moderate toxicity. LD_{50} Rabbits above 400mg/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:
Yellow staining of skin, profuse sweating, thirst, fever, excessive fatigue, and hypothermia.

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.
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 vapor levels to guidelines.

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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CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

PRODUCT NAME: SELECTIVE WEED KILLER DATE: 08/15/86 PAGE 1
EPA REG. NO.: 56077-11

SECTION I

Manufecturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137
Emergency Phone Number: 1-800-424-9300
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 Ammonium Salt Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	13.70
Isopropanol CAS # 67-56-1	400ppm	400ppm	

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	175	Specific Gravity	0.860
Vapor Pressure(mm Hg.)	35	Melting Point(°F)	n/a
Vapor Density(Air=1)	n/a	Evaporation Rate	n/d

Solubility in Water: Infinite
Appearance and Odor: Brown liquid, alcohol odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 66°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO_2, 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 Acids 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: Moderate Toxicity

Health Hazards (Acute and Chronic):
Oral Ingestion: Moderate Single Dose Oral Toxicity. LD_{50} Male Rats 205 mg/kg, Female Rats 178 mg/kg. May be fatal if swallowed.
Eye Contact: May cause moderate irritation and corneal injury.
Skin Contact: May cause slight irritation, colors skin yellow.
Skin Absorption: Readily absorbed through skin, moderate toxicity. LD_{50} Rabbits 212mg/kg.
Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m³. ACGIH TLV for isopropanol is 400ppm.

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

Signs and Symptoms of Exposure:
Yellow staining of skin, profuse sweating, thirst, fever, excessive fatigue, and hypothermia.

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.
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 vapor levels to guidelines.
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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CIBA–GEIGY

MATERIAL SAFETY DATA SHEET

CIBA–GEIGY Corporation
Agricultural Division
Post Office Box 18300
Greensboro, NC 27419

A 52

In Case of Emergency, Call
CIBA–GEIGY: 1-800-888-8372
1-800-334-9481
CHEMTREC: 1-800-424-9300

I. MATERIAL IDENTIFICATION

Product Name: Atrazine Technical **CAS #:** 1912-24-9

Active Ingredient (%): 97.0
Chemical Name: 2-chloro-4-ethylamino-6-isopropylamino-s-triazine
Chemical Class: Triazine Herbicide
EPA Signal Word: Caution

II. REGULATORY INFORMATION

SARA Title III Classification
Acute and Chronic Health Hazard

Proposition 65 (CA Only)
Not Determined

Reportable Quantity (RQ)
None

RCRA Classification
Not Applicable

DOT Classification
No Label or Placard Required

B/L Freight Classification
Compound, Weed Killing (Herbicide), N.O.S.

NFPA Hazard Ratings	
Health	1
Flammability	1
Reactivity	0

0 Least
1 Slight
2 Moderate
3 High
4 Severe

III. HAZARDOUS INGREDIENTS

Material	OSHA PEL	ACGIH TLV	NTP/IARC/OSHA Carcinogen
Atrazine	5 mg/m³	5 mg/m³	
Cyanazine	--	--	

IV. FIRST AID PROCEDURES

If poisoning is suspected, immediately contact a physician, the nearest hospital, or the nearest Poison Control Center. Tell the person contacted the complete product name, and the type and amount of exposure. Describe any symptoms and follow the advice given.

Ingestion: If victim is fully conscious, give 1 or 2 glasses of water to drink and induce vomiting. Never give anything by mouth to an unconscious person.

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Eye Contact: Immediately rinse eyes with a large amount of running water. Hold eyelids apart to rinse the entire surface of the eye and lids. Do not apply any medicating agents except on the advice of a physician.

Skin Contact: Wash with plenty of soap and water, including hair and under fingernails. Do not apply any medicating agents except on the advice of a physician. Remove contaminated clothing and wash before reuse.

Inhalation: Move victim from contaminated area to fresh air. Apply artificial respiration if necessary.

Notes to Physician
There is no specific antidote if atrazine is ingested. Induce emesis or lavage stomach. If a small amount has been ingested, administration of activated charcoal in water can be considered.

Based on the acute oral LD_{50} in rats, ingestion of 1/4 pound may be fatal to an adult human.

Medical Conditions Likely to be Aggravated by Exposure
Persons with allergy history or pre-existing dermatitis should use extra precautions in handling atrazine.

V. HEALTH HAZARD INFORMATION

Symptoms of Acute Exposure
Slight, temporary, eye or skin irritation may occur. Repeated skin contact may cause a sensitization (allergic) reaction in sensitive individuals.

Acute Toxicity/Irritation Studies

Ingestion:	slightly toxic Oral LD_{50} (Rat) = 1,869 mg/kg body weight
Dermal Absorption:	slightly toxic Dermal LD_{50} (Rat) = >3,100 mg/kg body weight
Inhalation:	moderately toxic Inhalation LC_{50} (Rat) = >0.71* mg/l air - 1 hour; 1.3* mg/l air - 4 hours (90% atrazine formulation)
	*Highest attainable concentrations; no animal deaths or symptoms occurred.
Eye Contact:	slightly irritating (Rabbit)
Skin Contact:	slightly irritating (Rabbit)
Skin Sensitization:	sensitizer (Guinea Pig)

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Chronic Toxicity Studies

Long-term exposure to low levels of atrazine is not known to cause any chronic ill effects in humans.

An elevated incidence of mammary tumors was observed in female Sprague-Dawley rats during a long-term feeding study with Atrazine Technical. This response did not occur in male rats or mice and is considered to be sex- and strain-specific. In other long-term feeding studies, very high doses of atrazine caused signs of cardiotoxicity in dogs and mice. Atrazine caused no adverse reproductive effects over two generations of rats and was not teratogenic in rats or rabbits. Atrazine has been reported to cause mutagenic effects in barley seeds and corn plants, however those findings have been successfully refuted, and data from studies documented as reliable in determining mutagenic potential indicate that atrazine is not a mutagen.

A metabolite of atrazine, 2,3-diamino-6-chloro-s-triazine (DACT), has caused signs of cardiotoxicity in dogs at high doses.

Toxicity of Other Components

Atrazine Technical may contain a very small amount (1.0% or less) of cyanazine as a process-related impurity. Cyanazine has been determined to cause birth defects (teratogenicity) in rats and rabbits at high dose levels.

VI. PERSONAL PROTECTION AND PRECAUTIONS

Ingestion:	Store the material in a well-ventilated, secure area out of the reach of children and domestic animals. Do not store food, beverages, or tobacco products in the storage area. Prevent eating, drinking, tobacco usage, and cosmetic application in areas where there is a potential for exposure to the material. Always wash thoroughly after handling.
Eye Contact:	To avoid eye contact, wear chemical safety glasses or goggles.
Skin Contact:	To avoid skin contact, wear rubber gloves, impervious boots, long-sleeved shirt, long pants, and hat.
Inhalation:	To avoid breathing dust, wear a dust mask.

VII. PHYSICAL HAZARD INFORMATION

Fire and Explosion

Flash Point (Test Method):	>200°C (Pensky-Martens CC)
Flammable Limits (% in Air):	Not Applicable
Autoignition Temperature:	480°C

Reactivity

Stability:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid:	None Known
Hazardous Decomposition Products:	May Include Carbon Monoxide, Hydrogen Cyanide, Acetonitrile

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Physical Properties

Appearance:	White Powder
Odor:	Odorless
Melting Point:	175-177°C
Solubility in H_2O:	33 ppm @ 22°C
Boiling Point:	Not Applicable
Specific Gravity:	1.19 @ 25°C
Vapor Pressure:	6.6×10^{-7} mm Hg @ 25°C
pH:	Not Available
Evaporation Rate:	Not Applicable

Unusual Fire, Explosion and Reactivity Hazards
Presents a possible dust explosion hazard.

VIII. ENVIRONMENTAL PROTECTION

In Case of Spill or Leak
Wear chemical safety glasses or goggles, rubber gloves, impervious boots, long-sleeved shirt, long pants, hat, and dust mask. For small spills, sweep up as much material as possible, keeping dust to a minimum, and place in an approved chemical waste container. Wash the spill area with water containing a strong detergent, absorb with pet litter or other absorbent material, sweep up and place in a chemical waste container. Seal container and dispose of in an approved manner. Rinse the spill area with water to remove any residue. Do not allow wash or rinse water to contaminate water supplies.

In Case of Fire
Use dry chemical, foam, or CO_2 extinguishing media. Wear full protective clothing and self-contained breathing apparatus. Evacuate nonessential personnel from the area to prevent human exposure to fire, smoke, fumes, or products of combustion. Prevent use of contaminated buildings, area, and equipment until decontaminated.

Disposal
Do not reuse product containers. Dispose of product containers, waste containers, and residues according to local, state, and federal health and environmental regulations.

Questions concerning the safe handling of Atrazine Technical should be referred to:

CIBA-GEIGY Corporation
Environmental Safety & Compliance
(919) 292-7100

Issued Date: 11/25/85
Revised Date: 2/06/89

Supercedes: 3/09/88

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein.

AUG 26 '91 10:52 CIBA GEIGY APD 504 642 1620 P.5

APPENDIX C

METHODOLOGY FOR CALCULATION OF CLEANUP CRITERIA

METHODOLOGY FOR CALCULATION OF CLEANUP CRITERIA

The development of site-specific health-based remedial goals is based on the health risk assessment process in accordance with EPA Risk Assessment Guidelines for Superfund (RAGS). Remedial goals for the identified constituents of potential concern are obtained through backcalculation of health risk estimation calculations.

CALCULATIONS OF CANCER RISK

The calculation of cancer risk is herein summarized. In the calculation of potential carcinogenic health risk at the site, the concentration of a constituent in the medium (Column A) is multiplied by a population specific intake factor (Column B) to obtain the daily intake of chemical (Column C) for the receptor population. To estimate cancer risk (Column E) the daily intake (Column C) is multiplied by the slope factor (Column D).

Chemical Concentration (mg/kg)	Intake Factor (kg/kg/day)	Lifetime Daily Intake (mg/kg/day)	Slope Factor $(mg/kg/day)^{-1}$	Cancer Risk
A	B	C	D	E

Daily Intake = (*Chemical Concentration*) (*Intake Factor*)

$C = (A)\ (B)$

Cancer Risk = (*Slope Factor*) (*Lifetime Daily Intake*)

$E = (D)\ (C)$

CALCULATION OF NONCARCINOGENIC HEALTH EFFECTS (HAZARD QUOTIENT)

The calculation of the potential for noncarcinogenic health effects, called the hazard quotient, is summarized as follows. The calculation is similar to the calculation for carcinogenics, the concentration of constituent in the medium (Column A) is multiplied by a population specific intake factor (Column B) to obtain the daily intake of chemical (Column C) for the receptor population. To estimate hazard quotient (Column E) the daily intake (Column C) is multiplied by the reciprocal of the reference dose (Column D).

Chemical Concentration (mg/kg)	Intake Factor (kg/kg/day)	Lifetime Daily Intake (mg/kg/day)	RfD (mg/kg/day)	Hazard Quotient
A	B	C	D	E

$$Daily\ Intake = (Intake\ Factor)\ (Chemical\ Corporation)$$

$$C = (B)\ (A)$$

$$Hazard\ Quotient = \frac{Daily\ Intake}{RfD}\ \frac{1}{}$$

$$E = C\ \frac{1}{D}$$

CLEANUP CRITERIA CALCULATIONS FOR CARCINOGENS

To derive site-specific chemical concentrations in medium that are protective of human health, the calculations presented above are reversed. For carcinogens, the designated acceptable cancer risk level (Column E) is divided by the slope factor (Column D) to

yield the acceptable daily chemical intake (Column C). The acceptable daily intake (Column C) is then divided by the intake factor (Column B) to obtain an acceptable concentration of chemical in the medium; i.e., a chemical-specific cleanup goal (Column A).

Acceptable Cancer Risk	Slope Factor $(mg/kg/day)^1$	Lifetime Daily Intake (mg/kg/day)	Intake Factor (mg/kg/day)	Chemical Concentration mg/kg
E	D	C	B	A

$$Lifetime\ Daily\ Intake = \frac{Cancer\ Risk}{Slope\ Factor}$$

$$C = \frac{E}{D}$$

$$Acceptable\ Chemical\ Concentrations = \frac{Lifetime\ Daily\ Intake}{Intake\ Factor}$$

$$A = \frac{C}{B}$$

CLEANUP CRITERIA CALCULATIONS FOR NON-CARCINOGENS

For noncarcinogenic constituents, the hazard quotient (Column E) is assigned an acceptable value which is multiplied by the reference dose (Column D) to yield the acceptable daily chemical intake (Column C). The acceptable daily chemical intake is divided by the intake factor (Column B) to obtain the acceptable concentration of chemical in the medium; i.e., a chemical-specific cleanup goal (Column A).

Acceptable Hazard Quotient	RfD (mg/kg/day)	Daily Intake (mg/kg/day)	Intake Factor (mg/kg/day)	Acceptable Chemical Concentration (mg/kg)
E	D	C	B	A

$$Daily\ Chemical\ Intake = (Acceptable\ Hazard\ Quotient)\ (RfD)$$

$$C = (E)(D)$$

$$Acceptable\ Chemical\ Concentration = \frac{Daily\ Chemical\ Intake}{Intake\ Factor}$$

$$A = \frac{C}{B}$$

Cleanup goals are usually governed by potential carcinogens found on-site although cleanup goals for noncarcinogenic compounds may also be evaluated. Where toxicity values for the evaluation of both carcinogenic and noncarcinogenic health effects are available, cleanup criteria were calculated for both and cleanup criteria will be established based on the more conservative chemical concentration calculated.

TARGET CANCER RISKS

An acceptable level of potential cancer risk is selected after evaluation of site variables including the types and activities of receptors on or near the site, types of potential exposures, the inherent toxicity of chemicals found on or near the site, the EPA guidelines governing remedial goals and risk management decisions (OSWER Directive 9355.0-30).

A target potential cancer risk 1 x 10^{-4} has been selected for the site. This level of potential risk has been selected based on the following:

- The areas are currently inactive process areas and access is restricted.
- Future site use will be industrial/commercial.
- Potential future exposures will be transient and related primarily to the duration and frequency with which workers are on-site.
- The potential carcinogens identified on-site have not been demonstrated to be carcinogenic in humans thereby further reducing the likelihood that the target level of potential risk can be reached.
- EPA guidelines state that for the calculation of cleanup goals for known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifeline cancer risk to an individual of 10^{-4} (EPA OSWER Directive 9355.0-30).

TARGET HAZARD QUOTIENT

A target potential hazard quotient of one has been selected for the development of soil cleanup criteria at the former pesticide facility. A hazard quotient less than one represents an exposure level that is without adverse health effects in exposed populations (EPA RAGS).

SPECIFIC CALCULATIONS FOR CEDAR - CARCINOGENS

Based on the assumptions noted above an intake factor is calculated:

$$\text{Intake Factor} = \frac{(IR)(CS)(FI)(EF)(ED)}{(BW)(AT)}$$

$$= \frac{(480 \text{ mg/day})(250 \text{ days/yr})(25 \text{ yrs})(10^{-6} \text{ kg/mg})}{(78\text{kg})(365 \text{ days/yr} \times 70 \text{ yrs})}$$

$$= 1.51\text{E-}06 \text{ kg/kg/day}$$

where:

IR = Ingestion Rate (mg soil/day)

200 mg/day (children, 1 through 6 years old; EPA 1989g
100 mg/day (age groups greater than 6 years old; EPA 1989g)

CS = Chemical Concentration in Soil (mg/kg)

FI = Fraction Invested from Contaminated Source (unitless)

Pathway-specific value (should consider contaminant location and population activity patterns)

Say (CS)(FI) = 4.8 at Cedar

EF = Exposure Frequency (days/years)

250 workdays/year at Cedar

ED = Exposure Duration (years)

70 years (lifetime; by convention)
30 years (national upper-bound time (90th percentile) at one residence; EPA 1989d)
9 years (national median time (50th percentile) at one residence; EPA 1989d)

Say 25 years working at Cedar

CF = Conversion Factor (10^{-6} kg/mg)

BW = Body Weight (kg)

70 kg (adult, average; EPA 1989d)
16 kg (children 1 through 6 years old, 50th percentile; EPA 1985a)

Cedar worker 78 kg

AT = Averaging Time (period over which exposure is averaged - days)

Pathway-specific period of exposure for noncarcinogenic effects (i.e., ED x 395 days/year), and 70 year lifetime for carcinogenic effects (i.e., 70 years x 365 days/year).

The following table is then prepared from calculations of noncumulative carcinogenic exposure:

Acceptable Concentration in Soil (ppm)	IF	Daily Chemical Intake	Oral Slope Factor	Risk
Atrazine 300 ppm	1.51E-06	4.5E-04	2.2E-01	10^{-4}
Toxaphene 60 ppm	1.51E-06	9.1E-05	1.1E+00	10^{-4}
Arsenic 38 ppm	1.51E-06	5.7E-05	1.75E+00	10^{-4}

SPECIFIC CALCULATIONS FOR CEDAR - NONCARCINOGENS

The intake factor is similar to the carcinogen calculation except that AT = 25.

$$\text{Intake Factor} = \frac{(IR)(CS)(FI)(EF)(ED)}{(BW)(AT)}$$

$$= \frac{(480 \text{ mg/day})(250 \text{ days/yr})(25 \text{ yrs})(10^{-6}\text{kg/mg})}{(78 \text{ kg})(365 \text{ days/yr} \times 25 \text{ yrs})}$$

$$= 6.15\text{E-}06 \text{ kg/kg/day}$$

The following table is then prepared from calculations of noncumulation noncarcinogenic exposure:

Acceptable Concentration in Soil (ppm)	IF	Daily Chemical Intake	RfD	HQ
Atrazine 813 ppm	6.15E-06	5E-03	5E-03	1
Dinoseb 163 ppm	6.15E-06	1E-03	1E-03	1
Arsenic 163 ppm	6.15E-06	1E-03	1E-03	1
Toluene 48,780 ppm	6.15E-06	3E-01	3E-01	1

ATTACHMENTS

- IRIS Printout - Atrazine
- HEAST Table - Atrazine
- OSWER Directive 9355.0-30

1 - IRIS
IRSN - 206
DATE - 910114
UPDT - Complete Update on 01/14/91, 52 fields added/edited/deleted.
STAT - Oral RfD Assessment (RDO) on-line 01/01/91
STAT - Inhalation RfC Assessment (RDI) no data
STAT - Carcinogenicity Assessment (CAR) pending
STAT - Drinking Water Health Advisories (DWHA) no data
STAT - U.S. EPA Regulatory Actions (EXSR) no data
IRH - 03/01/88 RDO Confidence levels revised
IRH - 08/22/88 RDO Withdrawn; new oral RfD in preparation
IRH - 09/07/88 RDO Revised oral RfD summary added
IRH - 10/01/89 REFS Bibliography on-line
IRH - 03/01/90 RDO Withdrawn; new oral RfD in preparation
IRH - 03/01/90 OREF Oral RfD references withdrawn
IRH - 05/01/90 RDO Oral RfD summary replaced; RfD unchanged
IRH - 05/01/90 OREF Oral RfD references replaced
IRH - 01/01/91 RDO Text edited
IRH - 01/01/91 CAR Carcinogen assessment now under review
RLEN - 13131
NAME - Atrazine
RN - 1912-24-9
SY - A 361
SY - AATREX
SY - AATREX 4L
SY - AATREX 80W
SY - AATREX NINE-O
SY - 2-AETHYLAMINO-4-CHLOR-6-ISOPROPYLAMINO-1,3,5-TRIAZIN
SY - 2-AETHYLAMINO-4-ISOPROPYLAMINO-6-CHLOR-1,3,5-TRIAZIN
SY - AKTIKON
SY - AKTIKON PK
SY - AKTINIT A
SY - AKTINIT PK
SY - ARGEZIN
SY - ATAZINAX
SY - ATRANEX
SY - ATRASINE
SY - ATRATOL A
SY - ATRAZIN
SY - Atrazine
SY - ATRED
SY - ATREX
SY - CANDEX
SY - CEKUZINA-T
SY - 2-CHLORO-4-ETHYLAMINEISOPROPYLAMINE-s-TRIAZINE
SY - 1-CHLORO-3-ETHYLAMINO-5-ISOPROPYLAMINO-2,4,6-TRIAZINE
SY - 1-CHLORO-3-ETHYLAMINO-5-ISOPROPYLAMINO-s-TRIAZINE
SY - 2-CHLORO-4-ETHYLAMINO-6-ISOPROPYLAMINO-1,3,5-TRIAZINE
SY - 2-CHLORO-4-ETHYLAMINO-6-ISOPROPYLAMINO-s-TRIAZINE
SY - 6-CHLORO-N-ETHYL-N'-(1-METHYLETHYL)-1,3,5-TRIAZINE-2,4-DIAMINE
SY - 2-CHLORO-4-(2-PROPYLAMINO)-6-ETHYLAMINO-s-TRIAZINE
SY - CRISATRINA
SY - CRISAZINE
SY - CYAZIN
SY - FARMCO ATRAZINE
SY - FENAMIN
SY - FENAMINE
SY - FENATROL
SY - G 30027
SY - GEIGY 30,027
SY - GESAPRIM
SY - GESOPRIM
SY - GRIFFEX
SY - HUNGAZIN
SY - HUNGAZIN PK
SY - INAKOR

SY - OLEOGESAPRIM
SY - PRIMATOL
SY - PRIMATOL A
SY - PRIMAZE
SY - RADAZIN
SY - RADIZINE
SY - STRAZINE
SY - TRIAZINE A 1294
SY - s-TRIAZINE, 2-CHLORO-4-ETHYLAMINO-6-ISOPROPYLAMINO-
SY - 1,3,5-TRIAZINE-2,4-DIAMINE, 6-CHLORO-N-ETHYL-N'-(1-METHYLETHYL)-
SY - VECTAL
SY - VECTAL SC
SY - WEEDEX A
SY - WONUK
SY - ZEAZIN
SY - ZEAZINE

RDO -

ORAL RFD SUMMARY :

Critical Effect	Experimental Doses*	UF	MF	RfD
Decreased body weights of F2 generation pups on postnatal day 21 2-Generation Rat Reproduction Study Ciba-Geigy, 1987a	NOEL: 10 ppm (0.5 mg/kg/day) LEL: 50 ppm (2.5 mg/kg/day)	100	1	5E-3 mg/kg/day

*Conversion Factors: 1 ppm = 0.05 mg/kg/day (assumed rat food consumption)

ORAL RFD STUDIES :

Ciba-Geigy Corporation. 1987a. MRID No. 40431303.
Available from EPA. Write to FOI, EPA, Washington, DC 20460.

In a 2-generation reproduction study, 120 rats/sex were randomly distributed into 4 treatment groups and fed atrazine at 0, 10, 50, or 500 ppm (0, 0.5, 2.5, and 25 mg/kg/day). Exposure to the test material began when male rats were 47 days old and females were 48 days old. They were maintained on these diets for 10 weeks prior to mating. Males and females were housed together in a 1:1 ratio and allowed 3 weeks for mating. The rats were separated following evidence of mating. One litter was produced in each generation. After weaning, 30 males and 30 females from the first generation were selected to be the second parental generation. The remaining male parental animals were sacrificed on days 133 to 134 of the study. Animals selected for the second generation were exposed to test diets for 12 weeks prior to mating. Mating was conducted in the same manner as for the first generation. Parental males were sacrificed on day 138 of the study and parental females on days 138, 139, and 152 after weaning of their litters.

The NOEL for reproductive toxicity is 10 ppm (0.5 mg/kg/day) based on statistically significantly lower F2 generation pup weights at postnatal day 21 at 50 and 500 ppm (2.5, and 25 mg/kg/day). The NOEL for parental toxicity is 50 ppm (2.5 mg/kg/day) based on statistically signficantly decreased body weights, body weight gain and food consumption for males and females throughout the study at 500 ppm (25 mg/kg/day). In addition, a statistically significant increase in relative testes weights was seen in both generations.

ORAL RFD UNCERTAINTY :

UF = 100. An uncertainty factor of 100 was used to account for the inter- and intraspecies differences.

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o ORAL RFD MODIFYING FACTOR :

MF = 1.

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o ORAL RFD COMMENTS :

Data Considered for Establishing the RfD

1) 2-Generation Reproduction - rat: see previous description; core grade minimum (Ciba-Geigy Corp., 1987a)
2) 1-Year Feeding - dog: Dietary levels tested: 0, 15, 150, and 1000 ppm (Male: 0, 0.48, 4.97, and 33.65 mg/kg/day; Female: 0, 0.48, 4.97, and 33.8 mg/kg/day). NOEL=150 ppm (4.97 mg/kg/day); LEL=1000 ppm (43 mg/kg/day) (HDT; based on death, cachexia, ascites, decreased body weight and body weight gain, decreased food consumption; EKG changes [irregular heart beat and increased heart rate, decrease P-II values, atrial premature complexes, atrial fibrillation]; cardiac lesions [dilation of atria, atrial degeneration]); core grade minimum (Ciba-Geigy Corp., 1987b)
3) 2-Year Feeding (oncogenic) - rat: Dietary levels tested: 0, 70, 500, and 1000 ppm (0, 3.5, 25, and 50 mg/kg/day). Administration of atrazine to male and female CD-1 Sprague-Dawley rats resulted in decreased mean body weights for males and females receiving 500 and 1000 ppm. Survival was decreased in high-dose females but increased in high-dose males. Red blood cell parameters (hemoglobin, hematocrit, and red cell count) were decreased in high-dose females only. The serum glucose level was decreased in high-dose females at 3, 6, and 12 months and serum triglyceride levels showed a decreasing trend in high-dose males throughout the study. There were decreases in organ-to-body weight ratios in high-dose animals, which were probably the result of body weight decreases. Hyperplastic changes in high-dose males (mammary gland, bladder, and prostate) and females (myeloid tissue of bone marrow and transitional epithelium of the kidney) were of questionable toxicologic importance. There was an increase in retinal degeneration and in centrilobular necrosis of the liver in high-dose females and an increase in degeneration of the rectus femoris muscle in high-dose males and females when compared to controls. Based on decreased body weight gain, the LEL for males and females is 500 ppm (25 mg/kg/day) and the NOEL is 70 ppm (3.5 mg/kg/day); core grade minimum (Ciba-Geigy Corp., 1986)
4) Developmental toxicity - rat: Dietary levels tested: 0, 10, 70, and 700 mg/kg/day (by gavage). Administration of atrazine technical to Charles River CD rats from days 6 to 15 of gestation resulted in maternal toxicity during and after the treatment period at the high-dose. Signs of toxicity at the high-dose included death (21 of 27 dams), reduced food consumption, reduced weight gain, salivation, ptosis, swollen abdomen, oral/nasal discharge, and bloody vulva. Maternal toxicity was also found at the 70 mg/kg/day dose level. Toxicity signs in this group included reduced food consumption, reduced body weight, and reduced weight gain. No maternal toxicity was observed in the 10 mg/kg/day or control groups. Based on the above effects, the maternal toxicity NOEL is 10 mg/kg/day and the LEL is 70 mg/kg/day. At 70 mg/kg/day, there were statistically significant increases in both fetal and litter incidences for skeletal variations indicating delayed ossification. Variations included: skull not completely ossified, metacarpals not ossified, metacarpals bipartite, and phalanx not ossified. Based on these effects the NOEL and LEL for developmental toxicity are 10 and 70 mg/kg/day, respectively.; core grade minimum (Ciba-Geigy Corp., 1984a)
5) Developmental toxicity - rabbit: Dietary levels tested: 0, 1, 5, 75 mg/kg/day (by gavage). Administration of atrazine technical to New Zealand White rabbits from days 7 to 19 of gestation resulted in maternal toxicity during the treatment period at doses of 5 and 75 mg/kg/day. Does in the 75 mg/kg/day group did not recover from symptoms of this toxicity during the period after dosing. Signs of maternal toxicity in the 5 mg/kg/day dose group were decreased food consumption and decreased body weight. Signs of maternal toxicity in the high-dose group included blood on vulva or in cage, decreased food consumption, abnormal stools, and decreased body weight and body weight gain. No effects were observed at the lowest dose

tested, 1 mg/kg/day. Based on the above effects, the maternal toxicity NOEL is 1 mg/kg/day and the LEL 5 mg/kg/day. An increased number of resorptions in the HDT was statistically significant and was not observed at any other dose level. In the HDT, the weights of both the male and female fetuses were significantly reduced. No compound-related malformations were observed. Skeletal variations, especially delayed ossification of appendicular skeletal elements, were found more frequently in the HDT. Based on the above effects, the developmental toxicity NOEL is 5 mg/kg/day and the LEL 75 mg/kg/day; core grade minimum (Ciba-Geigy Corp., 1984b)

Other Data Reviewed:

1) Chronic Feeding - mouse: Dietary levels tested: 0, 10, 300, 1500, and 3000 ppm (Male: 0, 1.4, 38.4, 194.0, and 385.7 mg/kg/day; Female: 0, 1.6, 47.9, 246.9, and 482.7 mg/kg/day). This study shows that there are dose-related effects of atrazine in CD-1 mice fed diets containing 1500 or 3000 ppm of atrazine. The dose-related effects were the production of cardiac thrombi, decreases of 23.5% and 11.0% in the mean body weight gain at 91 weeks in males and females, respectively, and decreases in erythrocyte count, hematocrit and hemoglobin concentration. An increase in the incidence of cardiac thrombi was found in females receiving 1500 and 3000 ppm. Based on the above effects, the LEL for systemic toxicity is 1500 ppm (Male: 194.0 mg/kg/day; Female: 246.9 mg/kg/day). The NOEL for systemic toxicity is 300 ppm (Male: 38.4 mg/kg/day; Female: 47.9 mg/kg/day).; core grade guideline (Ciba-Geigy Corp., Agricultural Division, 1987c)
2) 2-Year Feeding - dog: Dietary levels tested: 0, 14.1, 141.5, and 1415 ppm (0, 0.35, 3.54, and 35.38 mg/kg/day). The NOEL for systemic toxicity is 14.1 ppm (0.35 mg/kg/day) based on increased heart and liver weights in females at 141.5 ppm (3.54 mg/kg/day). Effects observed at 1415 ppm (35.38 mg/kg/day) included reduced food intake, decreased body weight, and reduced hemoglobin and hematocrit values. core grade supplementary (Ciba-Geigy Corp., 1964)
3) Developmental toxicity - rat: Dietary levels tested: 0, 100, 500, and 1000 mg/kg/day. Administration of atrazine at 1000 mg/kg/day produced 7 deaths in the 30 dams treated. Slight weight losses in females were observed at 500 mg/kg/day. A reduction in mean fetal weights and an increase in the number of embryonic and fetal resorptions were observed in the mid- and high-dose groups. Based on the above effects, the maternal toxicity and fetotoxicity NOEL and LEL are 100 and 500 mg/kg/day, respectively; core grade minimum (Ciba-Geigy, Corp., 1971)

Data Gap(s): None

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o ORAL RFD CONFIDENCE :

Study: High
Data Base: High
RfD: High

The critical study is of good quality and is given a high confidence rating. Additional studies are supportive and of good quality; therefore, the data base is given a high confidence rating. High confidence in the RfD follows.

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o ORAL RFD SOURCE DOCUMENT :

The only U.S. EPA documentation at present is on IRIS.

Pesticide Registration Standard

Pesticide Registration Files

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o REVIEW DATES : 07/08/86, 12/09/86, 05/20/87, 06/22/88, 02/21/90

o VERIFICATION DATE : 02/21/90

HEALTH EFFECTS ASSESSMENTS SUMMARY TABLE B: CARCINOGENICITY
Update: December, 1990

Compound	Exposure: Inhalation; Oral	Species: Inhalation	Species: Oral	Tumor Site: Inhalation	Tumor Site: Oral	EPA Group/Unit Risk [Slope Factor]: Inhalation $(\mu g/m^3)^{-1}$ [$(mg/kg/day)^{-1}$]	EPA Group/Unit Risk [Slope Factor]: Oral $(\mu g/\ell)^{-1}$ [$(mg/kg/day)^{-1}$]	Reference: Inhalation/Oral
Aniline	NA; 2-year dietary	NA	rat	NA	spleen	B2/ND	B2/1.6E-7 [5.7E-3][a]	U.S. EPA, 1990/ CIIT, 1982; U.S. EPA, 1985, 1990
Aramite	NA; 400 ppm in diet for 104 weeks (20 mg/kg/day)	NA	rat	increased incidence of liver tumors (also see Table A)	increased incidence of liver tumors	B2/7.1E-6 [2.5E-2][a]	B2/7.1E-6 [2.5E-2]	Popper et al., 1960; Oser and Oser, 1962; U.S. EPA, 1989/ Popper et al., 1960; Oser and Oser, 1962; U.S. EPA, 1989
Arsenic	100-5800 $\mu g/m^3$ continuous; 0.01-1.8 mg/ℓ in drinking water	human	human	respiratory tract (also see Table A)	skin	A/4.3E-3 [5.0E+1][e,f]	A/NA[k]	Brown and Chu, 1983a,b,c; Lee-Feldstein, 1983; Biggins, 1982; Enterline and Marsh, 1982; U.S. EPA, 1984a,b, 1990/U.S. EPA, 1990
Asbestos	occupational; dietary	human	rat	lung and mesothelioma	large intestine	A/2.3E-1 $(fibers/m\ell)^{-1}$[m]	A/ND	U.S. EPA, 1988, 1990/NTP, 1985; U.S. EPA, 1985, 1990
Atrazine	NA; 2-year dietary	NA	rat	NA	mammary gland adenoma, fibro-adenomas, adeno-carcinomas and carcinosarcomas	C/ND	C/6.3E-8 [2.22E-1][f]	U.S. EPA, 1984/ Ciba-Geigy, 1985, U.S. EPA, 1984
Azobenzene	NA; 2-year dietary	NA	rat	NA	abdominal cavity	B2/3.1E-5 [1.1E-1][a,b]	B2/3.1E-6 [1.1E-1][a]	U.S. EPA, 1990/ NCI, 1979; U.S. EPA, 1988, 1990
Benzene	occupational; occupational	human	human	leukemia	leukemia	A/8.3E-6 [2.9E-2][a]	A/8.3E-7 [2.9E-2][a,b]	Ott et al., 1978; Rinsky et al., 1981; Wong et al., 1983; U.S. EPA, 1985, 1987, 1989, 1990/ Ott et al., 1978; Rinsky et al., 1981; Wong et al., 1983; U.S. EPA, 1985, 1987, 1989, 1990

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 22 1991

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

OSWER DIRECTIVE 9355.0-30

MEMORANDUM

SUBJECT: Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions

FROM: Don R. Clay
Assistant Administrator

TO: Directors, Waste Management Division
Regions I, IV, V, VII, VIII
Director, Emergency and Remedial Response Division
Region II
Directors, Hazardous Waste Management Division
Regions III, VI, IX
Director, Hazardous Waste Division,
Region X

Purpose

The purpose of this memorandum is to clarify the role of the baseline risk assessment in developing Superfund remedial alternatives and supporting risk management decisions.

Specifically, the following points are made in the memorandum:

- Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4}, and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts. However, if MCLs or non-zero MCLGs are exceeded, action generally is warranted.

- Other chemical-specific ARARs may also be used to determine whether a site warrants remediation.

- A risk manager may also decide that a baseline risk level less than 10^{-4} is unacceptable due to site specific reasons and that remedial action is warranted.

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- Compliance with a chemical-specific ARAR generally will be considered protective even if it is outside the risk range (unless there are extenuating circumstances such as exposure to multiple contaminants or pathways of exposure).

- The upper boundary of the risk range is not a discrete line at 1 x 10^{-6}, although EPA generally uses 1 x 10^{-6} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions.

- The ROD should clearly justify the use of any non-standard exposure factors and the need for remedial action if baseline risks are within the generally acceptable risk range. The ROD should also include a table listing the final remediation goals and the corresponding risk level for each chemical of concern.

Background

The 1990 National Contingency Plan (NCP) (55 Fed. Reg. 8665-8865 (Mar. 8, 1990)) calls for a site-specific baseline risk assessment to be conducted, as appropriate, as part of the remedial investigation (Section 300.430(d)(1)). Specifically, the NCP states that the baseline risk assessment should "characterize the current and potential threats to human health and the environment that may be posed by contaminants migrating to ground water or surface water, releasing to air, leaching through soil, remaining in the soil, and bioaccumulating in the food chain" (Section 300.430(d)(4)). The primary purpose of the baseline risk assessment is to provide risk managers with an understanding of the actual and potential risks to human health and the environment posed by the site and any uncertainties associated with the assessment. This information may be useful in determining whether a current or potential threat to human health or the environment exists that warrants remedial action.

The "Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual - Part A" (HHEM) (EPA/540/1-89/002) provides guidance on how to conduct the human health portion of the baseline risk assessment. Volume II of the "Risk Assessment Guidance for Superfund" the "Environmental Evaluation Manual" (EPA/540/1-89/001) and the companion manual, "Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference" (EPA/600/3-89/013) provide guidance on conducting the environmental portion of the baseline risk assessment. Other pertinent guidance includes the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (RI/FS guidance, EPA/540/G-89/004), which describes how the baseline risk assessment fits into the overall RI/FS process. "Guidance on Preparing Superfund Decision Documents" (ROD guidance)

(EPA/624/1-87/001) provides information on how to document the results of the baseline risk assessment in the ROD.

Objective

The objective of this memorandum is to provide further guidance on how to use the baseline risk assessment to make risk management decisions such as determining whether remedial action under CERCLA Sections 104 or 106 is necessary. This memorandum also clarifies the use of the baseline risk assessment in selecting appropriate remedies under CERCLA Section 121, promotes consistency in preparing site-specific risk assessments, and helps ensure that appropriate documentation from the baseline risk assessment is included in Superfund remedy selection documents.

Implementation

RISKS WARRANTING REMEDIAL ACTION

Whenever there is a release or substantial threat of release of a hazardous substance into the environment (or a release or threat of release into the environment of a pollutant or contaminant "which may present an imminent and substantial danger to public health or welfare"), Section 104(a)(1) of CERCLA provides EPA with the authority to take any response action consistent with the National Contingency Plan it deems necessary to protect public health or welfare or the environment. Section 106 of CERCLA grants EPA the authority to require potentially responsible parties (or others) to perform removal or remedial actions "when the President determines that there may be an imminent and substantial endangerment to the public health or welfare or the environment because of an actual or threatened release of a hazardous substance from a facility."

As a general policy and in order to operate a unified Superfund program, EPA generally uses the results of the baseline risk assessment to establish the basis for taking a remedial action using either Section 104 or 106 authority. EPA may use the results of the baseline risk assessments to determine whether a release or threatened release poses an unacceptable risk to human health or the environment that warrants remedial action and to determine if a site presents an imminent and substantial endangerment. The risk assessment methodology for all sites should be the same regardless of whether the RI/FS or remedial design and remedial action is performed by EPA or potentially responsible parties.

Generally, where the baseline risk assessment indicates that a cumulative site risk to an individual using reasonable maximum exposure assumptions for either current or future land use exceeds the 10^{-4} lifetime excess cancer risk end of the risk

range, action under CERCLA is generally warranted at the site. For sites where the cumulative site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4}, action generally is not warranted, but may be warranted if a chemical specific standard that defines acceptable risk is violated or unless there are noncarcinogenic effects or an adverse environmental impact that warrants action. A risk manager may also decide that a lower level of risk to human health is unacceptable and that remedial action is warranted where, for example, there are uncertainties in the risk assessment results. Records of Decision for remedial actions taken at sites posing risks within the 10^{-4} to 10^{-6} risk range must explain why remedial action is warranted.

The cumulative site baseline risk should include all media that the reasonable maximum exposure scenario indicates are appropriate to combine and should not assume that institutional controls or fences will account for risk reduction. For noncarcinogenic effects of toxicants, unacceptable risk occurs when exposures exceed levels which represent concentrations to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, as appropriate to address teratogenic and developmental effects.

Chemical specific standards that define acceptable risk levels (e.g., non-zero MCLGs, MCLs) also may be used to determine whether an exposure is associated with an unacceptable risk to human health or the environment and whether remedial action under Section 104 or 106 is warranted. For ground water actions, MCLs and non-zero MCLGs will generally be used to gauge whether remedial action is warranted.

EPA uses the general 10^{-4} to 10^{-6} risk range as a "target range" within which the Agency strives to manage risks as part of a Superfund cleanup. Once a decision has been made to take an action, the Agency has expressed a preference for cleanups achieving the more protective end of the range (i.e., 10^{-6}), although waste management strategies achieving reductions in site risks anywhere within the risk range may be deemed acceptable by the EPA risk manager. Furthermore, the upper boundary of the risk range is not a discrete line at 1×10^{-4}, although EPA generally uses 1×10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions, including any remaining uncertainties on the nature and extent of contamination and associated risks. Therefore, in certain cases EPA may consider risk estimates slightly greater than 1×10^{-4} to be protective.

When an ARAR for a specific chemical (or in some cases a group of chemicals) defines an acceptable level of exposure,

compliance with the ARAR will generally be considered protective even if it is outside the risk range (unless there are extenuating circumstances such as exposure to multiple contaminants or pathways of exposure). Conversely, in certain situations EPA may determine that risks less than 1×10^{-4} are not sufficiently protective and warrant remedial action.

Where current conditions have not resulted in a release posing risks that warrant action but there is a significant possibility that a release will occur that is likely to result in an unacceptable risk, remedial action may also be taken. The significance of the potential future release may be evaluated in part based on the quantities of material at the site and the environmental setting.

RISKS CONSIDERED IN RISK MANAGEMENT DECISION

As noted above, both current and reasonably likely future risks need to be considered in order to demonstrate that a site does not present an unacceptable risk to human health and the environment. An adequate consideration of future risk may necessitate the assessment of risks assuming a land use different from that which currently exists at the site. The potential land use associated with the highest level of exposure and risk that can reasonably be expected to occur should be addressed in the baseline risk assessment. Further, this land use and these exposure assumptions should be used in developing remediation goals.

The preamble to the NCP states that EPA will consider future land use as residential in many cases. In general, residential areas should be assumed to remain residential; and undeveloped areas can be assumed to be residential in the future unless sites are in areas where residential land use is unreasonable. Often the exposure scenarios based on potential future residential land use provide the greatest risk estimates (e.g., reasonable maximum exposure scenario) and are important considerations in deciding whether to take action (55 Fed. Reg. at 8710).

However, the NCP also states that "the assumption of future residential land use may not be justifiable if the probability that the site will support residential use in the future is small." Sites that are surrounded by operating industrial facilities can be assumed to remain as industrial areas unless there is an indication that this is not appropriate. Other land uses, such as recreational or agricultural, may be used, if appropriate. When exposures based on reasonable future land use are used to estimate risk, the NCP preamble states that the ROD "should include a qualitative assessment of the likelihood that the assumed future land use will occur" (55 Fed. Reg. at 8710).

Unacceptable environmental risks also may prompt remedial action and may occur where there is no significant risk to human health. Threats or potential threats to sensitive habitats, such as wetlands, and critical habitats of species protected under the Endangered Species Act are especially important to consider when determining whether to take an action under CERCLA Section 104 or 106. Ambient Water Quality Criteria for aquatic organisms are chemical-specific standards that will generally be considered when determining whether to take an action based on the environmental risk of releases to surface waters.

NO-ACTION DECISIONS

If the baseline risk assessment and the comparison of exposure concentrations to chemical-specific standards indicates that there is no unacceptable risk to human health or the environment and that no remedial action is warranted, then the CERCLA Section 121 cleanup standards for selection of a Superfund remedy, including the requirement to meet applicable or relevant and appropriate requirements (ARARs), are not triggered. CERCLA section 121 (a) requires only that those remedial actions that are "determined to be necessary ... under section 104 or ... 106 ... be selected in accordance with section 121." If EPA determines that an action is necessary, the remedial action must attain ARARs, unless a waiver is invoked. Of course, sites that do not warrant action under CERCLA sections 104 or 106 may warrant action under another State or Federal statute, such as RCRA subtitle D requirements for the appropriate closure of a solid waste landfill.

The decision not to take action at an NPL site under section 104 and 106 should also be documented in a ROD. The decision documentation process should include the preparation of a proposed plan for public comment, ROD and eventually a closeout report and Federal Register deletion notice.

POINT OF DEPARTURE WHEN ACTION WARRANTED

Once remedial action has been determined to be warranted, the results of the baseline risk assessment may be used to modify preliminary remediation goals. These preliminary goals are developed at scoping based on ARARs and the 10^{-6} cancer risk point of departure pursuant to NCP section 300.430(e)(2)(i).

USE OF BASELINE RISK ASSESSMENT TO MODIFY PRELIMINARY REMEDIATION GOALS

Remediation goals developed under CERCLA Section 121 are generally medium-specific chemical concentrations that will pose no unacceptable threat to human health and the environment. Preliminary remediation goals are developed early in the RI/FS process based on ARARs and other readily available information,

such as concentrations associated with 10^{-6} cancer risk or a hazard quotient equal to one for noncarcinogens calculated from EPA toxicity information. These preliminary goals may be modified based on results of the baseline risk assessment, which clarifies exposure pathways and may identify situations where cumulative risk of multiple contaminants or multiple exposure pathways at the site indicate the need for more or less stringent cleanup levels than those initially developed as preliminary remediation goals. In addition to being modified based on the baseline risk assessment, preliminary remediation goals and the corresponding cleanup levels may also be modified based on the given waste management strategy selected at the time of remedy selection that is based on the balancing of the nine criteria used for remedy selection (55 Fed.Reg. at 8717 and 8718).

EARLY AND INTERIM ACTIONS

Early operable unit actions (e.g., hot spot removal and treatment) and interim actions (e.g., temporary storage or ground water plume containment) may be taken to respond to an immediate site threat or to take advantage of an opportunity to significantly reduce risk quickly (55 Fed. Reg. at 8705). For example, an interim containment action may be particularly useful early in the process for complicated ground water remedial actions, where concentrations greater than MCLs provide a good indication that remediation of a potential drinking water source is necessary; such quick remedial action is important to prevent further spread of the contaminant plume while a final ground water remedy is being developed.

Early and interim action RODs do not require a completed baseline risk assessment, although enough information must be available to demonstrate the potential for risk and the need to take action. Data sufficient to support the interim action decision can be extracted from the ongoing RI/FS for the site and set out in a focused feasibility study or other appropriate document that includes a short analysis of a limited number of alternatives (55 Fed. Reg. at 8704). These data should include a summary of contaminants of concern, concentrations and relevant exposure information. A discussion should accompany these data explaining the need for immediate remedial action based on the presence of contamination that, if left unaddressed in the short-term, either contributes immediate risk or is likely to contribute to increased site risk or degradation of the environment/natural resources. The early and interim action RODs should note that some exposure pathways at the site may not be addressed by the action.

An interim action ROD eventually must be followed by a subsequent ROD for that operable unit based on the complete RI/FS, that includes the baseline risk assessment, in order to document long-term protection of human health and the environment

at that portion of the site. The interim action ROD, however, should demonstrate qualitatively (and quantitatively if possible) that there is a risk or potential for risk and explain how the temporary measures selected will address a portion of this risk.

DOCUMENTATION OF BASELINE RISK ASSESSMENT RESULTS IN THE ROD

The Summary of Site Risks section of the ROD should include a discussion of the risks associated with current and future land use and a table presenting these risk levels for each exposure medium (e.g., direct contact with soil by potential future residents exposed via incidental soil ingestion and dermal contact). In some situations, risks from exposure via more than one medium (e.g., soil and drinking water) will affect the same potentially exposed individual at the same time. It is appropriate in these situations to combine the risks from the different media to give an indication of total risk that an individual may be exposed to from a site.

In addition to summarizing the baseline risk assessment information, the ROD (except no-action RODs) should include how remedial alternatives will reduce risks by achieving cleanup levels through treatment or by eliminating exposures through engineering controls for each contaminant of concern in each appropriate medium.

The Comparative Analysis should include a discussion of each of the nine criteria; consideration of risk is part of the discussion of several of the criteria. The discussion of overall protection of human health and the environment should include a discussion of how the remedy will eliminate, reduce, or control risks identified in the baseline risk assessment posed through each pathway and whether exposure levels will be reduced to acceptable levels. For example, if direct human contact with contaminated soil is identified as a significant risk at a site, the ROD (except no-action RODs) should indicate how the selected remedy will eliminate or control exposures to ensure protection of human health. The discussion of long-term effectiveness and permanence should include, where appropriate, an assessment of the residual risk from untreated residual waste remaining at the site. The short-term effectiveness discussion should address risks during remedial action to those on-site and nearby.

Finally, that part of the Decision Summary in the ROD that focuses on the selected remedy should show:

- the chemical-specific remediation level and corresponding chemical-specific risk level(s) to be attained at the conclusion of the response action and the points (or area) of compliance for the media being addressed; and

- The lead agency's basis for the remediation levels (e.g., risk calculation, ARARs).

The attached table, "Remediation Levels and Corresponding Risks," provides a direct means of displaying this information for health risks and, where appropriate, environmental protection (Table 1). The table should be completed for all media for which the ROD selects final cleanup levels. The table should serve as a summary of text in the selected remedy section of the ROD Decision Summary. For interim action RODs, only qualitative statements may be possible.

Additional guidance on the baseline risk assessment and its role in remedy selection is available from several sources. For guidance on the baseline risk assessment contact:

David Bennett, Chief
Toxics Integration Branch (OS-230)
Hazardous Site Evaluation Division
Office of Emergency and Remedial Response
phone: (FTS) or (202) 475-9486.

For additional guidance on the interaction of the baseline risk assessment and Superfund remedy selection, contact:

David Cooper
Remedial Operations and Guidance Branch (OS-220W)
Hazardous Site Control Division
Office of Emergency and Remedial Response
phone: (FTS) 398-8361
(commercial phone: (703) 308-8361)

For guidance on enforcement-lead sites contact:

Stephen Ells
Guidance and Evaluation Branch (OS-510)
CERCLA Enforcement Division
Office of Waste Programs Enforcement
phone: (FTS) or (202) 475-9803.

NOTICE: The policies set out in this memorandum are intended solely as guidance. They are not intended, nor can they be relied upon, to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided in this memorandum, or to act at variance with the guidance, based on an analysis of specific site circumstances. Remedy selection decisions are made and justified on a case-specific basis. The Agency also reserves the right to change this guidance at any time without public notice.

TABLE 1
Remediation Goals and Corresponding Risks [a]

Final Remediation Levels [b]					Corresponding Risk Levels [c]	
					Chemical-Specific RME Risk [d]	
Medium	Chemical	Remediation Level [e]	Point of Compliance [f]	Basis of Goal	Cancer	Non-Cancer
SOIL	A	2.0 ppm	All facility grounds	HI	N/A	0.5
	B	17.0 ppm		Risk	1.0×10^{-5}	N/A
	C	5.0 ppm		GW Risk	N/A	N/A
GROUND WATER	B	0.1 ppm	Waste Management Unit Boundary	Risk	1.0×10^{-5}	N/A
	C	4.0 ppm		MCL	1.0×10^{-5}	N/A
	F	7.0 ppm		MCLG	N/A	0.2
	G	15.0 ppm		MCL	6.0×10^{-6}	0.09
SEDIMENT	Q	100.0 ppm	Downstream from point A	Ecological Effects	N/A	N/A

---

a. Prepare summary sheets for selected remedy.

b. Final Remediation Levels are based on preliminary remediation goals developed in the Feasibility Study (FS) (RI/FS Guidance 4.2.1) as modified through the nine criteria evaluation and engineering design. In the process of achieving remediation levels for each chemical, some chemicals will be reduced to concentrations below their remediation levels.

c. Chemical specific risks correspond to associated remediation levels. Risks do not consider effects of exposures to other chemicals in media. If appropriate, risks may be summed to calculate media specific risks. Short term effectiveness is not considered.

d. Cancer risks are measured as Individual Incremental lifetime; non-cancer as Hazard Quotients.

e. Bases for values should be explained in the earlier *Record Of Decision* (ROD) table.

f. Bases for location and method for determining attainment (e.g., maximum value detected over area XYZ) should be explained in the description of the selected remedy.

N/A Not applicable

APPENDIX D

DATA COLLECTION QUALITY ASSURANCE PLAN

DATA COLLECTION QUALITY ASSURANCE PLAN

DRAFT

VICKSBURG CHEMICAL DIVISION
CEDAR CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI

for:

Cedar Chemical Corporation
Memphis, Tennessee

June 1991

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1.0
INTRODUCTION

The Vicksburg Chemical Division of Cedar Chemical Corporation (CCC) is located in Vicksburg, Mississippi. The facility is a manufacturer of chemicals. An 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. The effective date of the Consent Decree is July 1, 1991.

CCC has retained Woodward-Clyde Consultants (WCC) to perform a RCRA Facility Investigation (RFI) at the Vicksburg facility. WCC will conduct the investigation in compliance with the Consent Decree. Among the requirements and/or guidelines include in the decree are procedures to control the quality of data acquired in during the investigation. This document presents the overall approach that WCC will undertake to verify that the information, data, and procured results meets the quality objectives. A detailed discussion of sampling procedures and methodologies for specific media is also given. For information on the project description and background, refer to the Preliminary Report.

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2.0
DATA COLLECTION OBJECTIVES

2.1 DATA OBJECTIVES

The primary objectives of the RFI are as follows:

- Identify the contaminants of concern for each SWMU requiring further investigation
- Determine whether or not SWMUs in question are releasing hazardous constituents into the environment.
- Identify the source of contamination
- Determine vertical and horizontal extent of contamination.
- Collect data to be used in determining the necessity and feasibility of corrective action measures.

To meet the overall objectives of the investigation, WCC will collect surface soil, subsurface soil, and groundwater samples. The following sections present the data requirements and strategy for collection of samples from each media.

2.2 QUALITY ASSURANCE OBJECTIVES

The objectives of the Quality Assurance/Quality Control (QA/QC) procedures are to produce data that meet (or exceed) the requirements of standard analytical methods and satisfies the project requirements. The objectives of the QA efforts for this project are as follows:

- To provide the mechanism for ongoing control and evaluation of the quality of data measurement throughout the project.
- Utilizing quality control data to define data quality for various measurement parameters in terms of precision and accuracy.

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- To verify that all chemical samples are accurately and precisely collected, analyzed and documented so that proper treatment and/or disposal of waste material can occur.
- To verify compliance with the Department of Transportation and other agency requirements.
- To verify that samples are properly collected, analyzed and documented to provide data as part of the H&S Plan.

2.2.1 Definitions of Quality Assurance Terms

Definitions of precision, accuracy, completeness, representativeness, and comparability are 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, 1980).

2.2.1.1 Precision Precision is "a measure of mutual agreement among individual measurements of the same property. It is a measure of variability of individual sample measurements. Precision will be assessed from the laboratory duplicate analyses of field samples and from the set of duplicate matrix spiked samples. Precision will be measured as the percent difference in the duplicate measurements.

Average precision and its standard deviation of the concentration data for individual parameters will be used to evaluate the data collected and its acceptability for the objectives of the sampling. Data to be used in evaluation will meet the criteria defined herein and in Section 4.73 of this QAP. Confidence intervals will be derived for data sets using standard statistical methods. The precision criteria for laboratory QC samples is presented in Table 5.

2.2.1.2 Accuracy Accuracy is "the degree of agreement of a measurement with an accepted reference or true value" and is a measure of a system bias. Bias is the difference between the mean of the true sample values and the mean of the laboratory analysis. Accuracy will be assessed using laboratory spiked standard matrix samples in conjunction with field and trip blank samples and laboratory method and reagent blanks.

Average accuracy and its standard deviation of the concentration data will be used if sufficient data are collected for a specific sampling activity. The accuracy criteria for the laboratory QC samples is presented in Table 5. Accuracy criteria for samples tested in accordance with SW 846, 3rd Edition procedures or equivalent will be in accordance with the appropriate analytical method.

2.2.1.3 Completeness Completeness is "a measure of the amount of the valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions." The completeness of data objectives reflect the degree to which required samples specified in the appropriate sampling plan have been collected and the necessary analysis performed, in order to create a sufficient data base to meet the objectives.

The completeness objective for laboratory samples is presented in Table 5. If the completeness objective is not met, an evaluation will be undertaken to determine if resampling is required to provide adequate data to meet specific task objectives.

2.2.1.4 Representativeness 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." Representativeness is a function of the sample site selection and sample collection and analysis techniques. The objective of this program is to obtain samples which are representative of the media to be measured. The rationale of the selection of sample sites is provided in the project plans (including this QAP).

2.2.1.5 Comparability Comparability "expresses the confidence with which one set of data can be compared with another." Comparability can be related to precision and accuracy since these quantities are measures of data reliability. Qualitatively, data subjected to strict QA/QC procedures will be deemed more reliable than data obtained from another project or previous study. To maintain comparability, the sampling method used, chain-of-custody procedures, EPA analytical methods and qualified laboratories and establishment of strict QA procedures and sampling guidelines provide the basis for uniformity in all data collection and analysis activities.

2.2.2 Accuracy, Precision, and Sensitivity of Laboratory Analysis

The QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols.

The TCL and TAL parameters to be analyzed in the first round of samples are listed in Tables 2 and 3. The detection limits for metals analyses in accordance with SW846, 3rd Edition are presented on Table 4.

Accuracy and precision criteria for the parameters to be tested in accordance with EPA CLP protocols and SW846 is shown in Table 5. The accuracy and precision of laboratory analyses for samples tested in accordance with CLP and SW846 protocols will be determined by testing of laboratory blanks, duplicates, and spiked samples in accordance with the frequencies shown in Table 1. Compounds that will be used as matrix and surrogate spikes for CLP and SW846 organic analyses, and their control limits from CLP Protocols, are included in Tables 6 and 7.

2.2.3 Quality of Field Samples

Field duplicates, rinsate blanks, trip blanks, and matrix spikes/matrix spike duplicates will be taken in the field and submitted to the analytical laboratory to provide a means to assess the quality of the data resulting from field investigation tasks. Field duplicate samples will be analyzed to check for sampling and analytical reproducibility. Field and trip blank samples will be analyzed to check for procedural contamination and cross-contamination during shipment and storage of samples. Matrix spike/matrix spike duplicate samples will be analyzed to verify that recoveries falling outside acceptance windows are attributable to sample matrix interferences and not to laboratory analytical errors.

Field duplicates will be obtained at the frequencies indicated in Table 9. The samples will consist of obtaining a duplicate sample set for analysis from the sample. Rinsate samples will be prepared by rinsing decontaminated equipment with deionized water and collecting the rinsate sample. Matrix spike and matrix spike duplicates will be collected in the field but they will be spiked in the laboratory. Trip blanks will be prepared by

the laboratory and shipped with the sample containers. The trip blanks will be kept with collected samples and shipped back to the laboratory for analysis.

2.2.4 Accuracy of Field Measurements

Measurement data will be generated in many field activities that are incidental to collecting samples for analytical testing or unrelated to sampling. These activities include, but are not limited to, the following:

- Documenting time and weather conditions
- Determining depths in a borehole or piezometer and static water levels
- Measuring pH and conductivity of ground water samples
- Screening samples with an organic vapor analyzer (OVA)

The general QA objective for such measurement data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of such data through the documented use of standard procedures.

The QC level of effort for the field measurement of pH consists of pre-measurement calibration and post-measurement verification using two standard reference solutions each time to sample pH. This procedure will be performed for each sample tested. The QC effort for field conductivity measurements will include daily calibration of the instrument using standard solutions of known conductivity.

The accuracy of field measurements of pH will be assessed through pre-measurement calibrations and pH-measurements verifications using at least two standard buffer solutions. The two measurements must each be within $\pm$ 0.1 standard unit of buffer solution values. If measurements not within $\pm$ 0.1, the problem will be evaluated. A fresh portion of buffer solution will be utilized. If the problem persists, a different (new) buffer solution will be used. Precision will be assessed through replicate measurements. (The electrode will be withdrawn, rinsed and de-ionized water and re-immersed between each replicate). The instrument used will be capable of providing measurements to 0.1 standard unit. A total of four replicates for pH and conductivity will be performed.

The accuracy of measuring depths (for boreholes and static water levels) will be assessed by using a measuring device (weighted tape or electronic water level indicator such as an M-scope) that has been calibrated before use by measuring two known lengths. Any measurements taken with the device will be adjusted by the difference (if any) in length over the appropriate depth interval. At least three replicate depth measurements will be made and the average depth measurement will be used.

The data from the OVA is used for screening only to select samples for analysis. After receiving laboratory data the OVA and lab data will be evaluated for comparability.

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The specific objectives of the collection of the data are further discussed in the subsequent paragraphs.

3.1 GROUNDWATER SAMPLING DATA OBJECTIVES

As stated in the Preliminary Report water-bearing zones have been identified in previous investigations. Additional groundwater data may be needed to characterize these zones if contamination is found. Groundwater data needed could include:

- Approximate vertical boundaries of zones and stratigraphic relationships.
- Basic flow characteristics of each zone (direction, lateral flow rate, hydraulic conductivity, transmissivity and storage capacity).
- Hydraulic inter-relationships of the zones (vertical interconnection transmissivity between zones, etc).
- Effect of stratigraphic variations within each zone on contaminant transport.
- Nature and extent of contamination in each zone (approximate boundaries of contaminant accumulation).

Identification of water-bearing zone boundaries and relevant soil strata will required a detailed description of soil features (such as color, lithology, bedding, identifying features and relative degree of water saturation) to a depth sufficient to identify the base of the deepest contaminated water-bearing zone. The description will require accuracy to the nearest foot and professional geologic judgment to recognize and describe pertinent features.

The zones to be monitored will require sufficient screening intervals to characterize each zone. For low density immiscible contaminants (floaters), the screen will extend approximately two feet above the top of the zone to provide for fluctuations in water levels. If dense non aqueous phase contaminants are the concern (sinkers) the screen

will cover the base of the upper pervious zones and extend slightly below the base of the zone (± 6 inches. If dissolved constituents are the concern, the screened interval will correspond to that portion of the zone which is judged to have the highest hydraulic conductivity. If required, deeper zones will be monitored utilizing similar approaches as describe above.

Determination of groundwater flow direction will require measurement of elevations of the top of the piezometric surface of each zone. A sufficient number and spacing of measurement stations will be installed as an Interim Measure Activity to construct idealized contours of the piezometric surface elevations. The locations of measuring stations will be established such that they can be plotted on a site location map. Locations should be to the nearest 0.1 foot. Water level measurements should be made to the nearest 0.01 foot accuracy and reported in feet mean seal levbel (MSL). This data will be evaluated to verify the designated upgradient shallow well location and to identify upgradient background wells. As additional samplings are performed, the data will be reevaluated to verify results of previous sampling.

Determination of the nature and extent of groundwater contamination will require sampling and chemical analysis of groundwater from each water-bearing zone. A sufficient number of samples will be required to identify approximate lateral limits of contamination and establish and nature and concentrations of contaminants. Investigation of zones below the upper pervious zone will be performed if data does not define the vertical extent of groundwater contamination.

The samples will require analysis for Target Compound List (TCL) and Target Analyte List (TAL) constituents as presented in the Contract Laboratory Program CLP Statement of Work to identify or verify contaminants of concern. Sample collection and handling will require strict adherence to EPA approved procedures and close QA/QC surveillance. Sample analysis will be performed by CLP methods.

3.2 AQUIFER TESTING OBJECTIVES

Determination of lateral and vertical flow rates, hydraulic conductivities, transmissivities, storage capacities and vertical interconnection will require in-situ flow testing data. Lateral hydraulic conductivity/transmissivity data should be collected by at least two different methods in order to evaluate the credibility of the data and subsequent calculations. Storage capacity calculations and vertical interconnection determinations should be based on field pumping test data.

3.3 SURFACE SOIL SAMPLING DATA OBJECTIVES

The primary purpose of collecting surface soil data is to aid in determining potential for contamination of site runoff-water, potential for offsite migration of contaminated sediments (water transported) and/or potential for human/animal contact and/or ingestion. Consequently, sampling need not extend beyond about 12 inches below the natural ground surface. Background samples at 0 to 12 inches to 12 to 36 inches will be obtained in the site vicinity. The sample locations are selected based upon the lack of hazardous waste activities in those areas. The surface soil data much include laboratory analysis for soil classification and contaminant content. Soil classification data is needed to estimate the erosion susceptibility and transportability of the soil. Atterberg limits for cohesive soil and sieve analysis data for non-cohesive soils will be adequate for erosion susceptibility and transportability purposes. Laboratory analysis for contaminant content shall consist of TCL and TAL analyses using CLP methods.

3.4 SUBSURFACE SOIL SAMPLING DATA OBJECTIVES

The primary prupose of collecting subsurface soil (vadose zone) and soil structure data is to aid in determining the potential for downward percolation of contaminants into the shallow groundwater. Consequently sampling must be of sufficient quantity to identify lateral limits of contamination and must extent to a sufficient depth of identify and quantify accumulation of contaminants above and within the first occurring water-bearing zone. The data shall consist of laboratory analyses of the contaminated soil. Laboratory analyses shall consist of analysis for TCL and TAL compounds in accordance with CLP protocol.

3.5 SAMPLING ACTIVITIES

The sampling activities will occur during the RFI to address the data objectives for the media of concern identified above. A sampling location map of the RFI sampling activities is presented as Figure 1. The field investigation tasks to obtain the data will generally consist of the following:

- Obtaining sampling location characteristic information from topographic and information surveys.
- Obtaining background and current groundwater quality data from the existing site monitor wells (already completed).
- Characterizing the treatment zone at the former landfarm and the seidments in the retention basin by drilling subsurface borings to determine the wastes of concern.
- Subsurface soil sampling to evaluate the vertical and horizontal extent of contamination and constituents if released.
- Surface soil sampling for determination of sediment transport of contaminants from the retention basins and for background information.
- Groundwater assessment and sampling (monitor well installation, sampling and evaluation) to determine the areal and vertical extent of groundwater contamination and determine groundwater characteristics (i.e. flow direction, flow rate, transmissivity, etc).

As discussed in the RFI workplan approach and scope of work, the field investigation tasks will be conducted in a phased approach which will consist of the following:

- Phase I - Task A: Initial Source Characterization (sampling the landfram wastes, the retention basin seidments and discharge ditch sediments, sampling the shallow background ranges and discrete field sampling around the vehicle fuel tanks) to confirm sources of contamination and identify/verify contaminants of concern.

- Phase II - Task A: Discrete soil sampling to evaluate extent of surface soil contamination and potential groundwater contamination.

- Phase II - Task B: Investigation of deeper groundwater zones to determine vertical and horizontal extent of groundwater contamination.

- Phase III - Task A: Installation and sampling of monitor wells to evaluate degree of groundwater contamination and to provide for hydrogeologic characterization.

- Phase III - Task B: Additional well installation and sampling for delineation of contaminant plume(s) and for aquifer testing.

A project management chart is shown on Figure 2 which depicts various responsibilities for the implementation of the project.

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SAMPLING EQUIPMENT, PROCEDURES, AND MEASUREMENTS

The sampling locations, depths, type (grab vs. composite), number of samples, and analytical parameters were discussed in the RFI Workplan approach and scope of work. The procedures and equipment to perform the sampling for the RFI were discussed only in general terms in that document and are presented in more detail herein. In addition, procedures for monitor well installation and aquifer testing are presented. The sampling procedures presented below will be implemented along the RFI Workplan approach and scop of work as appropriate. As discussed, the RFI will be conducted in phases for all SWMUs and AOCs requiring further investigation. Minor changes in the procedures discussed here in will be documented and included in the interim reports. Significant changes which may affect the data quality objectives will be subject to approval by U.S. EPA. Additional specifications with respect to documentation, equipment, and procedures as required by CCC standard policies and manuals which do not affect data quality objectives may be incorporated into the workplan as appropriate.

4.1 SUBSURFACE SOIL SAMPLING

Subsurface soil sampling will be performed to characterize the wastes and to evaluate the extent of subsurface soil contamination, if any. A series of shallow borings will be drilled as discussed in previous sections to evaluate the contamination and determine locations for discrete sampling (Phase 2) as well as for shallow monitoring wells (Phase 3). As part of monitor well installation activities, other borings will be drilled with continuous soil sampling to confirm the absence or presence of contamination in the selected well location and to select appropriate screen intervals. The equipment and methods are discussed below along with an alternative method.

4.1.1 Equipment

Subsurface sampling will be performed by rotary auger drilling methods. The drilling apparatus will consist of a truck mounted rotary drilling rig. Samples will be obtained

by rotary drilling using a 3-inch diameter Shelby tube, or 2-inch diameter split spoon sampler.

Only petroleum jelly, teflon tape, lithium grease, or vegetable-based lubricants shall be used on the threads of downhole drilling equipment. Additives containing lead or copper shall not be used. Any hydraulic or other fluids used in the drilling rig, pumps, or other field equipment/vehicles shall not contain any polychlorinated biphenyls (PCBs).

If antifreeze is added to any pump, hose, etc., in an area in contact with drilling fluids, this antifreeze shall be completely purged prior to the equipment's use in drilling, mud mixing, or any other part of the overall drilling operation. Only antifreeze without rust inhibitors and/or sealants may be used.

Drilling equipment that has a visible loss of grease, hydraulic fluids, oils, fuels and/or transmission oil to drilling fluids to the borehole will not be allowed for borings and/or well installation until the problem is corrected.

Hydraulic rotary drilling operations will use portable recirculation tanks/pans for the "mud pit" and for mixing grout. Dug pits or sumps will not be used.

4.1.2 Procedure

The borings shall be continuously sampled with a thin-walled Shelby tube sampler or split-spoon sampler, extruded in the field and described or logged, following the guidelines of the appropriate and most current American Society for Testing and Materials (ASTM) Standards:

- D 1452 Practice for Soil Investigation and Sampling by Auger Borings,
- D 1586 Method for Penetration Test and Split-Barrel Sampling of Soils,
- D 1587 Practice for Thin-Walled Tube Sampling of Soils,
- D 2487 Test Method for Classification of Soils for Engineering Purposes, and

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- D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure).

All borings shall be sampled and described by a qualified WCC representative. The qualified WCC representative is to be on-site during all boring and sampling operations. Samples taken from borings will be handled as described later in this section.

All soil borings will be advanced with rotary drilling techniques with continuous soil sampling techniques unless it is determined to be unnecessary for strata identification and sample collection by the qualified WCC representative based on consistent site conditions. If the borehole becomes unstable and caving or sloughing of the walls develop, temporary surface casing may be used in the drilling operations. Dry rotary auger techniques will utilize an auger and cut and clear the borehole for sampling. Rotary wash will utilize potable water that is recirculated through the borehole to remove cuttings. Bentonite drilling mud (organic free) will be used only if required to maintain borehole stability.

Selected soil samples obtained during drilling will be tested to characterize soils from a lithology type encountered. The qualified WCC representative or an assistant will prepare the selected soil samples for geotechnical analyses. Cohesive soil samples obtained for geotechnical testing with Shelby tubes shall be wrapped in foil. Non cohesive soils will be obtained using a split spoon sampler and shall be placed in a clean jar or plastic bag. The boring number, depth, date, and project number shall be written in indelible marker on the foil on cores or on labels for jars or bags. Chain-of-Custody and sample analysis request forms will accompany the samples to the lab.

The data generated from this testing shall be reported on the soil boring log or attached to the soil boring log.

The samples obtained from the borings will be screened in the field for head-space analysis using an onsite OVA. Immediately upon removal of the soil sample from the Shelby tube or split spoon, the field geologist will visually log it. The visual logging will describe soil type and secondary color, penetration resistance and inclusions as described above. A portion of the sample will then be shaved with a clean knife or spatula to

remove at a minimum the outer approximately one-fourth inch which may have come in contact with the downhole fluids. This shaved sample will then be divided into two parts, each of which will be labeled based on boring number and sample depth. One portion of the sample will be placed in a glass jar, labeled, and placed on ice. The other portion will be placed in a wide mouth glass jar covered with aluminum foil or teflon sheeting and capped. The caps will have a predrilled hole to allow for the insertion of the OVA probe. The sample will be baked in an oven at constant temperature of 140° F for ten minutes to allow volatile organic constituents, if any, to build up in the head space. The head space will then be sampled by inserting the probe of the OVA into the hole of the cap through the aluminum foil or teflon. The OVA measurement will be made immediately and the reading recorded on the boring log.

A soil sample for each boring will be selected for chemical analysis and will consist of the duplicate of the sample from the boring demonstrating the highest OVA reading and/or is visually contaminated. The OVA readings will be recorded on the boring logs as will the soil classification based on the field visual logging. Additionally, one in every ten samples demonstrating non-detected readings from the OVA screening will also be analyzed to evaluate potential false negatives.

Based on the OVA readings or visible contamination, the qualified WCC representative will select samples for chemical analysis (as described above) to consist of TCL and, TAL constituents. The testing protocols to be followed are discussed in the Data Management Plan. Soil samples obtained from the shallow monitor well borings will be sampled and screened and a confirmation sample will be selected from each boring based on the highest OVA reading to confirm that there is no soil contamination in the boring. Samples will be retained on ice or refrigerated until delivery to the laboratory. One sample in 20 will be split to provide field duplicate samples for analysis and one rinsate blank will be collected for analysis from each drilling rig decontamination during drilling.

Shallow rotary borings will be drilled to the water table and will be advanced by dry-auger methods until free water is encountered. For borings drilled for shallow monitor well installation, drilling operations will be stopped when water is encountered for at least ten minutes to allow the water level to rise. Both the initial and second water level

will be measured and recorded. Drilling will then resume by rotary wash methods to the completion depth. Borings drilled for shallow well installation will be drilled 5 feet into the first water-bearing zone encountered.

Exploratory borings drilled prior to deep well installation will be drilled to the base of the deep water-bearing zone. The borings will be drilled in a manner similar to that previously described. The boring will be advanced by dry auger methods to the water table. Drilling will be stopped for approximately 10 minutes to allow the water level to rise. Both the initial and second water level will be measured and recorded. Drilling will resume using rotary wash methods to the boring completion depth. Rotary wash methods will be performed using potable water and, if required to maintain borehole stability, a bentonite drilling mud may be used.

The exploratory borings will be continuously sampled and field screened with an OVA (as described previously). The boring will be cased to a depth to be determined in the field based upon the OVA screening (to a non-detectable level) or the shallow water-bearing zone, whichever is deeper. Drilling will resume through the casing to the boring completion depth. Upon completion of drilling, the casing will be pulled and the borehole will be grouted as the casing is advanced out of the hole from the base of the borehole to ground surface. Grouting will be performed as described later in this section.

Borings drilled for the deeper monitor wells will be drilled within 10 to 15 feet of the corresponding exploratory borings in the same manner as described above except that a 12-inch diameter shallow PVC casing will be grouted in place to seal off the shallow water-bearing zone to the depth determined by the corresponding exploratory boring. The boring will first be drilled to the depth for the 12-inch casing. The hole will then be reamed to provide a minimum 14-inch diameter bore hole. The 12-inch diameter casing will be placed in the hole and grouted (as described later in this section) between the borehole and casing outer wall. The grout will be allowed to set for at least 24 hours. Drilling will then resume through the shallow casing to the completion depth.

Following completion of each borehole used for screening, the borehole will be grouted with a cement/bentonite (6 to 8 percent bentonite by dry weight per sack of cement)

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grout. The grout shall consist of Portland cement and powdered sodium bentonite. The grout mix will consist of a pumpable cement/bentonite slurry. The grout shall be mixed in clean, above ground, rigid containers with an appropriate quantity of water. The mixing of each component will be achieved by a mechanical paddle device or recirculation with a grout pump. Mixing activities will continue until a smooth, lump free consistency is achieved.

The grout mixture shall be pumped through a rigid, side discharge tremie pipe placed approximately 6 inches above the bentonite seal for monitor well installation or on the bottom of the hole for plugging and abandonment of soil borings. The grout mixture shall be pumped until undiluted grout flows from the annulus at the ground surface. The tremie pipe may be slowly withdrawn during grouting operations. The estimated volume of grout will be computed for each boring or well, based upon borehole dimensions and well dimensions. If actual grout placed is less than or exceeds 50 percent of the computed volume, the grouting for that boring or well will be evaluated to determine if grouting problems are present (i.e. caving or excessive grout takes).

After a 24-hour period, the boring or well will be inspected for settlement of the grout and more grout will be added as needed. This process shall be repeated until firm grout is at or within one foot of the ground surface.

The specifications for the materials making up the grout are:

- Bentonite will be powdered, granular or chipped sodium montmorillonite furnished in moisture resistant sacks and without additives.
- Cement will be a low-alkaline Portland Cement, Type I in conformance with ASTM C-150 and without additives.

4.1.3 Documentation

Subsurface soil sampling will be documented in the filed log book as well as on a boring log form for each boring drilled. The boring log will be of a form equal to or similar to Figures 5. Pertinent information will, at a minimum, include boring number, date,

logger, lithologic description, core recover, OVA or HNu readings, depth of water table and boring completion data.

The following information shall be routinely entered or attached to the soil boring log:

- Depths/heights shall be recorded in feet and fractions thereof (tenths).
- Soil classifications shall be in accordance with the Unified Soil Classification System (equivalent to ASTM D 2487 and 2488).
- Soil classifications which have been prepared in the field at the time of sampling by a WCC representative and are subject to change based upon laboratory tests and/or subsequent review. Factors to consider before changing a field determination include the expertise of the field geologist and laboratory personnel, representative character of the tested sample, labeling errors, etc.

Each soil sample taken shall be fully described in the log. The descriptions of intact samples shall include the following parameters:

- Lithologic Classification and Unified Soil Classification
- Color
- Plasticity
- Consistency (cohesive soil)
- Density (non-cohesive soil)
- Moisture Content. Use relative term.

Other information to be placed on the soil boring logs, as appropriate, include:

- The drilling equipment used will be generally described either on each log or in a general legend.
- Each log will record the drilling sequence.
- All special problems and their resolution will be recorded on the log; e.g., hole caving, recurring problems at a particular depth, sudden tool drops, excessive grout takes, drilling fluid losses, unrecovered tools in hole, lost casing, etc.

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- The dates for the start and completion of borings shall be recorded on the log.
- Each sequential boundary between the various soils and individual lithologies shall be noted on the log by depth. When depths are estimated, the estimated range shall be noted along the boundary.
- The depth of first encountered free water shall be indicated along with the method of determination. In addition, when free water is first encountered the following procedure will be followed; Allow the first encountered water to partially stabilize (10 to 15 minutes) and record this secondary level and time between measurements before proceeding.
- The estimated depth interval for each soil sample taken, classified, and/or retained shall be noted on the log. For each driven (split spoon), thin wall (shelby), and cored sample, the length of sample recovery and the sampler type and size (diameter and length) will be recorded.
- For thin wall samplers it should be indicated whether the sampler was pushed or driven. Blow counts shall be recorded in half foot increments when standard (1 3/8" ID by 2" OD) samplers are used. For penetration of less than a half foot, it will be noted in the log along with the blow count and the distance over which the count was taken.
- Special abbreviations used on a soil boring log and/or well diagram will be defined either in the log/diagram where used, or in a general legend.

4.1.4 Alternative Method

The hollow-stem drill and sampling methods described above may be deemed inadequate under certain field conditions. Potential problems may include the following:

- Collapse of borehole upon reversing hollow-stem auger out of the borehole.
- Significant hydraulic head from groundwater zones affecting hollow-stem drilling and sampling procedures.
- Larger diameter borehole requirements for setting multiple strings of casing that are not possible with hollow stem drilling capabilities.

If such conditions occur, rotary-wash drilling methods will be implemented to rectify these potential problems. Rotary wash will utilize only potable water that is recirculated through the borehole to remove cuttings. Bentonite drilling mud (organic free) will be used only if required to maintain borehole fluid stability for investigations below the upper pervious zone. Dry auger techniques will be utilized to the top of the uppermost water bearing zone. Hydraulic rotary drilling operations will use portable recirculation tanks/pans for the "mud pit" and for mixing grouting. Dug pits or sumps will not be used.

Sampling will be taken continuously from undisturbed strata by using either Shelby types or split spoons ahead of the bit, similar to that for hollow stem methods.

4.2 SURFACE SOIL SAMPLING

Surface soil samples will be obtained from areas that are potential pathways for surficial contaminant migration. The samples will be collected in areas as discussed in the RFI Field Investigation Workplan.

4.2.1 Equipment

Sampling equipment will consist of hand sampling tools such as trowels, shovels, or a drive tube sampler. Stainless steel sampling tools will be used if possible.

4.2.2 Procedure

The sample locations will be referenced to site coordinates. The sampling area will be first cleared of vegetation and/or debris. The sample will be collected to a depth of 12 inches such that minimal volatilization is allowed and then transferred in the appropriate container. The hole will be backfilled with native soils and vegetation.

4.2.3 Documentation

As previously stated, the sampling point will be referenced to the site coordinate system and ,if taken with an areal grid, the node number will be recorded. Visual classification

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and other observations will also be noted in the filed log book along with sample number, time, date, and other pertinent information.

4.3 GROUNDWATER SAMPLING

4.3.1 WATER LEVEL MEASUREMENT

4.3.1.1 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:

4.3.1.1.1 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 a 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.

4.3.1.1.2 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 a 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.

4.3.1.2 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.

4.3.1.3 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. Form 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.

Casing Diameter	Casing Volume
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.

4.3.1.4 Free-Phase Immiscible Contamination

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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 a logbook as described in SOP 3.4.

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 that ± 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 recharges 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:

4.3.2.1 Bailer Purging

Bailers can be used to evacuate shallow wells, and through 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.

4.3.2.2 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.

4.3.2.3 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 liens, 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.

4.3.2.4 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.

4.3.2.5 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.

4.3.3 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.

4.3.3.1 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 monitor well cap of each well will be removed carefully to avoid the incorporation of any contaminants in the well. Any plants or small trees that will be close to the well will also be removed, if possible. Prior to sampling, the initial static water elevation will be measured and recorded. The water level will be measured from the top of the riser piper to the nearest 0.01 foot using a calibrated electronic probe water level sensor (M-scope) or weighted tape (with sounder). Three replicate measurements will be made to verify accuracy. The probe or tape will be cleaned with deionized water after each use.

Following water level measurements, the well will be purged to remove stagnant water which would otherwise bias a representative sample. The purging will be performed using a dedicated bailer. The well will be purged until water parameters of pH, specific conductance, and temperature have stabilized and at least three well volumes or the well

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is purged to dryness. Purged water will be containerized for treatment. Measurements of pH, specific conductance, and temperature will be taken and recorded during the purging.

Vehicles or any other equipment that might be a potential source of contamination will be placed at a distance far enough from the wells during purging or sampling.

After purging, the well will be sampled with a dedicated or clean bailer. Clean plastic sheeting will be placed on the ground around each well to prevent contamination of the ground or any sampling equipment which is dropped. Care will be taken so that the sample is taken from the screened interval of the well. Samples will be retained in appropriately preserved laboratory containers. No head space will be allowed in VOA vials.

Samples will be collected and containerized in the order of the parameters volatilization sensitivity. Samples for organic compounds should be collected initially. Care will be taken not to allow the bailer to come into contact with the container while pouring the samples.

The following are potential sampling methods:

4.3.3.1.1 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 no 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.

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4.3.3.1.2 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.

4.3.3.2 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.

4.3.3.3 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.

4.3.3.4 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

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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.

4.3.3.5 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.

4.4 QUALITY CONTROL SAMPLES

To attain the project quality assurance objectives discussed in this document, certain Quality Control (QC) samples need to be collected and sent to the laboratory. The following is a discussion of those samples:

4.4.1 Trip Blanks

These samples consist of laboratory-prepared VOA vials, filled with volatile organic-free water which are shipped with the sample containers. These vials remain in the sample cooler and are not to be opened. They will be analyzed in the same manner as the collected samples, and are used to monitor volatile organic compounds due to container contributions or contamination during shipment. A trip blank shall accompany each sampling event (defined as the duration of the sampling of the wells in the plant) for which sample for volatile organic analysis are being collected.

4.4.2 Rinsate Blanks

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These samples are used to monitor contamination resulting from the sampling equipment and also to monitor the effectiveness of equipment decontamination procedures. Rinsate samples are collected by pouring reagent grade water over decontaminated sampling equipment, in such a manner as to contact the same surfaces as the samples and collecting that water for analysis. Rinsate blanks will be collected at a minimum of one per sampling event. If there is more than one type of parameter being monitored in that sampling event, the rinsate blank will be analyzed for only the organic constituents (volatile and semivolatile, if applicable).

4.4.3 Sample Preservation and Shipment

The appropriate preservative will be added to each sample bottle by the laboratory prior to being taken into the field. Table 8 lists containers, preservatives, and holding times for the parameters being analyzed in this program.

Once the sample is placed in the bottle, a label should be affixed to the bottle. The label shall contain the following information: plant area, sample number (monitor well number), date, time of sample collection, parameter for analysis, preservative (if any), and the collector's name. The samples shall be placed in an ice chest containing an adequate volume of ice to maintain samples at 4°C. The ice chest should be sealed for shipment.

All samples will be continuously tracked in the field and while in transit. A chain-of-custody form shall accompany the samples at all times. The sample custody procedures are further described in Section 4.4 of this document.

4.5 GROUTING

Following completion of each borehole, the borehole will be grouted with a cement/bentonite grout (4 to 8 percent bentonite by dry weight per 94-pound sack of cement.) The grout shall consist of Portland cement and powdered sodium bentonite. The grout mix will consist of a pumpable cement/bentonite slurry. The grout shall be mixed in clean, above ground, rigid containers with an appropriate quantity of water. The mixing of each component will be achieved by a mechanical paddle device or

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recirculation with a grout pump. Mixing activities will continue until a smooth, lump free consistency is achieved.

The grout mixture shall be pumped through a rigid, side discharge tremie pipe placed approximately 6 inches above the bentonite seal for monitor well installation or on the bottom of the hole for plugging and abandonment of soil borings. The grout mixture shall be pumped until undiluted grout flows from the annulus at the ground surface. The tremie pipe may be slowly withdrawn during grouting operations. The estimated volume of grout will be computed for each boring or well, based upon borehole dimensions and well dimensions. If actual grout placed is less than or exceeds 50 percent of the computed volume, the grouting for that boring or well will be evaluated to determine if grouting problems are present (i.e. caving or excessive grout takes).

After a minimum 24-hour period, the boring or well will be inspected for settlement of the grout and more grout will be added as needed. This process shall be repeated until firm grout is at or within one foot of the ground surface.

The specifications for the materials making up the grout are:

- Bentonite will be powdered, granular, or chipped sodium montmorillonite furnished in moisture resistant sacks and without additives.
- Cement will be a low-alkaline Portland Cement, Type I in conformance with ASTM C-150 and without additives.

4.6 AQUIFER TESTING

Single well tests are referred to as slug tests. These tests are performed by suddenly adding or removing a slug (known volume) of water from a monitor well and observing the recovery of the water surface to its original level. In systems where the entire depth of the aquifer formation is screened, such tests provide information on the horizontal component of hydraulic conductivity. When only a portion of the aquifer depth is screened, the slug test results give a hydraulic conductivity containing both horizontal and vertical components. Most of the pressure loss (head loss) is dissipated in a horizontal direction, therefore, the value of hydraulic conductivity evaluated is assumed

to be most horizontal. Bower (1978) discusses a slug-test procedure applicable to fully or partially penetrating wells in unconfined aquifers. He discusses the use of dimensionless solutions of the Thiem equation to determine the hydraulic conductivity from observed values of water level and elapsed time.

4.6.1 Equipment

Slug testing equipment will consist of:

- Pressure transducer(s)
- Suspended weight of known volume (slug).
- Electric water level probe and/or steel tape.
- Data logger (recorder)
- Field data printer.

Since the pumping test program will be developed after performing the slug testing, it is not possible to identify equipment to be used in conducting the pumping test(s) at this time. A listing of such equipment will be compiled when the pumping test program has been developed and will be approved by EPA.

4.6.2 Procedure

The specific slug test performed will be a falling head test followed by a rising head test. Measurements of the behavior of the monitor well system as it returns to equilibrium are then made and used for analysis. The test will be run until the system has achieved 90 percent equalization. Field procedures for slug testing are as follows:

1. The magnitude of instantaneous head change resulting from introduction or removal of the slug shall not cause water to overflow the well casing. To assure meeting these requirements, magnitude of head change shall be determined prior to introduction of the slug. The magnitude determination shall be based on the calculated volume of the slug and the inside diameter of the casing. The test shall proceed only when these requirement are met.

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2. All equipment entering the well shall be decontaminated prior to placing into the well. Decontamination shall consist of triple rinsing with deionized water.

3. The static water level shall be measured using an electronic water level sensor or weighted tape.

4. When the transducer is lowered into the well and in place, the slug shall be introduced to the well as rapidly as possible without causing undue splashing or turbulence so as to produce an instantaneous head increase. The instant the slug is set in place, the reference time will be time zero.

5. Water levels shall be measured continuously (millisecond intervals) with the transducer and recorded with the data logger unit. Measurements shall be terminated when the water level stabilizes or when the water level has reached a level within 10 percent of static level.

6. Water level measurements recorded shall be checked for credibility before proceeding to the next testing stage (removal of the slug).

7. When checking of data has been completed and the previous testing has been determined to be acceptable, the slug shall be removed from the well as rapidly as possible to produce an instantaneous head reduction . The instant the slug is removed from the water, the reference time will be time zero.

8. Water levels shall be measured continuously (as in the previous testing stage) using the transducer and shall be recorded using the data logger unit. Measurements shall be terminated when the water level stabilizes or reaches a level within 10 percent of initial static water level.

9. When measurements are terminated, the transducer shall be removed from the well.

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10. Water level measurements recorded shall be checked for credibility before proceeding to the next we..

11. Any test or test stage shall be repeated if review of the recorded data indicates questionable validity.

The data from the slug test will be reduced to evaluated time versus change in water level using the methods of Cooper, et al. (1967) or Bower and Rice (1976). Upon evaluating the results of the slug test, a pumping test plan will be developed and presented to the EPA for approval.

4.6.3 Documentation

Water level data shall be recorded with the data logger and preserved for offloading at the Woodward-Clyde Consultants office in Baton Rouge, Louisiana. To the extent possible, print outs shall be obtained for each set of tests during the data checking phase of testing. Printouts obtained shall be properly labelled to indicated the following and shall be preserved as raw field data:

- Monitor Well location
- Monitor Well number
- Date of Test
- Elevation of Base of Test Section
- Elevation of Top of Test Section
- Testing Stage (i.e., slug-in or slug-out)

If a printout cannot be obtained, the data shall be hand recorded in the field log book, if possible or the well will be retested at a later date.

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Upon completion of the drilling and sampling as described above for borings designated for monitor well installation, shallow and/or deep monitor wells may be installed at locations as determined by the Interim Measures piezometer and expanded groundwater testing data.

5.1 EQUIPMENT

In addition to drilling and sampling equipment described in Section 1.1, the material required for well installation will consist of:

- A screen to allow entry of ground water.
- A bentonite pellet seal above the filter pack to prevent downward migration into the filter media.
- A filter pack to fill the space between the borehole and the screen with a stable material and to limit entry of fine materials into the well.
- Blank pipe or casing connecting the screen to the ground surface.
- A low permeability grout seal between the casing and the borehole to isolate the screened interval from the ground surface.
- Intermediate casings to seal off permeable zones above the target stratum, as needed.
- A protective casing at the surface.
- A surface slab.
- Protective posts.

5.1.1 Procedure

The monitor well style construction for shallow wells (less than 20' deep) involves drilling of a 10-inch minimum diameter borehole to the total well depth and backfilling the hole in succession with the well screen (with a cap and sump on the bottom), the

blank pipe above the screen, a filter pack around the screen, a bentonite pellet layer and cement bentonite grout to the surface.

The deeper monitor wells will be constructed by drilling a borehole of at least 14-inch diameter through the base of the upper permeable zone and one to three feet, at the discretion of the qualified WCC representative, into the underlying clay. A 12-inch diameter Schedule 40 PVC casing is lowered into the borehole and pushed about one foot into the clay at the base of the boring. The casing is then grouted in place by pumping a cement bentonite grout through a tremie pipe into the borehole between the outer casing wall and borehole wall. At completion of the grouting, the grout is allowed to cure for 24 hours and the downhole drilling equipment is decontaminated. During the grout set period the casing will be capped to prevent tampering until well installation is resumed. After the grout has set, the inside of the 12 inch casing is thoroughly flushed with clean water. The borehole and well installation are then completed through the casing. Wells will be surveyed upon completion prior to sampling.

Well Screen.

Well screens will be 4-inch diameter Schedule 40 PVC with No. 10 slot size. Connections between the screen and the casing will be threaded. No glues, solvents, epoxies, thermal processes (except welding) or rivets will be used.

A direct measurement of borehole depth by the use of a clean, chemically inert, weighted measuring tape shall be made before screen placement. The depth, to the nearest tenth of a foot shall be recorded on the well construction log.

The borehole shall be purged or flushed with water, to the extent practical of drill cuttings and any bentonite drilling mud used during construction. If during construction unstable soils or other factors resulting in side wall caving or "blow-in", were encountered, the use of temporary casing will be required. The temporary casing shall be steam cleaned and free of coatings and rinsed with water prior to use.

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The screen shall be new, commercially fabricated continuously wound or slotted screen with a four-inch nominal diameter. No fittings shall obstruct the inside diameter. The screen will be free of foreign matter and steam cleaned prior to use.

Screens shall be 0.01 inch slot and no longer than 10 feet in length nor shorter than five feet. Screens will be placed based on the qualified WCC representative's description of formation materials.

Filter Pack.

After the screen is placed in the borehole the filter pack will be placed around it. The filter pack material will consist of a clean graded sand (typically 20-40 mesh sand).

None of the filter pack aggregate is to come in contact with the ground surface. Any aggregate that comes in contact with the ground surface or is otherwise contaminated shall not be introduced into the well. Filter aggregate may be placed directly from the bag; however, care will be exercised not to include the dust and fines from the bottom of the sack.

The filter pack is to be placed in the well by either tremie pipe or poured down and around the annulus in such a manner as to be distributed around the screen at a uniform height and density.

If temporary casing is used, the filter pack will be placed first and then the casing partially withdrawn to allow the filter pack to slump against the side walls of the boring. Additional filter aggregate will be added to allow for the slight increase in volume.

The filter pack will extend 1 to 2 feet above the top of the screen unless this height prevents proper placement of the bentonite seal. Placement of an adequate bentonite seal shall override the filter pack thickness except that the filter pack will come at least one foot over the top of screen. In no case shall the filter pack extend such that separate permeable zones are connected.

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Pipe and Casing.

Blank pipe or casing made of 4-inch diameter Schedule 40 PVC will extend from the top of the screen to between three and four feet above ground surface. This blank pipe will be attached to the screen by a threaded connection. The well casing will be capped with a vented top cap.

Grout Seals.

A bentonite pellet seal shall be 2 or 3 feet in thickness and will be placed in such a manner as to be uniform in thickness around the casing. In placing the bentonite pellets, care will be exercised so as not to incorporate any of the accumulated bentonite fines from the bottom of the packaging container into the annulus.

However, if the soils in this area are unstable to the degree that slumping or collapse of these soils against the permanent wall casing is highly probable, then the bentonite pellet seal shall be placed first and the temporary casing withdrawn as expeditiously as practical. After placement of the bentonite seal, the seal will be given adequate time to hydrate as determined by the qualified WCC representative. After the hydration period, the top of the bentonite seal shall be determined by direct measurement and recorded on the well construction log.

The annular space above the bentonite seal will be grouted. All grout materials shall be placed by pumping through rigid, side discharge tremie pipe. Grouting will be as previously described in Section 1.1.2.

Development.

The newly installed wells will be developed in order to: (1) restore the natural permeability of the formation screened, (2) to remove clay, silt, and other fines from the filter pack and well screen so that subsequent water samples will not be abnormally turbid or contain undue suspended matter, and (3) to remove remnant drilling fluids from the well, filter pack, formation and potential contaminants introduced during the time of drilling.

The development process is best accomplished by causing the natural formation water collected inside the well screen to be moved in through the screen in order to agitate the clay and silt and move these fines into the well where they can be removed. Use of water, other than the natural formation water will not be used due to the possibility of introducing contaminant or atypical water quality to the ground water. Any equipment used for development will be thoroughly cleaned prior to use within a well to prevent cross-contamination.

Development will be accomplished by bailing with a stainless steel or teflon bailer. The development shall be accomplished in such a manner as not to damage the well screen, or disturb the filter pack. No additional water, dispersing agents, acids, disinfectants, or other additives shall be used during development. A minimum of three volumes of standing water shall be purged during development. Development shall proceed until the following criteria are met:

- The well water is clear (or clear as possible under the limits of possible suspended colloids).
- Three well volumes (minimum) have been removed.
- The specific conductance and/or pH measurements approach a constant value.

All water removed from the wells during development will be containerized and transported to the onsite wastewater treatment facility. Following development the well will be allowed to stand for a minimum of 48 hours before sampling occurs.

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Protective Casing

A 8-inch locking protective casing shall be placed around the PVC riser pipe as soon as possible after grout inspection has been completed. The protective casing shall be provided with a threaded, 1/4-inch hole and drain plug at a base of the exposed portion of the protective casing. The protective casing shall fit over the well such that there is sufficient clearance for the well cap accessibility.

The inside of the locking cover of the protective casing shall have the following inscribed, stamped or otherwise permanently affixed:

- Well identification number
- Top of casing elevation
- Well depth
- Screen length
- Date of well installation
- Well construction contractor's name

The locking protective casing, at a minimum, shall be five feet in length and extend just over the riser pipe, and be manufactured of new black iron, steel, or stainless steel pipe or will be protective covers commercially manufactured for that purpose. Prior to placement, the casing shall be steam cleaned and free of any asphaltic or resinous coatings except paint or primer applied by the manufacturer. The casing shall be provided with a locking cap that telescopes or in some similar manner extends over and down the casing to prevent the entrance of rainwater, wind-blown dust particles, or insects into the casing. All protective casings shall be provided with a padlock, which shall be locked until the time of sampling.

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Surface Slab.

A concrete slab will be poured at the ground surface around each well after installation. The slab will be at least four inches thick and five feet square and sloped gently away from the well in all directions.

Protective Posts.

Wells located in areas of traffic will be further protected by the erection of four steel posts, or approved alternate, each radially located 4 feet from each well, placed 2 to 3 feet below ground surface, having 3 feet minimally above ground surface. Guard posts shall not be made a part of any protective slab constructed around the well.

5.1.2 Documentation

Each installed well shall be depicted in a well installation report. This report shall be attached to the boring log for that installation and shall graphically denote, by depth from ground surface (unless otherwise specified):

- The bottom of the boring (that part of the boring most deeply penetrated by drilling and/or sampling) and borehole diameter;
- Screen location;
- Granular filter pack;
- Bentonite pellet seal;
- Grout;
- Cave-in(s);
- Height of riser (without cap/plug) above ground surface;
- Protective casing detail;
  -height of protective casing without cap/cover
  -base of protective casing
  -drainage port location and size
  -guard post configuration

The construction report will include:

- The actual quantity and composition of the grout, seals, and granular filter pack used for each well.
- The screen slot size (in inches), outside diameter, schedule/thickness, composition, and manufacturer.
- The outside diameter, schedule/thickness, composition, and manufacturer of the well casing.
- The joint design and composition.
- Location of placement of bentonite pellet seal.
- Location of placement of annular grout.
- Protective casing composition and nominal inside diameter.
- Special problems and their resolutions; e.g., grout in wells, lost casing and/or screens, bridging, etc.

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- Dates and times for the start and completion of well installation.

All abbreviations used on the boring logs/well diagrams shall be designated on the log-diagram or in an attached general legend.

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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.

6.1 BORING LOGS

Field boring logs of a type similar to that presented in Figure 5 will include at a minimum the following information for each boring location:

- Project name and number
- Boring number
- Location of boring (including measured offset and reason for offset)
- Drilling method

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- Name of WCC representative

Each log will also include:

- Sample location number and depth
- Water levels and the respective times of each reading
- Description of subsurface materials using the Unified Soil Classification System (USCS) including classification, consistency, texture, plasticity, moisture content, color, stratification, etc.
- Sample recovery in inches
- Results of organic vapor monitoring, if required
- Sample interval

6.2 MONITOR WELL INSTALLATION/DEVELOPMENT REPORTS

A monitor well installation report will be completed for each newly installed monitor well at the site. Information on these reports shall include the screening interval, depth to sand pack and bentonite seal, and grout backfill. The report will be documented using a well development form as shown on Figure 9.

6.3 GROUNDWATER SAMPLING REPORT

A sample collection log specific to groundwater sampling will be completed for each monitor well sampled at the site. These reports shall include static groundwater elevation, volumes purged, weather conditions, etc. The report will be on a form similar to Figure 10.

6.4 SAMPLE CUSTODY DOCUMENTATION

Chain-of-custody will be maintained for each sample collected. The chain-of-custody will provide an accurate written record which can be used to trace the possession and holding of samples from the time of collection through data analysis and reporting. The following information will be specified for each sample on the chain-of-custody form:

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- Sample number
- Sample date
- Sample time
- Sample location and depth where appropriate
- Analyses to be performed

The chain-of-custody form will be signed by the sample custodian. It will be placed in a water-tight plastic bag and taped to the underside of the lid of the cooler containing the samples designated on the form. The lid of the cooler will be securely taped shut and signed custody seals will be placed on the opening of the cooler lid to allow detection of any possible tampering. Upon arrival in the laboratory, samples will be received by the analytical laboratory representative. Samples contained in the shipment will be compared of the chain-of-custody form to verify that all samples designated have been received. Sample custody within the laboratory will be maintained on internal tracking forms.

The chain-of-custody procedures document sample possession from the time of collection to final disposition. A Sample Analysis Request Form will accompany the Chain-of-Custody form and will document the requested sample analysis.

For the purpose of these procedures, a sample is considered in custody if it is:

- In one's actual possession
- In view, after being in physical possession
- Locked so that no one can tamper with it, after having been in physical custody
- In a secured area, restricted to authorized personnel

A chain-of-custody record will be initiated in the field, and the original will accompany the samples with copies retained at intermediate steps.

Each time responsibility for custody of the sample changes, the new custodian will sign the record and denote the date. A copy of the signed record will be made and retained

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by the immediately previous custodian to allow tracking of sample possession. All changes of custody of samples must be a person-to-person change of physical possession.

6.5 ANALYSIS REQUEST

Analysis of the samples collected shall be in accordance with the EPA CLP protocol. All samples shipped for analytical testing shall be accompanied by a Chain-of-Custody form and Sample Analysis Request form for document requested analyses, a copy of which is presented as Figures 11 and 12, respectively.

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7.0
DECONTAMINATION

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.

7.1 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.

To prevent contamination prior to drilling operations, the following will be applied:

- Only new materials will be used. Only bagged cement, powdered bentonite in bags or bentonite pellets in well protectors will be used.
- PVC pipe for riser and well screen will be cured and free of plasticizers and oils.

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- Workers will wear clean cotton or surgical gloves when handling riser and well screen.
- Electrical tape will not be used to band pumps.

7.2 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 particular 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 HCl 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 well be collected as indicated in the Quality Assurance Plan.

7.3 Pump Decontamination

If a monitor well has been purged or sampled using any of the pumps as discussed, 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.

7.4 Downhole Equipment Decontamination

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The drilling rig with associated tools and all sampling equipment will be decontaminated before entering the site and leaving the site. Downhole equipment (i.e., augers, bits, samplers, etc.) will be cleaned between boring or other sampling locations at a decontamination/washdown pad. Wash water will be containerized or transported to the wastewater treatment facility.

The equipment will be cleaned as described below:

- The drill rig, all auger flights, auger bits, drilling rods, drill bits, core barrel samplers, Shelby tubes, or other parts of the drilling and well development equipment that will contact the soil or groundwater should be cleaned with a steam cleaner or hand washed with a brush and detergent to remove oil, grease, and any contamination that has accumulated on the equipment.
- Any sampling equipment which can be safely steam cleaned shall be decontaminated as described above.
- These units should then be rinsed thoroughly with potable water

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8.1 ANALYTICAL PROCEDURES

Analytical methods to be used in the investigation will be in accordance with CLP procedures utilizing the following statements of work:

- SOW February 1988 (or more recent) for organics
- SOW July 1988 (or more recent) for inorganics
- SOW September 1986 (or more recent) for 2,3,7,8-TCDD

CLP procedures provide step be step guidelines and requirements for the analysis of TCL and TAL constituents, including detection limits as shown in Tables 2 and 3.

The laboratory selected to analyze the samples for this project will submit a QA plan for review and approval by U.S. EPA prior to initiating project.

In the second phase of the investigation, specific constituents of concern identified from the Phase 1 investigation will be analyzed for utilizing the procedures described above.

8.2 CALIBRATION PROCEDURES AND FREQUENCY

Measuring and test equipment used in the field and laboratory shall be controlled by a formal calibration program. The program shall provide 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.

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8.2.1 Calibration Procedures

Documented and approved procedures shall be used for calibrating measuring and test equipment. Whenever possible, widely accepted procedures, such as those published by the ASTI or U.S. EPA, or procedures provided by manufacturers in equipment manuals, shall be adopted.

Calibrated equipment shall be uniquely identified by using either the manufacturer's serial number, an 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), shall be attached to the equipment. If this is not possible, records traceable to the equipment shall be readily available for reference. It is the responsibility of all personnel to check the calibration status from the due date labels or records prior to using the equipment.

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

Reference standards (physical and chemical) shall be used only for calibration. Physical standards shall be stored separately from working measuring and test equipment. Equipment that fails calibration or becomes inoperable during use shall be removed from service and segregated to prevent inadvertent use and shall be tagged to indicate it is out of calibration.

Records shall be prepared and maintained for each piece of calibrated measuring and test equipment to indicate that established calibration procedures have been followed. Laboratory calibration records shall be maintained by the laboratory.

8.2.2 Field Equipment Calibration

Field calibration procedures will be performed on field instrumentation as follows:

- pH Meter - Premeasurement calibration and post-measurement verification using at least two standard buffer solutions for each sample tested. The buffer solutions should bracket the sample pH. The two measurements must be within ± 0.05 standard unit of buffer solution values.

- Conductivity Meter - Daily calibration using potassium chloride (KCl) standard solution. The meter measurement must read ± 10 percent of the standard to be considered in control.

- Temperature - Temperature is measured using a thermostat built into the conductivity meter. The readings will be checked at least once at the start of the field use of the instrument using a quality grade thermometer.

- OVA - The instrument will be calibrated daily to a methane in air standard.

Calibration of field equipment shall be documented in the field log book for reference and maintained in the project files.

8.2.3 Laboratory Equipment Calibration

Laboratory calibration procedures for analytical testing will be performed in accordance with SW-846, 3rd Edition and EPA CLP protocols, as appropriate.

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9.0
DATA REDUCTION, REPORTING, AND VALIDATION

Data reduction, validation and reporting will follow strict guidelines as presented in this section. The only data that will be reported will be data that meet the record keeping, quality assurance/quality control criteria and reporting formats as defined in this QA Protocol. Laboratory data review will follow documented data validation procedures. Data will be classified as accepted (quantified), estimated (qualified), or rejected based upon the validation procedures. For samples where the analytical data have been rejected, a decision will be made as to whether the results are critical and resampling is required. Only data that are classified as quantified or qualified will be reported.

The following sections describe the procedures to be used in data reduction, validation and reporting of analytical data. All analytical concentration reports will be reported unambiguously as concentration in µg/L or mg/L for aqueous samples.

9.1 Data Reduction

All concentration 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 both the volatile and semivolatile base/neutral/acid compounds and following an external calibration for both the pesticide and herbicide compounds.

9.2 Data Reporting

The intention of these sampling data reporting procedures is to maintain accurate records of all samples taken and to follow the status of the sample location and analytical results, while minimizing the duplication of record keeping activities and the possibilities for errors.

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The tabulation and flow of all data reporting information can be broken down into the following activities:

- Assignment of sample numbers, sample label preparation, and initial permanent record keeping,
- Preparation and labeling of all sample bottles,
- Sampling and in-the-field record keeping,
- Sample receiving and preparation for shipping, and
- Complete sample record book.

9.2.1 Sampling Record Keeping Prior to collecting a group of samples, a sample coordinator will assign a sample number and a description to all samples to be collected within the group. Sample numbers will be assigned to all divisions of the original sample, all of which have the same identification number with letters denoting subset containers. The sample number and corresponding description will be entered into a permanent record book. The information in the record book will then be written onto the appropriate sample label. When written, the sample labels will be given to the individual responsible for preparing the sample bottles.

The typed/printed labels for a group of sequentially numbered samples and a copy of the data book pages that include these numbers will be given to the sample bottle preparer and/or the sampler. This individual is responsible for applying all labels on the appropriate types of bottles. The sample preparer may also be the person who will be doing the sampling. A copy of the data book pages that include information about the samples will also be given to the person doing the sampling in order to provide a list of samples to check off during the sampling activity.

The individual(s) doing the sampling is (are) responsible for verifying that each sample is put in the appropriate sample bottle. At the time of sampling this person must fill in the time sampled, the date sampled, and sign and complete the sample's label. By the end of the sampling day, the sampler must return all samples to the geologist or engineer, who will oversee preparation of the samples for shipment (i.e., review chain-of-custody formes, inspect packaging, etc.

The person responsible for shipping the full sample bottles will compare the sample bottles with the appropriate sample data book pages. This person will then prepare the samples for shipping. Chain-of-custody forms must be completed for each sample; the originals must be sent with the samples, and copies will be sent to the sample coordinator to include in the appropriate project files.

9.2.2 Sample Custody and Shipment When the samples are ready to be sent to the laboratory, the sample coordinator will examine the samples and note their condition. Information including the date sampled, time sampled, and method of preservation,for each sample will be entered in the sample record book.

At the time the samples are shipped, the sample coordinator will have a copy of the pages in the sample record book that include information on the sample numbers and the corresponding information on the date sampled, time sampled, and the date shipped.

The chain-of-custody record will document the fact that the evidentiary integrity of the samples was maintained.

9.2.3 Laboratory Response The laboratory will be responsible for reviewing all sample analyses according to their internal QA/QC procedures. Data validation will be completed by the laboratory prior to the delivery of the data package. Completed data packages will be available for review by the project data validation coordinator and the project QA officer who will also evaluate the laboratory's checks. Any problems will be resolved and all data will be validated before the data are reported.

Laboratory data for all CLP TCL and TAL parameters will be maintained sufficient to be able to generate the standard CLP forms, if necessary at a later date. The quality control data and sample data results will be presented in a concise and convenient tabulated summary. 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. In addition, routine laboratory reports will include the following:

- Chain-of-Custody Records
- Quality Control Summary

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- Sample Data Results

When generated, each hard copy CLP data package will provide thorough coverage according to the following areas:

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

The case narrative will provide the following information:

- Sample Identification
- Parameters Characterized
- Analytical Methods Employed
- Any Deviation from the Project Work Plan
- All Problems Encountered
- Any Corrective Actions Taken

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9.3 Data Validation

Data validation, according to Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-0050/80, Office of Monitoring System sand 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 purpose of data validation is to determine if the data conform to specifications and are suitable for the intended project usage. Therefore, all data will be subjected to

screening in terms of conformance to project specifications and suitability for use. After completing a sampling program, the field data package (calibration records, chain-of-custody, field logs, etc), will be reviewed for completeness and accuracy. Data validation of analytical data will be completed before any of the results are released. The validation process described below will be done separately from the laboratory performing the analytical work as a separate process from internal laboratory data validation.

The following is a brief description of the methods that will be used during validation of the CLP laboratory data. These data will be reported in a summary data package and evaluated for conformance to the analytical limits set forth in 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). These checks will be performed on all samples analyzed, and the results will be summarized in a report for each lot of reported sample data. Qualified data will be reported as such and the appropriate qualifiers will be used for reporting. Non-CLP data and CLP data reported without the CLP summary data packages will be reviewed with respect to holding times, initial and continuing calibrations, method blanks, laboratory control samples, samples, matrix spikes and matrix spike duplicates or duplicates.

If problems occur which would reject data, the following procedures should detect these problems and the problem data will not be reported. However, rejected data will be addressed in the validation report to evaluate completeness goals.

1) Compile a list of all investigative samples.

2) Compile a list of all QC samples, including but not limited to:
   - -Trip blanks
   - -Laboratory blanks
   - -Laboratory duplicates
   - -Performance samples
   - -Matrix spikes

-Matrix spike duplicates
-Laboratory control spikes
-Laboratory control spike duplicate

3) Review chain-of-custody documents for completeness and correctness.

4) Review laboratory analytical procedures and instrument performance criteria.
   -Sample media identification
   -Sample location and descriptions
   -Proper concentration units
   -Proper significant figures

5) This data summary will be reviewed for potential data quality problems including:
   -Unexpected results
   -Common laboratory contaminants
   -Unusual spacial concentration/identification relationships
   -Samples in which dilution was necessary
   -Samples which may have exhibited "carry over"

6) A sample summary will be prepared to access precision, accuracy and completeness of the analytical data.

7) Laboratory records and data package requirements will be checked to access completeness of the data package.

Laboratory performance results will be documented from the validation procedures or from precision or accuracy evaluations. The validation personnel will provide a means to notify the laboratory and initiate the appropriate corrective actions.

Despite all efforts to achieve the objectives of the laboratory QA/QC plan, the potential for error exists in laboratory chemical analyses and in the data reporting process. Every reasonable effort will be made to compare and double-check data reported from the

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laboratory, data entered into the data management system and data subsequently reported in accordance with the procedures described herein.

All analytical results are to be classified as quantified, qualified or rejected through data validation activities. Quantified data are to be used in laboratory reports at the numerical value identified. Qualified data are to be used as an estimate and are not to be used as a quantitative measurement. Rejected data are not to be included in the analytical report. No further use for design or other activities is to be made on the basis of rejected data.

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10.1 DATA TRANSCRIPTION

All data transcriptions for final reports will be reviewed before reporting. Data transcription requirements may vary, but should be monitored in accordance with requirements for accuracy and legibility.

10.2 FIELD SAMPLING QUALITY CONTROL

Quality control for field sampling includes duplicate samples, field blanks and rinsate blanks. Steps and checks used to validate precision and accuracy of the measured parameters and to support the representativeness, comparability, and completeness of the work include:

- Description of the calibration of methods and instruments,
- Description of routine instrument checks (noise levels, drift, linearity, etc).,
- Documentation of traceability of instrument standards, samples and data,
- Documentation on analytical methodology and QC methodology,
- Description of applicable performance audits with appropriate audit materials,
- Description of controls for interference contaminants in analytical methods (use of reference blanks and check standards for method accuracy and precision),
- Description of levels of routine maintenance to verify analytical reliability, and
- Documentation of sample preservation and transport.

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10.3 VERIFICATION AND REVIEW

The laboratory analyst should review data to verify that where appropriate, the laboratory:

- Calculates the recoveries of surrogate spikes,
- Verifies that there are no contaminants in all associated blanks,
- Compares samples and duplicates for matches in data results,
- Reviews surrogate and spike recovery data to make sure they are within quality acceptance limits,
- Verifies calibration performance for acceptability,
- Reviews and verifies instrument tuning,
- Reviews internal areas of response for acceptability.

Upon meeting all technical criteria, the sample folder will then be review to:

- Make sure the surrogate recovery section has been completed
- Make sure that all analyzed compounds have been properly recorded
- Confirm identified sample spectra with standard spectra
- Verify accuracy of calculations on compound quantities.

The supervisor examines the entire sample folder to verify that all data transcriptions and documentation included meets wcc requirements. The supervisor also reviews all data enclosed to verify that the data transcriptions are error free and that all documents are legible and in contractual order.

The laboratory QA department performs the review of completed folders on a percent complete basis to verify that the data is present so the WCC can evaluate data quality.

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In order to verity that procedures outlined in the Quality Assurance Plan and the Sampling Plan, performance and system audits should be conducted. Such audits help to verify that the integrity of the data and related information is maintained.

11.1 FIELD ACTIVITY AUDITS

A senior project personnel or designee should periodically conduct audits of the collection activities to verify that proper sampling protocol is being followed. Some of the items to evaluate include (but are not limited to): sampling operations, sampling labelling, sample handling, field notes, decontamination procedures, and chain-of-custody. The auditor will prepare a summary audit report containing the result of the evaluation and recommendations for any corrective actions.

At a minimum, the auditor will check the following items to determine the completeness and accuracy of field activities:

1. Sample Labels: A selected number of sample labels will be examined to determine if they were filled out properly and completely.

2. Chain-of-Custody Procedures: Several chain-of-custody records will be examined to determine if they were properly filled out; if parameters for analysis were properly identified; all custody transfers were documented; and date and time of transfer were recorded.

3. Field Notebooks: The notebooks will be examined to determine if proper recording format is being followed; if al insitu measurements and filed observations are being documented suitably to explain and reconstruct field activities.

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Intermittent audits may be performed by members of the sampling team for each filed sampling task. one independent team member may audit other members who are performing a separate task (i.e., sample handling member may audit sample collection). Results of audits will be included as part of the interim progress reports to the U.S. EPA.

11.2 LABORATORY PERFORMANCE AUDITS

The performance of laboratories in the U.S. EPA Contract Laboratory Program is monitored by the agency by using quarterly blind performance samples. Should the laboratory employed to analyze groundwater samples be in the CLP, then acceptable results on the most recent quarterly blind performance evaluation sample will be accepted as demonstrating laboratory capability to perform volatile, semivolatile and pesticide/PCB analyses. Performance evaluation samples should be obtained from a commercial supplier for laboratories that are not part of the EPA Contract Laboratory Program.

An onsite laboratory evaluation helps to verify that all the necessary quality control is being applied by the laboratory in order to deliver a high quality product. One laboratory audit of each laboratory used for sample analysis may be performed during the program. An internal laboratory audit by the respective laboratory QA officer will be performed during the program.

Quality assurance evaluations allow the evaluators to determine that:

- The organization and personnel are qualified to perform assigned tasks.
- Adequate facilities and equipment are available.
- Complete documentation, including chain-of-custody of samples, is being implemented
- Required analytical methodology is being used.
- Adequate analytical quality control, calibration including reference samples, control charts, and documented corrective action measures, is being provided.

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- Acceptable data handling, documentation techniques, and data review are being used.

As described above, audit results will be transmitted to the U.S. EPA in the interim progress reports.

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In order to timely and effectively complete a measurement effort, an attempt should be made to minimize downtime of all instrumentation. This is achieved by regular inspections of equipment and the availability of spare parts or supplemental instrumentation should the equipment fail.

WCC's preventative maintenance program is designed to minimize the down time of crucial sampling and/or analytical equipment due to expected or unexpected 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.

12.1 Field Instrumentation

All instrumentation to be used in collecting or testing the groundwater samples will be regularly serviced and at a minimum, inspected prior to going out in the field to collect samples.

When laboratory or field equipment is damaged or it cannot be verified that it will produce acceptable data, the equipment will be removed from service to be repaired or replaced. The equipment will not be returned to service until it has been verified that it is capable of producing acceptable data. Acceptable data as referenced here is data which meets quality assurance criteria for precision, accuracy, and representativeness. Equipment leased or purchased to replace damage equipment shall be capable of producing equivalent data. The WCC site managers will be responsible for the repair

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and/or replacement of damaged field equipment and filed equipment provided by its subcontractors.

If non-analytical type field equipment is damaged, it will be repaired immediately such that work may progress, or be replaced with similar or equivalent equipment such that the project objectives and the approved work plan will be met. The laboratory manager and site manager will retain documentation for the repair and/or replacement of laboratory and field equipment, respectively. All notable problems with equipment will be included in the interim progress reports to the U.S. EPA.

12.2 Analytical Instrumentation

The laboratory is expected to maintain and inspect their equipment. Instrument redundance, to the extent possible, coupled with an extensive stock of spare parts and expendable materials onsite will serve to minimize downtime.

Subcontract laboratories are inspected to verify that similar preventive maintenance programs are in operation, and are properly documented including the following:

- Accepting data with an acknowledged level of uncertainty.
- Resampling and analyzing.
- Recalibration of instruments using freshly prepared calibration standards.
- Replacement of solvent or other reagents that give unacceptable blank values.
- Additional training of laboratory personnel in correct implementation of sample preparation and analysis methods.

The laboratory manager will be responsible for the repair and/or replacement of damaged laboratory equipment.

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13.0
CORRECTIVE ACTION

During the course of this investigation, it will be the responsibility of the supervisor and the sampling team members to see that all measurement and sampling procedures are followed as specified and that measurement data meet the prescribed acceptance criteria. In the event a problem is discovered, it is imperative that prompt and prescribed action to be taken to correct the problem. Corrective action will be initiated, for instance, if QC data are found to exceed acceptability limits.

Whenever corrective action is necessary to eliminate the cause of nonconformance, a closed-loop corrective action system will be used. As appropriate, the sample coordinator, analysis coordinator, or the program manager will verify that all of these steps are followed:

- The problem will be defined,
- Responsibility for investigating the problem will be assigned,
- The cause of the problem will be investigated and determined,
- A corrective action to eliminate the problem will be determined,
- Responsibility for implementing the corrective action will be assigned and accepted,
- The effectiveness of the corrective action will be established, and
- The fact that the corrective action has eliminated the problem will be verified.

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13.1 Corrective Action for Field Situations

The need for corrective action will be identified as a result of the field audits previously described as well as by other means (e.g., equipment malfunction). If problems become apparent that are identified as originating in the field, corrective action will take place. If corrective action does not resolve the problem, appropriate personnel will be assigned to investigate and evaluate the cause of the problem. Once a corrective action is implemented, the effectiveness of the action will be verified.

13.2 Corrective Action for Laboratory Situations

The need for corrective action resulting from QA audits will be initiated by the environmental programs coordinator in consultation with the environmental lab personnel. Corrective Action may include, but is not limited to :

- Accepting data with an acknowledged level of uncertainty,
- Resampling and analyzing,
- Recalibration of instruments using freshly prepared calibration standards,
- Replacement of solvent or other reagents that give unacceptable blank values,
- Additional training of laboratory personnel in correct implementation of sample preparation and analysis methods.

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14.0
QUALITY ASSURANCE REPORTS TO MANAGEMENT

Quality Assurance reports will include a tabulation of the analytical data and an explanation of any sampling conditions or QA/QC problems and their possible effects on data quality. In addition, audit reports will be issued as appropriate

14.1 ANALYTICAL QA REPORTS

The laboratory analytical program manager, laboratory QA coordinators, QA officer, and the data validation coordinator will communicate as needed to verify that all QA/QC practices are being carried out and to review possible or potential problem areas. Data anomalies are to be investigated to assess whether they are a result of operator or instrument deviation, or if they are a true reflection of the site or task function.

Final analytical reports will contain a discussion of QA/QC evaluations summarizing the quality of the data collected an/or used as appropriate to each phase of the project. The objective of the project QA/QC summary will be to ensure that the data are sufficient in quality and quantity to support the remedial alternative. The QA/QC summary will include:

1. Tabulated results of the analytical data.
2. A report from the QA officer evaluating the results of field and laboratory audits as described in Section 11.0.
3. AS tabulation of the data validation work sheets for each batch analysis from the data validation personnel evaluating the validity of the analytical data with respect to accuracy, precision, and completeness.
4. A summary of significant QA problems with the corrective actions taken to rectify the situation.
5. A report by the QA officer summarizing the validity of the analytical data with respect to accuracy, precision, completeness, representativeness, and comparability.

14.2 AUDIT REPORTS

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Audit reports will be issued upon completion of any audits. These reports will describe the person involved with audits, what was being audited, and the findings of the audit. Any follow-up or repeat audit to verify corrective action will also be reported.

14.3 PROGRESS REPORTS

As described in the RFI Workplan approach, interim progress reports are to be submitted to the EPA on RFI activities at the end of each phase. Included in these reports will be a summary of any significant QA related information during that period following the guidelines presented above.

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TABLE 1

QUALITY CONTROL LEVEL OF EFFORT

PARAMETERS		FREQUENCY OF EPA CLP ANALYSIS	FREQUENCY FOR SW846 ANALYSIS
Metals	Calibration Blank (ICP and AA)	Each calibration, beginning and end of each run, 10% frequency	Each calibration, beginning and end of each run, 10% frequency
	Initial Calibration Verification	Daily and each instrument setup	Daily and each instrument setup
	Continuing Calibration Verification (ICP and AA)	Beginning and each of each run; 10% frequency or every 2 hours	End of each run and 10% frequency
	Preparation Blank (ICP and AA)	One per batch or one per 20 samples received	One per batch or one per 20 samples received
	Matrix Spike Analysis (ICP and AA)	One per case or one per 20 samples received	One per case or one per 20 samples received
	Duplicate Sample Analysis (ICP and AA)	One per case or one per 10 samples received	One per case or one per 20 samples received
	Laboratory QC Sample Analysis	One per batch or one per 20 samples received	One per batch or one per 20 samples received
	Duplicate Injections (AA-Furnace)	Each sample (at least a single analytical spike will be performed to determine if the method of standard addition is required for quantitation)	
	Interference Check Sample (ICP)	Beginning and end of each run or one per 4-hour shift	Beginning and end of each run or one per 4-hour shift
	Serial Dilution Analysis (ICP)	One per case or one per 20 samples received	One per case or one per 20 samples received

TABLE 1

QUALITY CONTROL LEVEL OF EFFORT

PARAMETERS		FREQUENCY OF EPA CLP ANALYSIS	FREQUENCY FOR SW846 ANALYSIS
Cyanide	Calibration Blank	One per analytical run or at least one per setup	One per analytical run or at least one per setup
	Matrix Spike Analysis	One per analytical run or at least one per setup	One per analytical run or at least one per setup
	Duplicate Sample Analysis	One per analytical run or at least one per setup	One per analytical run or at least one per setup
	Laboratory QC Sample Analysis	One per analytical run or at least one per setup	One per analytical run or at least one per setup
Organics (GC/MS)	Laboratory Blank	One per case or one per 20 samples received	One per case or one per 20 samples received
VOA, Semi-Volatile, Pesticide/ PCBs	Matrix Spike Analysis	One per case or one per 20 samples received	One per case or one per 20 samples received
	Matrix Spike Duplicate Analysis	One per case or one per 20 samples received	One per case or one per 20 samples received
	Surrogate Spike	Each sample	Each sample

TABLE 2
TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMIT (CRQL)*

Volatile Organics	Quantitation Limits[a]	
	Groundwater µg/L	Low Soil/Sediment µg/Kg[b]
Chloromethane	10	10
Bromomethane	10	10
Vinyl Chloride	10	10
Chloroethane	10	10
Methylene Chloride	5	5
Acetone	10	10
Carbon Disulfide	5	5
1,1-Dichloroethene	5	5
1,1-Dichloroethane	5	5
1,2-Dichloroethene (Total)	5	5
Chloroform	5	5
1,2-Dichloroethane	5	5
2-Butanone	10	10
1,1,1-Trichloroethane	5	5
Carbon Tetrachloride	5	5
Vinyl Acetate	10	10
Bromodichloromethane	5	5
1,2-Dichloropropane	5	5
cis-1,3-Dichloropropane	5	5
Trichloroethene	5	5
Dibromochloromethane	5	5
1,1,2-Trichloroethane	5	5

TABLE 2
TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMIT (CRQL)*

Volatile Organics	Quantitation Limits[a]	
	Groundwater µg/L	Low Soil/Sediment µg/Kg[b]
Benzene	5	5
trans-1,2-Dichloropropane	5	5
Bromoform	5	5
4-Methyl-2-pentanone	10	10
2-hexanone	10	10
Tetrachloroethene	5	5
Toluene	5	5
1,1,2,2-Tetrachloroethane	5	5
Chlorobenzene	5	5
Ethyl Benzene	5	5
Styrene	5	5
Xylenes (Total)	5	5

[a] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

[b] Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment CRDL.

* 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 2
TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMIT (CRQL)*

Semivolatile Organics	Quantitation Limits[a]	
	Groundwater µg/L	Low Soil/Sediment µg/Kg[b]
Phenol	10	330
bis-2-Chloroethyl)ether	10	330
2-Chlorophenol	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
Benzyl Alcohol	10	330
1,2-Dichlorobenzene	10	330
2-Methylphenol	10	330
bis(2-Chloroisopropyl)ether	10	330
4-Methylphenol	10	330
N-Nitro-di-n-dipropylamine	10	330
Hexachloroethane	10	330
Nitrobenzene	10	330
Isophorone	10	330
2-Nitrophenol	10	330
2,4-Dimethylphenol	10	330
Benzoic Acid	50	1600
bis(2-Chloroethoxy)methane	10	330
2,4-Dichlorophenol	10	330
1,2,4-Trichlorobenzene	10	330
Naphthalene	10	330

TABLE 2
TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMIT (CRQL)*

Semivolatile Organics	Quantitation Limits[a]	
	Groundwater µg/L	Low Soil/Sediment µg/Kg[b]
4-Chloroaniline	10	330
Hexachlorobutadiene	10	330
4-Chloro-3-methylphenol (para-chloro-meta-cresol)	10	330
2-Methylnaphthalene	10	330
Hexachlorocyclopentadiene	10	330
2,4,6-Trichlorophenol	10	330
2,4,5-Trichlorophenol	50	1600
2-Chloronaphthalene	10	330
2-Nitroaniline	50	1600
Dimethylphthalate	10	330
Acenaphthylene	10	330
2,6-Dinitrotoluene	10	330
3-Nitroaniline	50	1600
Acenaphthene	10	330
2,4-Dinirophenol	50	1600
4-Nitrophenol	50	1600
Dibenzofuran	10	330
2,4-Dinitrotoluene	10	330
Diethylphthalate	10	330
4-Chlorophenyl-phenyl-ether	10	330
Fluorene	10	330

TABLE 2
TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMIT (CRQL)*

Semivolatile Organics	Quantitation Limits[a]	
	Groundwater µg/L	Low Soil/Sediment µg/Kg[b]
4-Nitroaniline	50	1600
4,6-Dinitro-2-methylphenol	50	1600
N-Nitrosodiphenylamine	10	330
4-Bromophenyl-phenylether	10	330
Hexachlorobenzene	10	330
Pentachlorophenol	50	1600
Phenanthrene	10	330
Anthracene	10	330
Di-n-butylphthalate	10	330
Fluoranthene	10	330
Pyrene	10	330
Butyl Benzyl Phthalate	10	330
3,3'-Dichlorobenzidine	20	660
Benzo(a)anthracene	10	330
Chrysene	10	330
bis(20Ethylhexyl)phthalate	10	330
Di-n-octylphthalate	10	330
Benzo-(b)fluoranthene	10	330
Benzo-(k)fluoranthene	10	330
Benzo(a)pyrene	10	330
Indeno(1,2,3-cd)pyrene	10	330

TABLE 2
TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMIT (CRQL)*

Semivolatile Organics	Quantitation Limits[a]	
	Groundwater µg/L	Low Soil/Sediment µg/Kg[b]
Dibenz(a,h)anthracene	10	330
Benzo(g,h,i)perylene	10	330

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

[b] Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment CRDL.

* 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.

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TABLE 2
TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMIT (CRQL)*

Pesticide/PCBs	Quantitation Limits[a]	
	Groundwater µg/L	Low Soil/Sediment µg/Kg[b]
alpha-BHC	0.05	8.0
beta-BH	0.05	8.0
delta-BHC	0.05	8.0
gamma-BHC	0.05	8.0
Heptachlor	0.05	8.0
Aldrin	0.05	8.0
Heptachlor Epoxide	0.05	8.0
Endosulfan I	0.05	8.0
Dieldrin	0.10	16.0
4,4'-DDE	0.10	16.0
Endrin	0.10	16.0
Endosulfan II	0.10	16.0
4,4'DDD	0.10	16.0
Endosulfan Sulfate	0.10	16.0
4,4'-DDT	0.10	16.0
Methoxychlor	0.05	80.0
Endrin ketone	0.10	16.0
alpha-Chlordane	0.05	80.0
gamma-Chlordane	0.05	80.0
Toxaphene	1.0	160.0
Aroclor-1242	0.5	80.0
Aroclor-1248	0.5	80.0

TABLE 2
TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMIT (CRQL)*

Pesticide/PCBs	Quantitation Limits[a]	
	Groundwater µg/L	Low Soil/Sediment µg/Kg[b]
Aroclor-1061	0.5	80.0
Aroclor-1221	0.5	80.0
Aroclor-1232	0.5	80.0
Aroclor-1254	1.0	160.0
Aroclor-1260	1.0	160.0

- Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.
- Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment CRDL.
- 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 ANALYTE LIST (TAL) INORGANICS	
Analyte	Contract Required Detection Limits* (µg/l)
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	3
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20
Cyanide	10

* The reporting limits are 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

TABLE 4 DETECTION LIMITS FOR METALS[1]				
	Nominal Water Dectection Limit, mg/L			
Metal	Flame AA	Furnace AA	Other AA	ICP
Aluminum	0.1	0.003	—	0.05*
Antimony	0.2	0.002**	—	0.30*
Arsenic	0.5	0.002*	0.002	0.05*
Barium	0.1	0.002	—	0.005*
Beryllium	0.002	0.0001	—	0.001*
Cadmium	0.005	0.0001**	—	0.002*
Calcium	0.01	—	—	0.01*
Chromium	0.05	0.001	—	0.005*
Cobalt	0.05	0.001	—	0.003*
Copper	0.02	0.001	—	0.002*
Iron	0.03	0.001	—	0.01*
Lead	0.1	0.001*	—	0.02
Magnesium	0.05	0.001	—	0.1*
Manganese	0.01	0.0002	—	0.005*
Mercury	—	—	0.00002*	—
Nickel	0.04	0.001	—	0.01*
Potassium	0.01	—	—	0.3*
Selenium	—	0.002*	0.002	0.075
Silver	0.01	0.0001**	—	0.003*
Sodium	0.002	—	—	0.5*
Thallium	0.1	0.001*	—	0.040
Tin	1	0.05	—	0.03*
Vanadium	0.2	0.004	—	0.002*
Zinc	0.005	0.00005	—	0.004*

* Recommended method for analyses (RMAL).
** More sensitive method sometimes used.
[1] Based upon SW846, 3rd Edition Methods

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TABLE 5
PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES

Measurement Parameters	Experimental Conditions	Surrogate Percent Recovery	Precision (Relative Percent Difference	Accuracy (Percent Recovery)	Completeness (Percent)	Other EPA CLP Control Limits
Volatile (Purgeable) Organic Target Compounds[1]	Spiked and unspiked field samples	Compound Specific[2]	Compound Specific[3]	Compound Specific[3]	90	Laboratory Blank: ± D.L. Laboratory Duplicate: ±35% RPD Initial Calibration: RRF[4] >.05 and ≤30% RSD[5] Continuing Calibration: >.05 RRF and ≤25% D[6] Internatal Standard GC/MS: -50 to + 100%
Semivolatile (Base/Neutral and Acid) Organic Target Compounds[1]	Spike and unspiked field samples	Compound Specific[2]	Compound Specific[3]	Compound Specific[3]	90	Laboratory Blank: ± D.L. Laboratory Duplicate: ±35% RPD Initial Calibration: RRF[4] >.05 and ≤30% RSD[5] Continuing Calibration: >.05 RRF and ≤25% D[6] Internatal Standard GC/MS: -50 to + 100%
Pesticides and PCBs[1]	Spiked and unspiked field samples	Compound Specific[2]	Compound Specific[3]	Compound Specific[3]	90	Laboratory Blank: ±D.L. Laboratory Duplicate: ±35% RPD Initial Calibration: 10% RSD Continuing Calibration: 15 or 20% RSD DDT/Endrin Degradation: <20%

TABLE 5
PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES

Measurement Parameters	Experimental Conditions	Surrogate Percent Recovery	Precision (Relative Percent Difference	Accuracy (Percent Recovery)	Completeness (Percent)	Other EPA CLP Control Limits
Mercury[4]	Spiked and Unspiked filed samples		±20 percent provided both sample and duplicate greater than 5 times CRDL ±CRDL if either sample or duplicate less than CRDL	75 to 125 percent unless the sample 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	90	Calibration Blank: ±D.L. Calibration Verification: 80-120% Preparation Blank: ±D.L. Duplicate Sample Analysis: ±D.L. or 20%RPD Lab QC Sample Analysis: 80-120%
Cyanide, Total[4]	Spike and unspiked field samples		±20 percent provided both sample and duplicate greater than 5 times CRDL ±CRDL if either sample or duplicate less than CRDL	75 to 125 percent unless the sample exceeds the spike concentration by a factor of four or more	90	Calibration Blank: ±D.L. Calibration Verification: 85-115% Preparation Blank: ±D.L. Duplicate Sample Analysis: ±D.L. or 20%RPD Lab QC Sample Analysis: 80-120%
Target Analyte List (TAL) Metals Other than Mercury[4]	Spiked and unspiked field samples		±20 percent provided both sample and duplicate greater than 5 times CRDL ±CRDL if either sample or duplicate less than 5 times CRDL	75 to 125 percent unless the sample 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	90	Calibration Blank: ±D.L. Calibration Verification: 90-110% Preparation Blank: ±D.L. Duplicate Sample Analysis: ±D.L. or 20%RPD Lab QC Sample Analysis: 85-115%

TABLE 5
PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES

Measurement Parameters	Experimental Conditions	Surrogate Percent Recovery	Precision (Relative Percent Difference	Accuracy (Percent Recovery)	Completeness (Percent)	Other EPA CLP Control Limits
Restricted Target Analyte List (TAL) Metals[4] Calcium Magnesium Potassium Sodium	Unspiked field samples		±20 percent provided both sample and duplicate greater than 5 times CRDL ±CRDL if either sample or duplicate less than CRDL	Not applicable. Matrix spikes not employed with these analytes.	90	Calibration Blank: ±D.L. Calibration Verification: 90-110% Preparation Blank: ±D.L. Duplicate Sample Analysis: ±D.L. or 20%RPD Lab QC Sample Analysis: 85-115%

1 See Table XX for an enumeration of the Target Compound List (TCL) parameters and Contract Required Quantitation Limits (CRQLs).

2 See Table XX for an enumeration of spike surrogate compounds and control limits.

3 See Table XX for an enumeration of matrix spike compounds and control limits.

4 See Table XX for an enumeration of the Target Analyte List (TAL) parameters and Contract Required Detection Limits (CRQLs).

Abbreviations:

AA Atomic Adsorption
CRDL Contract Required Detection Limit
D.L. Diction Limit
D Percent Difference
ICP Inductively Coupled Plasma
RPD Relative Percent Difference

TABLE 6

SURROGATE SPIKE RECOVERY LIMITS

ANALYTICAL FRACTION	SURROGATE COMPOUND	RECOVERY LIMITS (%)
Volatile	4-Bromofluorobenzene	86 - 115
	1,2-Dichloroethane-d_4	76 - 114
	Toluene-d_8	88 - 110
Base/Neutral	Nitrobenzene-d_5	35 - 114
	2-Fluorobiphenyl	43 - 116
	p-Terphenyl-d_{14}	33 - 141
Acid	Phenol-d_6	10 - 94
	2-Flurorphenol	21 - 100
	2,4,6-Tribromophenol	10 - 123
Pesticide	Dibutylchlorendate[1]	24 - 154

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 7

MATRIX SPIKE RECOVERY AND RELATIVE PERCENT DIFFERENCE CONTROL LIMITS

ANALYTICAL CATEGORY	MATRIX SPIKE COMPOUND	RELATIVE PERCENT DIFFERENCE	RECOVERY LIMITS (%)
Volatile	1,1-Dichloroethene	14	61 - 145
	Trichloroethene	14	71 - 120
	Chlorobenzene	13	75 - 130
	Toluene	13	76 - 125
	Benzene	11	76 - 127
Base/Neutral	1,2,4-Trichlorobenzene	28	39 - 98
	Acenaphthene	31	46 - 118
	2,4-Dinitrotoluene	38	24 - 96
	Di-n-Butylphthalate	40	11 - 117
	Pyrene	31	26 - 127
	N-Nitroso-Di-n-Propylamine	38	41 - 116
	1,4-Dichlorobenzene	28	36 - 97
Acid	Pentachlorophenol	50	9 - 103
	Phenol	42	12 - 89
	2-Chlorophenol	40	27 - 123
	4-Chloro-3-Methylphenol	42	23 - 97
	4-Nitrophenol	50	10 - 80
Pesticide	Lindane	15	56 - 123
	Heptachlor	20	40 - 131
	Aldrin	22	40 - 120

TABLE 7

MATRIX SPIKE RECOVERY AND RELATIVE PERCENT DIFFERENCE CONTROL LIMITS

ANALYTICAL CATEGORY	MATRIX SPIKE COMPOUND	RELATIVE PERCENT DIFFERENCE	RECOVERY LIMITS (%)
	Dieldrin	18	52 - 126
	Endrin	21	56 - 121
	4,4'-DDT	27	38 - 127

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.

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TABLE 8
SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter	Container	Preservation	Holding Time
Total Dissolved Solids (TDS)	1,000-ml glass wide-mouth bottle with teflon-lined screw closure, or high density polyethylene bottle	Cool, 4°C	48 hours after collection
Total Organic Carbon (TOC)	500-ml glass bottle cleaned according to Protocol A or B	Cool, 4°C, H_2SO_4 to pH < 2	28 days after collection
Volatiles	Two 40-ml glass vials with teflon-faced silicone septa with open top polyethylene screw closure cleaned according to Protocol B	Cool, 4°C HCl to pH < 2 Zero Headspace Cool, 4°C Zero Headspace	7 days after collection 14 days after collection
Semivolatiles	Two 1,000-ml amber glass wide-mouth bottles with teflon-lined screw closures cleaned according to Protocol A	Cool, 4°C	7 days after collection 40 days after extraction
Chlorides	1,000-ml glass wide-mouth bottle with teflon-lined screw closure or high density polyethylene bottle cleaned according to Protocol A or C	Cool, 4°C	28 days after collection

TABLE 8
SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter	Container	Preservation	Holding Time
Metals	1,000-ml glass wide-mouth bottle with teflon-lined screw closure or high density polyethylene bottle cleaned according to Protocol A	HNO_3 to pH < 2	Mercury: 28 days after collection Other Metals: 180 days after collection
Pesticides/PCBs	Two 1,000-ml amber glass wide-mouth bottles with teflon-lined screw closures cleaned according to Protocol A	Cool, 4°C	7 days after collection 40 days after extraction
Nitrate/Nitrite[1]	500-ml glass wide-mouth bottle with teflon-lined screw closure or high density polyethylene bottle cleaned according to Protocol B	Cool, 4°C H_2SO_4 to pH < 2	28 days after collection
Radionuclides	Three 1,000-ml glass wide-mouth bottles with teflon-faced screw closure or high density polyethylene bottle cleaned according to Protocol A	HNO_3 to pH < 2	180 days after collection

TABLE 8
SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter	Container	Preservation	Holding Time
Extractables BNA	Four 1,000-ml amber glass wide-mouth bottles with teflon-lined screw closures	Cool, 4°C	7 days after collection 40 days after extraction
Oil and Grease	1,000-ml amber glass wide-mouth bottles with teflon-lined screw closures	Cool, 4°C	28 days after collection
BOD_5	500-ml glass wide-mouth bottle with teflon-lined screw closure, or high density polyethylene bottle	Cool, 4°C	48 hours after collection
Total Suspended Solids (TSS)	1,000-ml glass wide-mouth bottle with teflon-lined screw closure, or high density polyethylene bottle	Cool, 4°C	7 days after collection
Sulfates	1,000-ml glass wide-mouth bottle with teflon-lined screw closure or high density polyethylene bottle	Cool, 4°C	28 days after collection
pH	1,000-ml glass wide-mouth bottle with teflon-lined screw closure or high density polyethylene bottle	Cool, 4°C	immediately upon receipt

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TABLE 9

FIELD QUALITY CONTROL SAMPLE FREQUENCY
GROUNDWATER MONITOR WELLS[1]

MATRIX	FIELD DUPLICATE	RINSATE BLANK	TRIP[2] BLANK	MS/MSD[3]
Ground Water	1	1	1	1
Analytical Parameter	All Parameters	VOA and Semi Volatile	VOA	Spike

1 There are less than 20 monitor wells. A sampling event or sample delivery group shall consist of a groundwater sample from each well plus the 5 quality control samples.

2 Trip blanks will be prepared by the laboratory and shipped with the sample containers. One trip blank will be kept with the collected samples and shipped back to the laboratory in the last shipment.

3 Matrix Spiked/Matrix Spiked Duplicate samples will be spiked in the laboratory.

TABLE 10

DFTPP AND BFB TUNING AND CALIBRATION CRITERIA

	EPA CLP ORGANIC ANALYSIS[1]	SW846 ORGANIC ANALYSIS[2]
EXTRACTABLE ORGANICS (DFTPP)		
51	30.0 - 60.0% of m/z 198	30.0 - 60.0% of m/z 198
68	<2.0% of m/z 69	<2.0% of m/z 69
70	<2.0% of m/z 69	<2.0% of m/z 69
127	40.0 - 60.0% of m/z 198	40.0 - 60.0% of m/z 198
197	<1.0% of m/z 198	<1.0% of m/z 198
198	base peak, 100% relative abundance	base peak, 100% relative abundance
199	5.0 - 9.0% of m/z 198	5.0 - 9.0% of m/z 198
275	10.0 - 30.0% of m/z 198	10.0 - 30.0% of m/z 198
365	>1.0% of m/z 198	>1.0% of m/z 198
441	present, but less than m/z 443	present, but less than m/z 443
442	>40.0% of m/z 198	>40.0% of m/z 198
443	17.0 - 23.0% of m/z 442	17.0 - 23.0% of m/z 442
VOLATILE ORGANICS (BFB)		
50	15.0 - 40.0% of the base peak	15.0 - 40.0% of the base peak
75	30.0 - 60.0% of the base peak	30.0 - 60.0% of the base peak

TABLE 10

DFTPP AND BFB TUNING AND CALIBRATION CRITERIA

	EPA CLP ORGANIC ANALYSIS[1]	SW846 ORGANIC ANALYSIS[2]
95	base peak, 100% relative abundance	base peak, 100% relative abundance
96	5.0 - 9.0% of the base peak	5.0 - 9.0% of the base peak
173	<2.0% of m/z 174	<1.0% of the base peak
174	>50.0% of the base peak	>50.0% of the base peak
175	5.0 - 9.0% of m/z 174	5.0 - 9.0% of m/z 174
176	>95.0%, but less than 101.0% of m/z 174	>95.0%, but less than
177	5.0 - 9.0% of m/z 176	5.0 - 9.0% of m/z 176

Source: [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 Protective Agency, Washington, D.C., May, 1989.

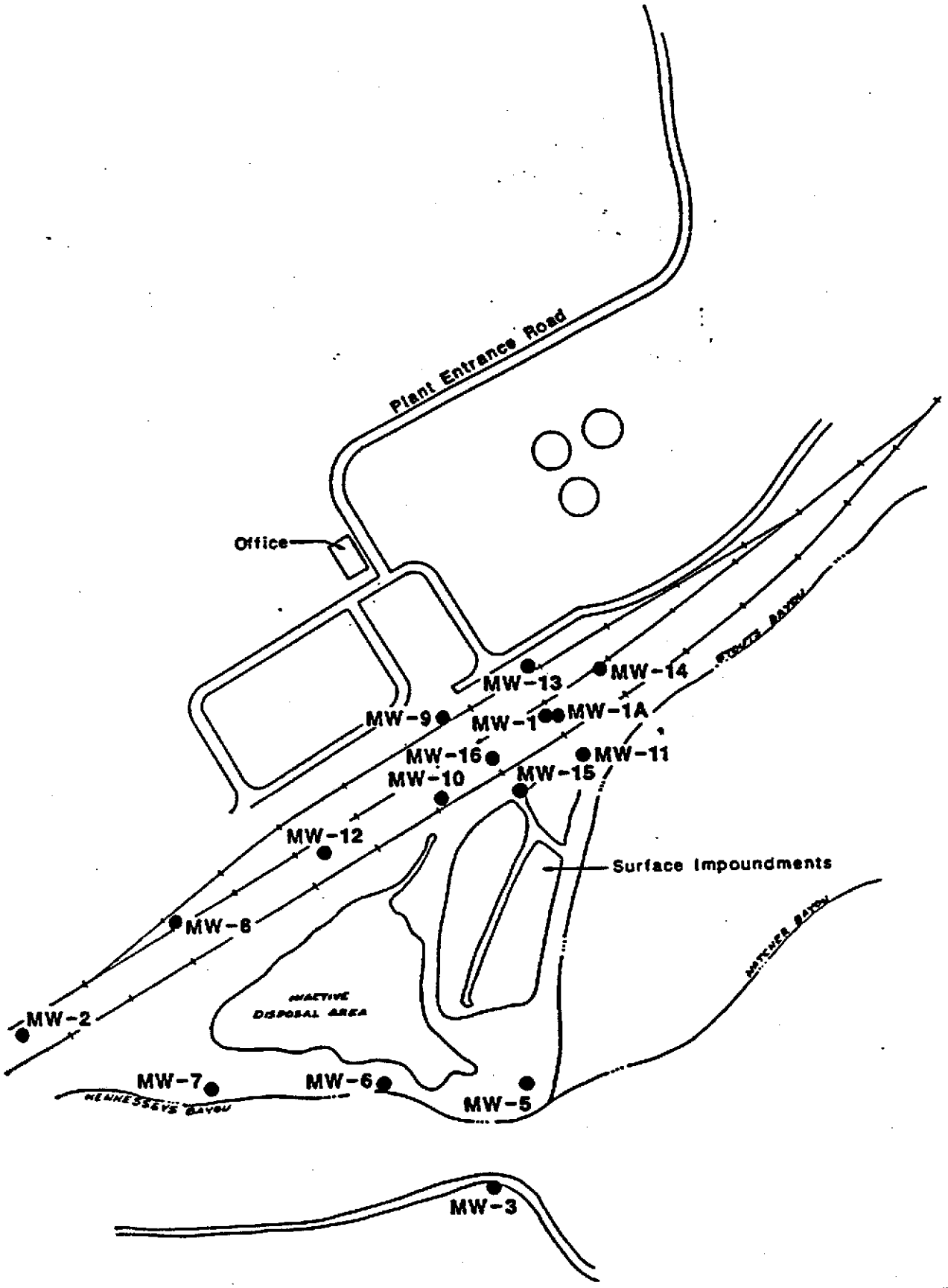
[2]SW846, 3rd Edition

TABLE 11 ANALYTICAL METHOD SUMMARY		
Category/Parameter	Method	Reference
TCL	EPA CLP SOW 2/88	1
TAL	EPA CLP SOW 7/88	2
BOD_5	SW846 or Equivalent Method	3
TSS	SW846 or Equivalent Method	3
TOC	SW846 or Equivalent Method	3
TDS	SW846 or Equivalent Method	3
pH	SW846 or Equivalent Method	3

1. Statement of Work for Organic Analysis Multi-Media Multi-Concentration, SOW 2/88, Revision 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. 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.

3. SW-846 Methods, from 3rd Edition or equivalent EPA Method.



CEDAR CHEMICAL CORPORATION
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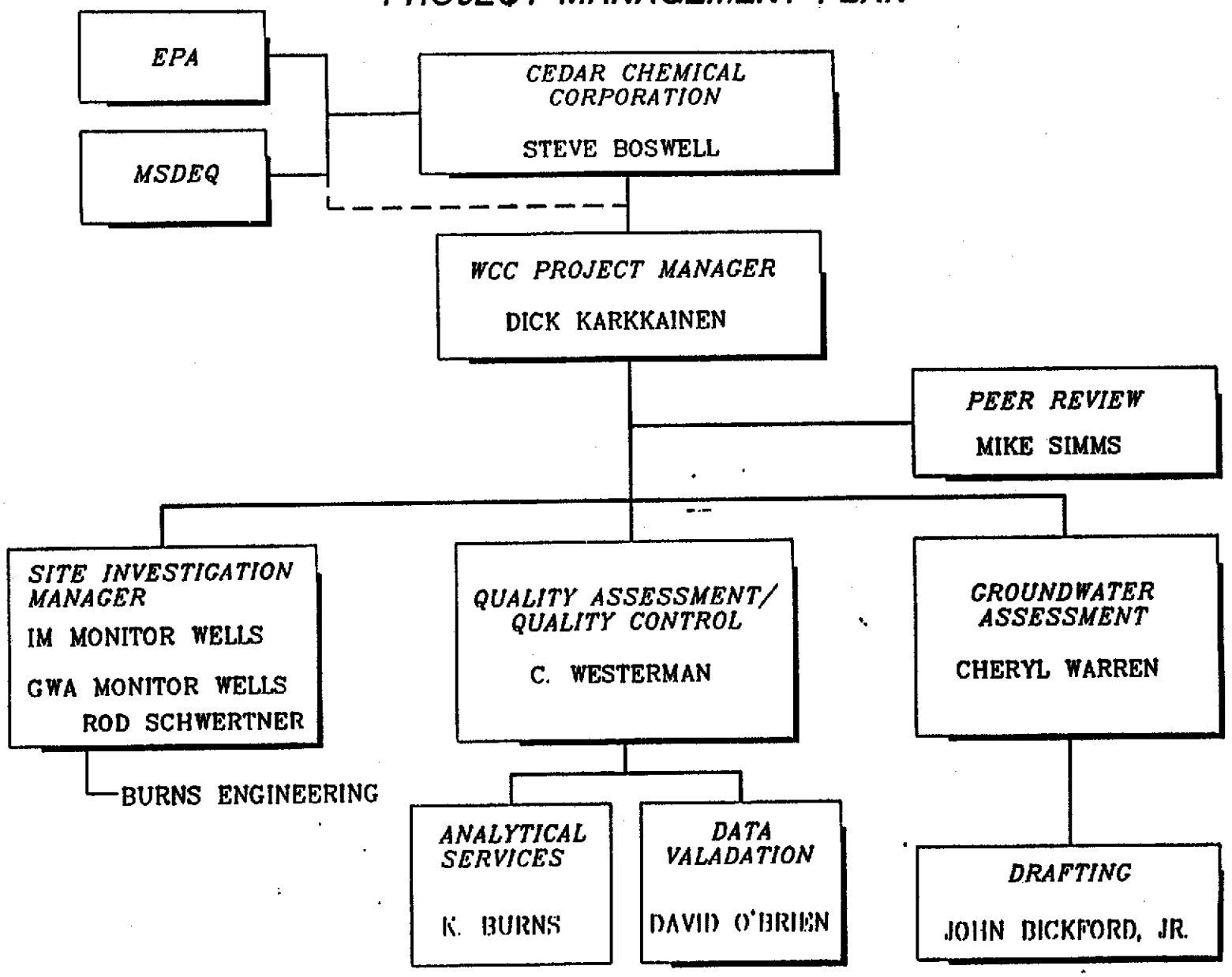
Baton Rouge, Louisiana

SCALE: 1"=400'
DRAWN BY: SB
DATE: 4/91
CHKD. BY:
DATE:

ACTIVE GROUNDWATER MONITORING WELLS

FILE NO. 90B451C
FIG. NO. 1

PROJECT MANAGEMENT PLAN



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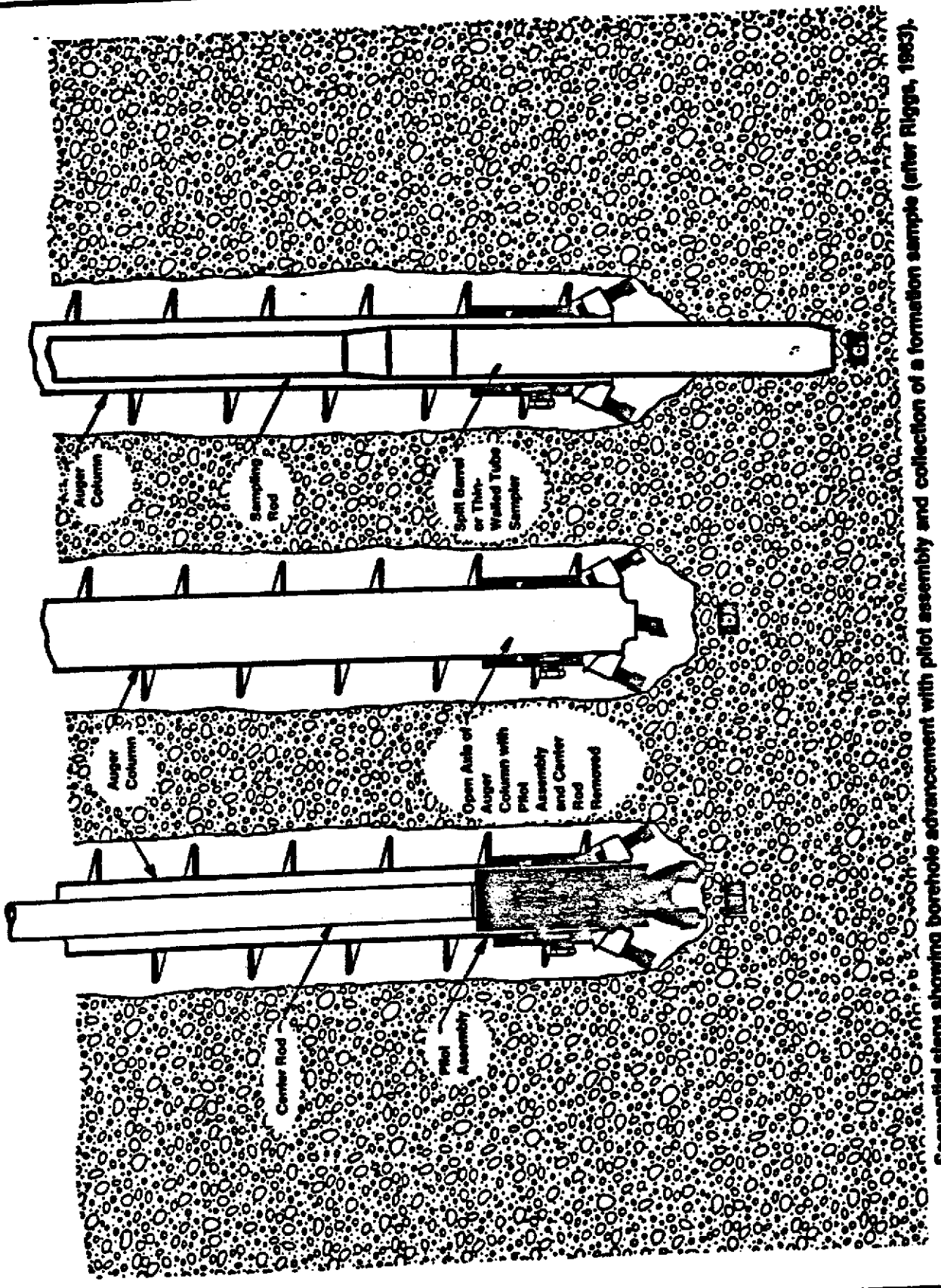
DRAWN BY: FY
CHKD. BY:
DATE: 5/10/91
DATE: 5/12/91

FIG. NO. 2
FILE NO. 90B451C



Sequential steps showing borehole advancement with pilot assembly and collection of a formation sample (after Riggs, 1983).

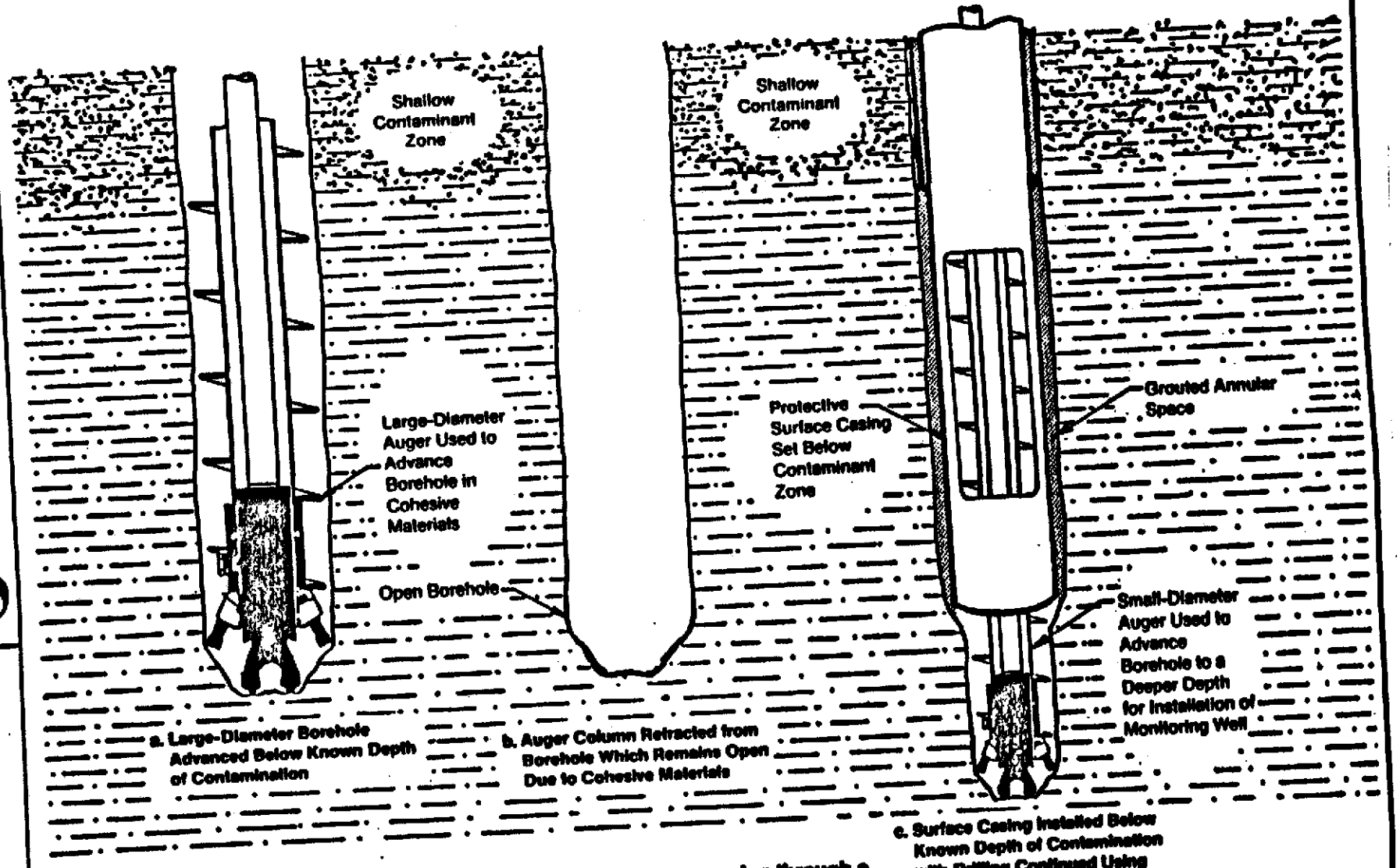
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Baton Rouge, Louisiana

HOLLOW STEM SAMPLING PROCEDURES

FILE NO

FIG. NO. 3

SCALE:	DRAWN BY:	DATE
NONE	CHKD BY:	DATE 4-19-90



Sequence showing the installation of protective surface casing through a shallow contaminated zone in a cohesive formation.

RFI WORKPLAN

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

SCALE: NONE
DRAWN BY:
CHKD BY:
DATE:
DATE: 4-14-90

INSTALLATION OF PROTECTIVE CASING

FIG. NO. 4

FILE NO.

LOG OF BORING

PROJECT

LOCATION

CLIENT

BORING

FILE

DATE

TECHNICIAN

APPROVED

PAGE ____ of ____

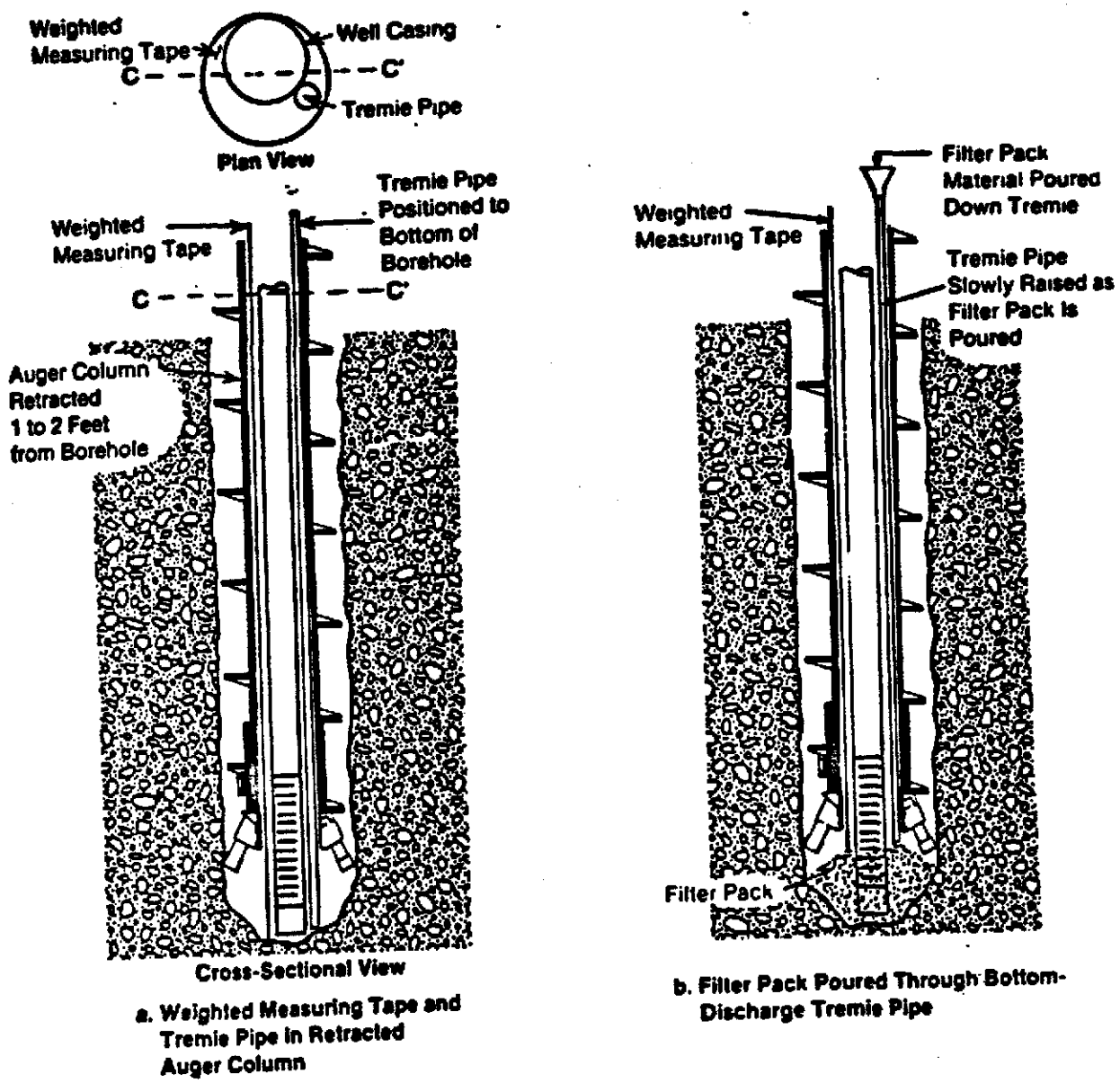
DRY AUGERED

WASH BORED

DEPTH (FEET)	SAMPLE	B.P.T. (B/FT) OR PEN. RES. (TSF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	L.L. (%)	P.I. (%)	DESCRIPTION OF STRATUM

FIGURE 5

WOODWARD-CLYDE CONSULTANTS

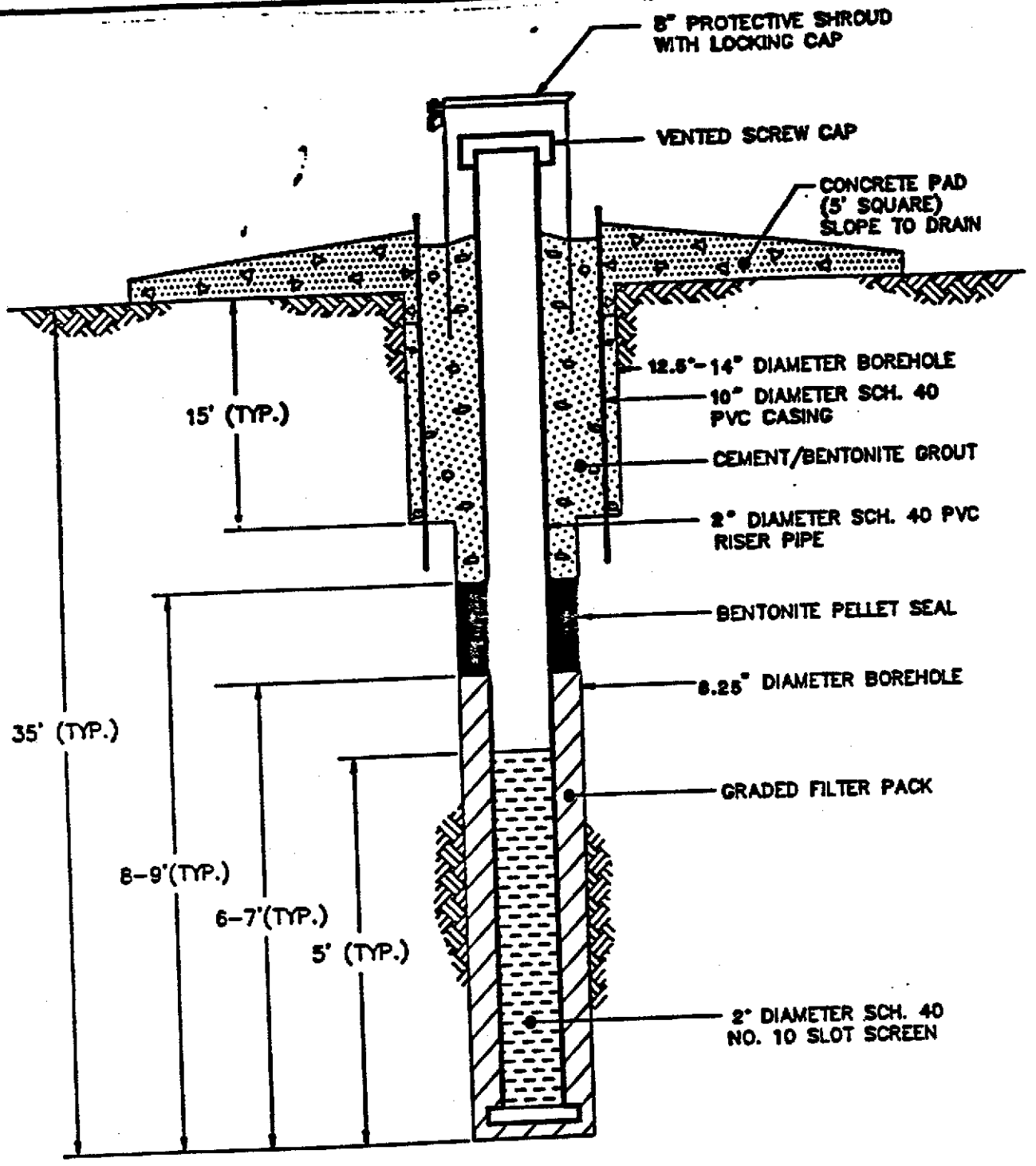


a. Weighted Measuring Tape and Tremie Pipe in Retracted Auger Column

b. Filter Pack Poured Through Bottom-Discharge Tremie Pipe

Tremie method of filter pack emplacement with a hollow-stem auger.

RFI WORKPLAN	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Baton Rouge, Louisiana	FILTER PACK PLACEMENT THROUGH A HOLLOW STEM AUGER	FILE NO.
	SCALE: NONE DRAWN BY: CHKD BY: DLB DATE: DATE 4/19/90		FIG. NO. 6



NOTE: IF WELL WIZARD SAMPLER IS INSTALLED, TOP CAP WILL BE OF TYPE MANUFACTURED BY QED INC. OR SIMILAR AND WELL WIZARD PUMP INLET WILL BE POSITIONED AT MIDDLE OF SCREEN

RFI WORKPLAN

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

SCALE: NONE
DRAWN BY:
CHKD BY: JLN
DATE:
DATE: 4/14/90

TYPICAL MONITOR WELL CONSTRUCTION DIAGRAM

FILE NO.

FIG. NO. 7

Woodward-Clyde Consultants

MONITOR WELL INSTALLATION REPORT

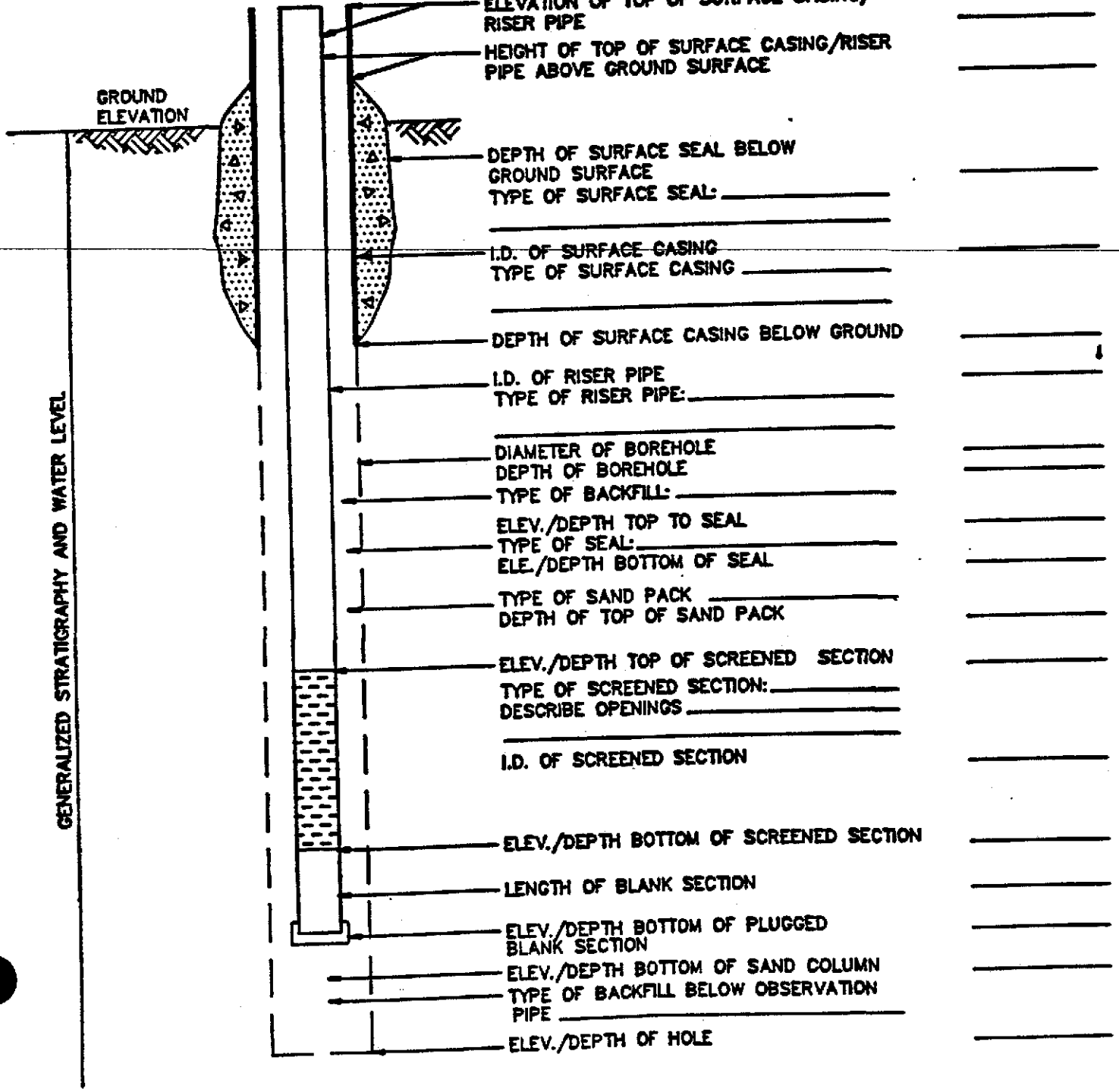
PROJECT _____ PAGE _____ OF _____

LOCATION _____ WELL NO. _____

DATE COMPLETED _____ ORIGINAL DEPTH _____ AQUIFER _____

INSPECTED BY _____ DATE _____

CHECKED BY _____ DATE _____ DEPTH INTERVAL _____



Woodward-Clyde Consultants

Project: _____ Made by: _____ File: _____

_____ Date: _____

Well Number: _____ Checked by: _____ Date: _____

GENERAL CONDITIONS:

Depth (ft. TOC/bottom):	Stick-up (ft. TOC/pad):
WCC Representatives:	

PURGING DATA:

Purging (2 min. cycles)			Pressures (psi)		Water Level (ft. TOC)	
Date	Start	Stop	Tank	Working	Before	After

METHODS: _____

PUMPING DATA:

Pumping			Pressures		Water Level		Production (gpm)	Quantity (gallons)	Conditions
Date	Start	Stop	Tank	Working	Before	After			

STABILIZATION DATA:

Time										
Temperature										
Conductivity										
pH										

RECOVERY DATA:

Time (min)	2	5	7	10	15	20	25	30	40	50	60	90	120	240	24hr	final
Level (ft.)																

REMARKS:

_____

_____

_____

_____

FIGURE 8

Woodward-Clyde Consultants

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 _____

SAMPLING PERSONNEL

TIME _____ TO _____

DATE _____

_____
(SIGNED)

LOCK OR SERIAL NUMBER _____ REPLACEMENT SERIAL NUMBER _____

FIGURE 10

CHAIN - OF - CUSTODY RECORD

SAMPLE NO.	DATE MM/DD/YR	TIME	SAMPLE TYPE		STATION LOCATION	TOTAL NO. CONTAINERS					
			COMP.	GRAB							

SAMPLE COLLECTION:

PROJECT NO. AND NAME _____

LOCATION OF SAMPLE: _____

COLLECTOR'S NAME _____ TELEPHONE: ( )

COMPANY NAME: _____

ADDRESS: _____

WITNESS: _____ COMPANY NAME: _____

FIELD INFORMATION:

TYPES OF SAMPLES: LIQUID GAS SLUDGE SOIL OTHER(SPECIFY) _____

FIELD NOTES: _____

TRANSPORTER: _____ AIRBILL/INVOICE: _____ DESTINATION: _____

SAMPLE TRANSFER (Original must be retained with sample at all times)

		RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
1	NAME:				
	COMPANY:				
2	NAME:				
	COMPANY:				
3	NAME:				
	COMPANY:				

TERMINATION OF CHAIN-OF-CUSTODY:

AUTHORIZED BY: _____ DATE: _____ TIME: _____

COMPANY NAME: _____

SAMPLE DISPOSTION: STORAGE _____ DISPOSAL _____ OTHER _____

FIGURE 11

Woodward-Clyde Consultants

SAMPLE ANALYSIS REQUEST FORM

PROJECT NAME _____
PROJECT NUMBER _____
PROJECT CONTACT _____
REPORTING ADDRESS _____

LOCATION _____
SAMPLING TEAM _____
PURCHASE ORDER NO. _____
PROJECT CONTACT PHONE NO. _____
REQUESTED TURNAROUND _____
LABORATORY DESTINATION _____

SAMPLE NO.	SAMPLE TYPE	SAMPLE VOLUME	PRESERVATIVE	REQUESTED ANALYSIS	COMMENTS

SPECIAL HANDLING (e.g. ICE, DRYROOM, FLAMMABLE, ETC.) _____

DATE SHIPPED: _____ PACKAGED BY: _____
SHIPPING METHOD: _____ AIRBILL/INVOICE: _____
CUSTODY ATTACHED? YES NO

FIGURE 12

Woodward-Clyde Consultants

CORRECTIVE ACTION REPORT

DATE _____

PROJECT NUMBER AND NAME _____

LOCATION _____

INITIATOR'S NAME AND TITLE _____

NONCONFORMANCE _____

_____

_____

_____

_____

REPORTED TO _____

_____

CORRECTIVE ACTION _____

_____

_____

_____

_____

_____

IMPLEMENTED BY _____

REVIEWED BY _____

cc: PROJECT MANAGER _____

SITE MANAGER _____

QA OFFICER _____

FIGURE 13

APPENDIX E

DATA MANAGEMENT PLAN

RCRA FACILITY INVESTIGATION
DATA MANAGEMENT PLAN

DRAFT

VICKSBURG CHEMICAL DIVISION
CEDAR CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI

for:

Cedar Chemical Corporation
Memphis, Tennessee

June 1991

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LIST OF APPENDICES

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1.1 INTRODUCTION

During the RCRA Facility Investigation (RFI), various types of data will be generated. At a minimum, data gathered as a part of the RFI will consist of field data sheets, field log books, boring logs, chemical data from analysis of soil and groundwater, field parameter measurements, maps and drawings. This Data Management Plan describes procedures that will be used to physically manage project related information. The Data Management Plan addresses:

- Project organization and responsibilities
- Technical approach to data management
- Flow of data (tracking)
- Data validation and reduction
- Data presentation

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A description of primary project personnel and their responsibilities is presented below. Changes in personnel will be reported to U. S. EPA as soon as they become known. Minor changes in procedures presented below will be documented and discussed in the interim reports. Significant changes which may affect data quality will be subject to U. S. EPA approval.

2.1 AUTHORITY AND RESPONSIBILITIES

2.1.1 Project Manager

Richard D. Karkkainen, Vice President and Principal, will serve as Woodward-Clyde Consultants Project Manager. The Project Manager will be the prime contact with the Cedar concerning all the work that is done by Woodward-Clyde Consultants (WCC). Project organization and management procedures will be established by the Project Manager, including reviews and approval of work scope, budget, schedules and reports. The Project Manager will also direct financial reporting and subcontractor recommendations for Cedar's approval.

2.1.2 Site Manager

A Site Manager will be designated for this project. The Site Manager's primary responsibility is to oversee all field phases of the RFI activities under the direction of the Project Manager. Additionally, the Site Manager will manage onsite files and monitor quality assurance in the field.

2.1.3 Task Leaders

The task leader for data management is David O'Brien and the task leader for analytical services is Kathy Burns.

2.1.4 Records Administrator

This project will require the administration of onsite and office central project record files. The records systems managed by the Project Administrator shall provide adequate control, confidentiality, and retention for project-related information. Record control shall include receipt from external sources, transmittal, transfer to storage, and indication of record status. Retention shall include receipt at storage areas, indexing and filing, maintenance, and retrieval. All project files will be secured.

2.2 PROJECT COMMUNICATIONS

2.2.1 Record Control

The control of records provides for the flow of information both internal and external to WCC.

Following receipt of information from external sources, completion of analyses, and issuance of reports or other transmittals; associated records shall be submitted to the WCC office central project files. This shall include any records generated for WCC by subcontractors. Records shall be legible and easily identifiable. In addition, field records and records transmitted between WCC and contractor offices shall be adequately protected from damage and loss during transfer (e.g., hand carrying or making copies prior to shipment).

Field records, laboratory data summaries, numerical calculations, reports and other data transmittals, copies of proposals, purchase orders, contracts, correspondence, memorandums, telephone records, photographs, and reference material shall be transferred to the project central file.

Records submitted to the project central file, with the exception of correspondence, should be bound, placed in folders or binders, or otherwise secured for filing.

2.2.2 Record Status

All individuals on the Project Staff shall be responsible for reporting obsolete or superseded project-related information to the Project Manager on a periodic basis. In turn, the Project Manager shall notify the Project, Laboratory Staff, and Quality Assurance personnel of the resulting status change in project documents, such as drawings and project procedures. Notification of personnel of status changes in quality assurance procedures shall be the responsibility of the Project Manager.

In general, outdated drawings and other documents shall be marked "void." Any copy of void documents maintained for the project files shall state the reasons for and date of voiding.

To denote that calculations, drawings, and other material which have not been formally checked are preliminary, they shall be marked "preliminary".

2.2.3 Record Retention

Information associated with the project shall be retained in the WCC office central project files.
These files will include the following:

- Project central file (project material except drawing originals, records related to laboratory analysis
- Original drawing file
- Generic quality assurance file

Project records shall be received at the various storage areas by designated personnel. Designated personnel shall check that incoming records have proper identification for filing, are legible, and are in suitable condition for storage. Indexing and filing of records shall be performed only by the designated personnel.

For the project central file, the individual file folders shall be divided into appropriate categories based on content and numbered and filed sequentially within each category.

A numbered index for the project central file shall list the individual file folders and identify the records therein to facilitate locating the records. The index shall be kept in a separate folder at the front of the project file. If appropriate, information on project material not stored in the project central file should be included with the index.

For the original drawing and quality assurance files, all material shall be filed only by project number.

The record storage in the central files shall utilize facilities that provide a suitable environment to minimize deterioration or damage and that prevent loss. The facilities shall, where possible, have controlled access and shall provide protection from excess moisture and temperature extremes. Records shall be secured in binders, placed in folders or envelopes, or otherwise secured for storage in containers (e.g., steel file cabinets).

Storage systems shall provide for the prompt retrieval of information for reference or use outside the storage areas. For the project central file, sign out sheets shall be maintained so that a record of files removed is available.

2.2.4 Onsite Records

Appropriate requirements for the field control and retention of records generated as a result of site investigation, sampling, and testing shall be followed. A file, similar to the project central file, will be established and maintained by the field personnel under the direction of the WCC Site Manager.

Upon completion of the field program or program phase, the onsite file will be transferred to, and integrated with, the WCC office central project files.

2.2.5 Change Control

It is imperative that the status of work items be up-to-date. A status system includes:

- Formal document and design drawing revision
- Nonconformance identification, documentation, and reporting
- Change documentation and approval

Change from original design documents, procedures, and specifications must be expected. Change does not imply a nonconformance to the work, but simply means that original plans must be altered because of information or events that occur during the work.

Change must be documented, evaluated, and reported as necessary. It is necessary to manage change so that the actual course of the project, not the original plan, can be demonstrated and justified. Changes must be documented so that the actual course of work is known and the effect of the change upon the course of work can be evaluated.

It is the responsibility of project personnel to appropriately record the change and to make the documentation available as appropriate to project or laboratory management. The effect of the change upon the project shall be evaluated by the project or laboratory management, quality assurance personnel, and/or subcontractor management. Approval and signatures documenting the approval will be obtained prior to implement changes to the scope by project management and the reviewing agency (U.S. EPA).

Review and written approval for changes which affect the project activities should be provided by the Project Manager. Following the review and approval process, notification of the change should be made to appropriate personnel and affected documents revised as necessary to reflect the work as actually performed.

Project documents and design drawings (as discussed below) must be reviewed, approved, distributed, and revised as necessary. This control will provide approved, up-to-date information and drawings.

3.1 GENERAL PRINCIPLES

Three major approaches to database design are the Network, the Hierarchial and the Relational approaches. These three approaches have their respective strengths and weaknesses and in some applications, one approach is more suited than the others. Of the three methods, the relational approach is gaining momentum in the database market and is used in various applications. Because of its popularity, versatility, ease of use and the availability of many commercial relational database packages, WCC has chosen the relational approach for its design of the Cedar database.

In the relational approach, the information is stored in tables and columns. A table is called a relation and columns are the attributes of the relation. A good relational design of a database management system minimizes data redundancy, maintains data consistency and ensures data integrity. Data redundancy refers to the storing of the same information in multiple tables. Redundancy can rarely be totally eliminated but can be reduced. Data consistency refers to maintaining redundant data in the same form at all locations in the system. That is, if data is changed at one location, the system should propagate similar changes in that data in other related tables. This action ensures the integrity of the data in the database.

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3.2 OBJECTIVES OF THE SYSTEM

The data management, as defined herein for this project, refers to the actual management of the data, but also includes data validation. Quality Assurance/Quality Control (QA/QC) deals with data validation procedures. WCC has identified the following objectives for effectively managing the field data and the laboratory results data from the Cedar site:

1. Store and organize all field, analytical and other data.
2. Track the samples for extraction and analysis holding time deadlines.
3. Validate the analytical results.
4. Make provisions for transmission of data to Cedar.

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The above objectives are accomplished through a data management task leader and a data validation task leader.

4.1 DATA MANAGEMENT TEAM

The task leader is responsible for the following:

1. Design and develop a system to store and organize all field and analytical data.
2. Establish procedures to follow as the data arrives from the field and the laboratory.
3. Interface with WCC's technical staff and provide the information they request.
4. Produce tables for reports to Cedar, regulatory agencies and other appropriate groups.
5. Maintain and administer the system developed.

The need for an organized system which facilitates easy and instant access to the information desired, is obvious because of the volume of the data generated by this project. Without such a system, the process to organize the data in the desired manner will be very time consuming and labor intensive. Establishment of proper procedures will streamline the operation of data collection, organization and presentation. Once the system is established, maintenance and administration is essential for its continued success.

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4.2 DATA VALIDATION TEAM

The task leader is responsible for the following:

1. Review the QA/QC information for the samples.
2. Validate the analytical results.
3. Contact the laboratory, if inconsistencies exist.
4. Interface with the data management team to insure the validity of analytical results in the data management system.
5. Maintain records of the validation of analytical data.

Validation of analytical results is essential to determine the quality of the analytical data received from the laboratories and assure quality data in the system. The Data Collection Quality Assurance Plan details the method of validation for organic and inorganic analyses.

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5.1 ENVIRONMENTAL DATA SYSTEM

To achieve the objectives outlined in section 4.0, data management utilizes an Environmental Data System (EDS) to store and organize all field and analytical data. ORACLE, a commercial relational database system was used to develop EDS. EDS consists of the following modules:

1. Sample General Information
2. Sample Analysis Information
3. Sample Tracking Information
4. Site, Well Information
5. Export - Import

5.1.1 Sample General Information.

This module tracks sample information such as sample number, sample location, date collected, time collected, number of containers used, the type of analysis requested, the person collecting, and so forth. This module has the options for adding, editing, browsing, querying, and printing information.

5.1.2 Sample Analysis Information.

This module tracks analytical results received from the laboratories. It stores the date extracted, date analyzed, concentration and all pertinent information for each sample. It has the same options as before for adding, editing, deleting, browsing, querying, and printing analytical results information.

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5.1.3 Sample Tracking Information

This module provides the sample extraction and analysis holding time deadlines for each sample. Reports of extraction and analysis holding time deadlines can be printed for any sample. This kind of reporting will help with data validation.

5.1.4 Site, Well Information

This module tracks site, monitoring well, and other support information required for the project. The system provides add, edit, delete, browse, query, and print options for each entity for this module.

5.1.5 Export - Import

This module provides the mechanism to both export and import data from laboratories and other consultants on the project. The import facility is laboratory specific. The export facility can provide the data requested by the analytical laboratory and others.

The following are procedures to be followed to effectively manage project data:

1. All field and analytical data should be sent to a designated person.
2. The field personnel will send a copy of the Chain-of-Custody (COC) form to the Baton Rouge Office via facsimile after sending a batch of samples to the laboratory for analysis.
3. When the preliminary analytical results arrive, the results are verified with COC, assuring that samples are identified with correct sample numbers.
4. The data management task leader informs the data validation leader, if any discrepancies are found in the data. The coordinator, in turn, notifies the project manager so that discrepancies can be rectified.
5. When the final analytical results arrive, the data package is routed to the data validation task leader for validation.

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5.2 DATA REDUCTION AND VALIDATION

Data reduction, validation, and reporting will follow strict guidelines as presented in this section. The only data that will be reported by WCC will be data that meet the record keeping, quality assurance/quality control criteria, and reporting formats as defined in the Data Collection Quality Assurance Plan.

The following sections describe the procedures to be used in data reduction, validation and reporting of analytical data.

5.2.1 Sampling Data

The intention of these sampling data management procedures is to maintain accurate records of all samples taken and to follow the status of the sample location and analytical results, while minimizing the duplication of record keeping activities and the possibilities for errors.

The tabulation and flow of all data management information can be broken down into the following activities:

- Assignment of sample numbers, sample label preparation, and initial permanent record keeping,
- Preparation and labeling of all sample bottles,
- Sampling and in-the-field record keeping,
- Sample receiving and preparation for shipping, and
- Complete sample record book.

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5.2.1.1 Sampling Record Keeping

Prior to collecting a group of samples, a sample coordinator will assign a sample number and a description to all samples to be collected within the group. Sample numbers will be assigned to all divisions of the original sample, all of which have the same identification number with letters denoting subset containers. The sample number

and corresponding description will be entered into a permanent record book. The information in the record book will then be written onto the appropriate sample label. When written, the sample labels will be given to the individual responsible for preparing the sample bottles.

The typed/printed labels for a group of sequentially numbered samples and a copy of the data book pages that include these numbers will be given to the sample bottle preparer and/or the sampler. This individual is responsible for applying all labels on the appropriate types of bottles. The sample preparer may also be the person who will be doing the sampling. A copy of the data book pages that include information about the samples will also be given to the person doing the sampling in order to provide a list of samples to check off during the sampling activity.

The individual(s) doing the sampling is (are) responsible for verifying that each sample is put in the appropriate sample bottle. At the time of sampling this person must fill in the time sampled, the date sampled, and sign and complete the sample's label. By the end of the sampling day, the sampler must return all samples to the geologist or engineer who will oversee preparation of the samples for shipment (i.e., review chain-of-custody formes, inspect packaging, etc.

The person responsible for shipping the full sample bottles will compare the sample bottles with the appropriate sample data book pages. This person will then prepare the samples for shipping. Chain-of-custody forms must be completed for each sample; the originals must be sent with the samples, and copies will be sent to the sample coordinator to include in the appropriate project files.

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5.2.1.2 Sample Data Management

When the samples are ready to be sent to the laboratory, the sample coordinator will examine the samples and note their condition. Information including the date sampled, time sampled, and method of preservation,for each sample will be entered in the sample record book.

At the time the samples are shipped, the sample coordinator will have a copy of the pages in the sample record book that include information on the sample numbers and the corresponding information on the date sampled, time sampled, and the date shipped.

5.2.2 Analytical Data

5.2.2.1 Data Flow

The laboratory will be responsible for reviewing all sample analyses according to their internal QA/QC procedures. Data validation will be completed by the laboratory prior to the delivery of the data package. Completed data packages will be available for review by the project data validation coordinator and the project QA officer who will also evaluate the laboratory's checks. Any problems will be resolved and all data will be validated before the data are reported. Following satisfactory completion of all QA/QC checks by the laboratory and the project data validation coordinator, the data will be available for external reporting.

5.2.2.2 Data Management

A data validation report will be provided in a timely manner following the completion of the laboratory analytical report. Only data that has been validated are to be released. Data that has been validated will be logged into a data base in which validated results are stored.

5.2.2.3 Data Validation

Data Validation, according to Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-0050/80, Office of Monitoring System 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.

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The purpose of data validation is to determine if the data conform to specifications and are suitable for the intended project usage. Therefore, all data will be subjected to screening in terms of conformance to project specifications and suitability for use. After completing a sampling program, the field data package (calibration records, chain-of-custody, field logs, etc.) will be reviewed for completeness and accuracy. Data validation of analytical data will be completed before any of the results are released. The validation process described below will be done separately from the laboratory performing internal laboratory data validation.

The following is a brief description of the methods that will be used during validation of the CLP laboratory data. These data will be reported in a summary data package and evaluated for conformance to the analytical limits set forth in 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). These checks will be performed on all samples analyzed, and the results will be summarized in a report for each lot of reported sample data. Qualified data will be reported as such and the appropriate qualifiers will be used for reporting. Non-CLP data and CLP data reported without the CLP summary data packages will be reviewed with respect to holding times, initial and continuing calibrations, method blanks, laboratory control samples, samples, matrix spikes and matrix spike duplicates or duplicates.

If problems occur which would reject data, the following procedures should detect these problems and the problem data will not be reported. However, rejected data will be addressed in the validation report to evaluate completeness goals.

1. Compile a list of all investigative samples.

2. Compile a list of all QC samples, including but not limited to:
   - -Field blanks
   - -Trip blanks
   - -Laboratory blanks

-Laboratory duplicates
-Performance samples
-Matrix spikes
-Matrix spike duplicates
-Laboratory control spikes
-Laboratory control spike duplicate

3. Review chain-of-custody documents for completeness and correctness.

4. Review laboratory analytical procedures and instrument performance criteria.
   -Sample media identification
   -Sample location and descriptions
   -Proper concentration units
   -Proper significant figures

5. This data summary will be reviewed for potential data quality problems including:
   -Unexpected results
   -Common laboratory contaminants
   -Unusual spacial concentration/identification relationships
   -Samples in which dilution was necessary
   -Samples which may have exhibited "carry over"

6. A sample summary will be prepared to access precision, accuracy, and completeness of the analytical data.

7. Laboratory records and data package requirements will be checked to access completeness of the data package.

Laboratory performance results will be documented from the validation procedures or from precision or accuracy evaluations. The validation personnel will provide a means to notify the laboratory and initiate the appropriate corrective actions.

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Despite all efforts to achieve the objectives of the laboratory QA/QC plan, the potential for error exists in laboratory chemical analyses and in the data reporting process. Every reasonable effort will be made to compare and double-check data reported from the laboratory, data entered into the data management system and data subsequently reported in accordance with the procedures described herein.

All analytical results are to be classified as quantified, qualified or rejected through data validation activities. Quantified data are to be used in laboratory reports at the numerical value identified. Qualified data are to be used as an estimate and are not to be used as a quantitative measurement. Rejected data are not to be included in the analytical report. No further use for design or other activities is to be made on the basis of rejected data.

5.3 OTHER DATA (CALCULATION, LOGS, COMPUTER PROGRAMS, DRAWINGS) REDUCTION AND VALIDATION

During RFI activities, calculations, logs, drawings, and computer programs may be generated as part of some of the RFI tasks (site characterization, risk assessment, etc.) in the form of potentiometric interpretations, calculations for cancer risk, quantity calculations of contaminants, etc. In order to maintain consistency in the development of the data, the following verification procedures are presented.

Numerical analysis, risk assessment, and environmental modeling, if performed, will be subjected to strict controls. Any changes to final analysis, assessments, and modeling will be subject to the same level of control used for the original task.

Analysis, assessment, and modeling activities shall be performed in a planned and controlled manner. Performance responsibility rests with the Project Manager. Prior to initiating the activities, the Project Manager shall discuss the scope of the work, contractual and regulatory requirements, and applicable quality assurance/quality control procedures with assigned personnel. At the request of the Project Manager, this task may be done by Quality Assurance personnel.

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5.3.1 Procedures

To provide evidence of satisfactory work performance, analyses, assessments, modeling, and their results shall be completely documented. Documentation may include calculations, computer programs, logs, drawings, and tables.

Calculations

Calculations shall be legible and in a form suitable for reproduction, filing, and retrieval. Documentation shall be sufficient to permit a technically qualified individual to review and understand the calculations and verify the results.

Calculations shall be performed on standard WCC calculation paper whenever possible. All calculations will proved the originator's name and date of work, the checker's name and date, calculation subject, project number, and page number. All of this information shall be completed for each page. For extra pages, such as large graphs, this information shall also be included.

Calculations should, as appropriate, include a statement of calculation intent, description of methodology used, assumptions and their justification, input data and equation references, numerical calculations including unites, and results. Input data may include:

- Regulatory requirements,
- Performance and operational requirements under various conditions,
- Material, geological, environmental, and geotechnical requirements,
- Results of field and laboratory testing or calculations, and
- Information obtained from external personnel or literature and site data surveys.

Computer printouts that becomes an integral part of the calculations shall be referenced in the calculations by run number or other unique means of identification.

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At the end of calculations, the results should be summarized if this will provide clarity.

Computer Programs

Computer output shall be dated and clearly identified as to contents. Large sets of output shall be labeled with project name and number, program used, analysis title, and the user's name.

Logs, Drawings, and Tables

The results of analysis, assessment, and modeling activities may be presented in logs, drawing, and tables of various forms. The format of logs and tables shall be governed by the information to be presented. Drawings shall be uniquely identified by drawing or figure number and appropriate title. Standardized symbols and nationally accepted drafting standards shall be used. References to other drawings and sources of information shall be provided, as necessary.

Drawings shall be signed and dated by the draftsperson performing the work and the project task leader or Project Manager who has checked the drawing.

Revisions shall be noted on the drawing original with a revision number and a brief note describing each revision. The note shall be signed and dated by the draftsperson performing the work and the project task leader or Project Manager who has checked the revision.

Indication of final drawing and revision approval shall be through signing and dating the drawings by the project task leader or Project Manager.

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5.3.2 Verification

Calculations, computer program input, logs, drawings, and tables shall be formally checked using the process outlined in the following paragraphs.

Calculations

Verification of calculations shall be performed by an individual(s) other than the persons who performed the original work, or specified the method or input parameters to used. The individual(s) selected shall have technical expertise in the calculation subject.

It is emphasized that a numerical check is not sufficient. The checker is responsible for every item on every sheet-including the completion of the title block and page numbers.

To properly check calculations:

- The originator supplies the designated checker with a machine copy of the calculations. Originals should not leave the originator's possession until they are ready for final checker signing,
- The checker marks the calculation copy with a highlighter for all items he approves,
- The checker marks the calculation copy with a highlighter for all items he approves,
- If the checker disagrees, for any reason, the checker crosses through the item with different colored markers and writes the recommended correction or comment above it,
- The checker initials and dates all pages of the checkprints,

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- The checker returns the checkprints to the originator who, in turn, reviews all recommended changes. If a disagreement exists, the originator adds comments to the checkprints using a third color and then confers with the checker until all differences are resolved,

- The originator corrects, or "scrubs," the calculation originals so they agree with the checkprints. A one-to-one correspondence between the originals and checkprints must exist,

- The originator gives the originals the checkprints to the checker who compares them to verify agreed-to-corrections have been made, and

- When the checker is satisfied, he signs and dates the originals.

Computer Program Input

Computer input shall be formally checked using the process outlined above. A single exception to this process is that the checking may be performed on the input originals. The verification shall include a conceptual review of the program itself based on the problem being solved, a review of the computer model employed, a check that the program has been verified, and a formal check of the input data.

Drawings

Drawings shall be checked like calculations using different colored markers. Checkprints of the same drawing shall be marked CP1, CP2, etc., to show progression of the checking process.

If a drawing is revised, the entire checking process shall be repeated for the revised areas only. A new checkprint shall be prepared.

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Logs and Tables

Final subsurface logs shall be verified by the responsible member of the Site Characterization Team. The verification shall provide that changes from the original field representative's logs to the final log sheets are consistent with the results of other investigations. The final log sheets shall be checked in the same manner as all calculations or drawings, with the checker signing and dating all checkprints.

In addition, all final tables presenting information, data, or the results shall be checked using the process previously described. Checkprints of the same table shall be marked CL1, CL2, etc., to show progression of the checking process.

5.4 DATA PRESENTATION

AutoCAD, a computer aided design program is used for drawing maps and various figures. A base map will be used to produce the site map for field personnel and to produce maps of contaminant concentrations.

5.5 DATA MEASUREMENT ASSESSMENT PROCEDURES

This section summarizes QA/QC procedures for assessing the chemical data derived from the sampling and chemical analysis tasks. This same information is found in the Data Collection Quality Assurance Plan.

The data validation procedures will be used by the QA officer and the data validation coordinator for assessing duplicate and spike samples and checking blank samples that are submitted to the analytical laboratory from the field or generated internally by the laboratory. The purpose of implementing these procedures is to verify that the chemical data generated during the project are accurate, precise, complete, and representative of site conditions.

Detailed discussions of the procedures for data validation are presented in Section 5.2.3. The format for QC data assessment reporting is presented below.

5.5.1 Procedures for Assessing Data Accuracy, Precision, and Completeness

Chemical data derived from the project will be assessed for accuracy and precision for both the analytical laboratory and field sample collection programs. The primary goal of the program is to verify that the data reported during the project are representative of conditions in the local study area. To meet this goal, a combination of procedures and qualitative evaluations will be used to check the quality of the data. Sample recollection and analysis will be used only if the data are rejected and sample results are deemed to be critical to the determination of a project objective.

The QA/QC assessment program will evaluate the project's data based on the types of quality control samples described in the Data Collection Quality Assurance Plan. The procedures for evaluating both the project and laboratory QA/QC data are the same and are presented below for QA/QC spikes, blanks, and duplicate and/or replicate samples.

5.5.2 Blanks

The evaluation procedure for blanks is a qualitative review of the chemical analysis data reported by the laboratories. The procedure for assessing blank samples will be as follows:

1. Tabulation of the data from the blank samples,
2. Identification of any blank samples that have chemicals detected in the sample,
3. If no chemicals are detected in the blank samples, the tables are ready for entry into the appropriate report,
4. If any chemicals are found in blank samples, the compound(s) and concentration(s) will be reported and the field data for that period of time will be assessed for potential problems with data interpretation. Data may be removed from the data base on the basis of chemicals being detected in blank samples. Appropriate notations, however, will be made in the data base reports,

5. Quality control records will be maintained for each source of water which is used. These records shall demonstrate over time the presence/absence and level of contaminants found.

5.5.3 Spikes

The procedure for assessing spike samples will be as follows:

Tabulate spike sample data and calculate the Spiked Sample Recovery (SSR) percent as shown below for each sample.

$$SSR\ (\%) = \frac{(T-X)}{A} \times 100$$

where:
T = total concentration found in spiked sample
X - original concentration in sample prior to spiking
A - actual spike concentration added to sample

A comparison of the spiked sample calculated recoveries will be made to the percent recovery for each spiked analyte as specified within U.S. EPA CLP, as appropriate.

5.5.4 Duplicates

The procedure for assessing duplicate and replicate samples will be as follows:

Tabulate duplicate data and calculate the Relative Percent Difference (RPD) as shown below for each duplicate pair:

$$RPD\ (\%) = \frac{(X1 - X2)}{X} \times 100\%$$

where:
X1 = concentration for Sample 1 of duplicate
X2 = concentration for Sample 2 of duplicate
X = average of Samples 1 and 2

The calculated relative percent difference will be compared to the control limit values given in the EPA CLP, as appropriate for each of the spiked analytes to qualitatively

evaluate the significance of the data. The evaluation will focus on historic variations in concentrations, whether problems arise for one particular compound or random compounds and whether the problem is limited to one sampling location, sample homogeneity, the amount of the spike, etc. If data quality problems arise, the analytical data will be annotated, and the laboratory will be notified for corrective action, as appropriate. Data will be reported only if approved by data validation coordinator or the QA officer. The laboratory and the data validation personnel must review the analytical data in a timely fashion for an effective data evaluation process.

The laboratory data verification and review process includes a review of the data file for completeness, the results, and includes a preliminary QA/QC review. The laboratory data package (or report) is reviewed to locate and check the following, where appropriate.

- Laboratory and field blanks for verification of frequency and that there are no contaminants in the associated blanks and, if present, assess their impact on interpretation of the data.
- Field and laboratory duplicates to determine if the data results match adequately and if the frequencies are acceptable.
- Spike recovery data to assure they are within quality acceptance limits and frequencies are acceptable.
- Calibration documentation to verify equipment performance is acceptable.
- Accuracy and precision of Laboratory Control Samples.
- Instrument tuning documentation to verify successful completion.
- Holding time evaluation.

5.5.5 Identification of Outliers

A reported concentration value that is much different from most other values in a data set for the same group is referred to as an "outlier." The reasons for outliers can include:

- Inconsistent sampling or analytical chemistry methodology
- Errors in transcription of data values or decimal points
- Actual but extreme concentration values
- Amended errors in analytical methodologies

The procedures described for data validation and review will identify any outliers that are due to the first two causes mentioned above. Any outlier not attributable to these two causes may be due to actual but extreme concentration values. The data point in question will then be compared to data from similar settings. For example, a reported high concentration of one compound in ground water from a well will be compared to previous data from the same well, if available, and/or compared to data from nearby wells. Also, other aspects of the reported data will be examined to determine if a high reported concentration of a single constituent occurs in other samples but cannot be duplicated in replicate or QC samples. Sample results designated as "outliers" may be resampled and analyzed if deemed to be necessary by WCC.

CLOSURE PLAN

HAZARDOUS WASTE CONTAINER STORAGE AREA
OFF-SPECIFICATION PRODUCT STORAGE AREA

SOUTH PLANT

CEDAR CHEMICAL CORPORATION
VICKSBURG CHEMICAL DIVISION

for:

Cedar Chemical Corporation
Memphis, Tennessee

April 1991

Woodward-Clyde Consultants

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Woodward-Clyde Consultants

April 29, 1991

Mr. Steve Boswell
Director, Environmental Affairs
Cedar Chemical Corporation
Vicksburg Chemical Division
Post Office Box 3
Rifle Range Road
Vicksburg, Mississippi 39180

Re: WCC File Number 90B451C

Dear Steve:

The attached closure plan for the drum storage areas has been revised to reflect the comments of the March 28, 1991 letter from the Mississippi Department of Environmental Quality (MSDEQ).

The following are the MSDEQ comments and summary of the response:

MSDEQ COMMENT:

1. The proposed performance standards for the given target constituents, dinoseb (0.04 mg/l), arsenic (0.05 mg/l) and toxaphene (0.005 mg/l), in the hydroblast water are adequate. Also, the proposed performance standards for dinoseb (80.0 mg/kg), arsenic (80.0) mg/kg) and toxaphene (0.6 mg/kg) in soils are adequate.

   In the draft RCRA Facility Assessment (RFA) Report conducted by A. T. Kearney for U. S. E.P.A., it was noted that some portions of the drum storage area were covered in what appeared to be atrazine. Therefore, the Department recommends that closure standards for atrazine be added. The standard for atrazine in the hydroblast water is 0.175 mg/l and for soils the standard is 400 mg/kg.

   These atrazine levels are determined based on a reference dose (RFD) of 0.005 mg/kg-d.

   The appropriate analytical method for atrazine should be selected by Cedar Chemical.

RESPONSE:

Atrazine has been added as a target constituent. The standard proposed for atrazine has been added and an analytical method has been suggested.

MSDEQ COMMENT:

2. At least one soil sample should be collected from beneath each of the sumps for target constituent analysis.

RESPONSE:

The sample points adjacent to the two sumps have been moved to be through the bottom of the sump.

MSDEQ COMMENT:

3. The plan must describe a sampling protocol whereby soils collected from sampling points where cutting torches have been used are not affected by the use of said torches.

RESPONSE:

The plan has been modified such that the concrete will be cut with saws and no cutting torches used.

MSDEQ COMMENT:

4. The plan calls for analysis of two concrete samples from the hazardous waste container storage area to be analyzed for the four target constituents. Additionally, two concrete samples should be collected from the off-specification product storage area and analyzed.

RESPONSE:

The plan has been so modified.

MSDEQ COMMENT:

5. The plan calls for "plastic sheeting and other solids generated during the decontamination operations" to be wipe tested and disposed of properly, or else triple rinsed. No criteria is given as to how a decision will be made to handle such solid waste. This criteria should be clearly stated in the closure plan.

   Also, no mention is made as to how solids, such as chunks of concrete dislodged by hydroblasting, be handled. This issue should be addressed in the closure plan.

RESPONSE:

A representative composite sample containing bits of plastic sheeting, dislodged concrete and any other solids generated during the decontamination operations will be sent to an offsite laboratory for Toxicity Characteristics Testing. If the results of TC testing are less than TC trigger levels and the results of the analyses of the concrete samples performed as a part of clean closure are less than action levels then the waste will be disposed in a commercial solid waste disposal facility that is permitted to accept industrial waste. Otherwise the waste will be disposed in a hazardous waste facility.

MSDEQ COMMENT:

6. Cedar Chemical should submit a proposed schedule of activities in its revised closure plan more detailed than that in Section 6 of the January 1991 Closure Plan.

RESPONSE:

The detailed schedule has been added as Table 2.

MSDEQ COMMENT:

7. Typically, organic materials such as butyrate or visqueen are not used in the collected of environmental samples for organics analyses. However since the target constituents in this closure effort are limited to four specific compounds, organic-based materials shouldn't interfere with the required analyses.

   However, Cedar may wish to consider replacing these organic materials in the plan with inorganic materials.

RESPONSE:

A stainless steel tube will be used instead of a butyrate sampler.

There is, we believe, no practical alternative to the use of visqueen sheeting as proposed to contain hydroblast water and wrap sampling tools.

MSDEQ COMMENT:

8. Holes in the concrete slab should be labeled in some fashion after filling so that they may be easily identified in case some subsoil samples show contamination.

RESPONSE:

They will be labeled.

MSDEQ COMMENT:

9. The recommended decontamination procedure of the U. S. Environmental Protection Agency's Athens, Georgia Laboratory is as follows:

   a) wash in detergent (Alconox) solution;
   b) rinse with distilled, deionized water; and,
   c) rinse with pesticide-grade isopropanol
   d) after rinsing with isopropanol, the equipment should be allowed to air dry.

The Athens, Georgia, Laboratory of the U. S. E.P.A. has said that Threshold Limit Value (TLV) for methanol may be approached or exceeded when used in such activity.

RESPONSE:

The decontamination procedure is adopted.

MSDEQ COMMENT:

10. At least four sample splits should be sent to an offsite laboratory for dinoseb and arsenic analyses in order to verify the accuracy of Cedar's onsite lab.

RESPONSE:

The samples will be sent out as directed.

MSDEQ COMMENT:

11. In the copy of the final report of closure activities to be submitted to the Mississippi Office of Pollution Control (MOPC), actual photographs, rather than photocopies of photographs, should be submitted.

RESPONSE:

Actual photographs are enclosed.

MSDEQ COMMENT:

12. MOPC should be notified two (2) full working days prior to sampling activities such that a representative of MOPC may observe sampling or collect splits, as desired.

RESPONSE:

The MSDEQ will be so notified.

If you have any questions, please call.

Very truly yours,

Dick Karkkainen
RDK/lbh

CLOSURE PLAN

HAZARDOUS WASTE CONTAINER STORAGE AREA
OFF-SPECIFICATION PRODUCT STORAGE AREA

SOUTH PLANT

CEDAR CHEMICAL CORPORATION
VICKSBURG CHEMICAL DIVISION

for:

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Memphis, Tennessee

April 1991

Woodward-Clyde Consultants

Consulting Engineers, Geologists, and Environmental Scientists
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A	Cedar Chemical Dinoseb Test Method
B	Material Safety Data Sheets for Products

1.0 INTRODUCTION

This workplan defines the activities to be executed by Cedar Chemical Corporation at its facility in Vicksburg, Mississippi pursuant to closure of a container storage area. The workplan or closure plan is consistent with RCRA rules and regulations.

1.1 Description of the South Plant

The Vicksburg Chemical Division of Cedar Chemical Corporation is located in Warren County, Mississippi along the Mississippi River immediately on the south limits of the City of Vicksburg. (See Figure 1). The address is:

Cedar Chemical Corporation

Vicksburg Chemical Division

Post Office Box 3

Rifle Range Road

Vicksburg, Mississippi 39180

The facility is a manufacturer of chemicals. The plant site is divided physically and functionally into a "north plant" and a "south plant". The north plant is primarily a manufacturer of potassium nitrate and additionally manufactures by-products chlorine and nitrogen tetroxide. The south plant formerly manufactured chlorinated pesticides and nitrogen based herbicides. The South Plant presently manufacturers nitric acid, which is used entirely as a raw material in the north plant.

The south plant contained the manufacturing operations for production of the following products:

- o Atrazine
- o Toxaphene
- o Dinitrobutyl phenol (dinoseb)
- o Monosodium methane arsenate

1.2 History of the South Plant

All pesticide plants were shut down by 1986 and have been partially dismantled. Any non-deminimus spills from toxaphene would have been handled as a hazardous waste (P123). The monosodium methane arsenate plant generated listed RCRA waste K031, a by-product salt. The by-product salt cake was directly discharged into a "roll-off sludge container". When the container was full (2-4 days) it was transported by a hazardous waste transporter to a hazardous waste landfill. The plant was designed such that there was intended to be no effluent with all spills, etc. retained and recycled to the process.

The dinitrobutyl phenol (Dinoseb) plant produced process wastewater that was hazardous by virtue of characteristic (D002). The waste was pumped to 1-3 day storage and was transported by a hazardous waste transporter to off-site disposal by hazardous waste deep well injection. At times the manufactured process wastewater was neutralized with ammonia and pumped to a 1.6 million gallon storage tank. The water did not exhibit the characteristic of a hazardous waste at this time and was pumped through activated carbon prior to discharged to the 3 million gallon surface impoundment.

The hazardous waste container storage area and off-specification product storage area were in operation from 1976 to 1986 (Figure 2). The hazardous waste container storage area stored contaminated debris, trash and waste product material in 55-gallon drums. The off-

specification product storage area stored 55-gallon drums and 5-gallon pails of product returned from clients which could be put back into the manufacturing process and recovered.

1.3 Description of the Container Storage Area's

The two container storage areas which are to be closed are two distinct sections or area's of a continuous concrete area in the South Plant. This area is a six-inch (minimum) poured 3,000 psi reinforced concrete slab with sumps, curbs, containment areas (See Figure 2).

The hazardous waste container storage stored trash and debris contaminated with products or byproducts produced at the South Plant. This area also stored off-specification product which could not be reclaimed or recycled into new product. These wastes were typically stored in 55-gallon drums. The area is trapezoid in shape, approximately 30 feet by 46 feet by 14 feet by 40 feet. Photographs and maps of the area have been included as Figures 3, 4 and 5.

The off-specification product storage area is a covered area immediately adjacent to the hazardous waste storage area but separated by curbs. This is a 2,000 Square Foot area roughly 28 feet by 70 feet which stored off-specification product until it could be returned to the manufacturing process and recycled into new product. This area stored an assortment of 55-gallon drums, and 5-gallon pails and 1 gallon containers. Photographs and maps of the area have been included as Figures 3 through 7.

1.4 Description of Wastes Stored

The container storage area's stored off-specification products, products, waste products or trash and debris contaminated with the following chemical compounds:

Toxaphene	(P123)
Dinitrobutyl phenol (dinoseb)	(P020)
Monosodium Methane Arsenate (MSMA)	(K031)
Atrazine	

2.0 CLOSURE PERFORMANCE STANDARD

This closure plan is based upon closure of both container storage area's with no wastes or contamination remaining in place above the health based action levels published by the EPA for corrective action at hazardous waste management facilities. These health based clean-up action levels are described in the Friday, July 27, 1990 Federal Register for toxaphene and arsenic. From "Appendix C- Range of Concentrations for Establishing Media Protection Standards for Carcinogens", the range for toxaphene is soil is from 0.6 ppm to 60.0 ppm. From "Appendix A - Examples of Concentrations Meeting Criteria for Action Levels", the reading for arsenic in soils is 80.0 ppm. Health based clean-up action levels are also described in Volume 1 of the RCRA Facility Investigation Guidance Document. From Table 8-7 "Health Based Criteria for Systemic Toxicants", the reading for Dinoseb in soil in 80.0 ppm. The performance standard for atrazine is 400 mg/kg based on a reference dose (RFD) of 0.005 mg/kg-d. Appropriate tables from these documents are attached to this plan. This closure plan is intended to result in a "clean" closure which will eliminate the need for post-closure maintenance and care. The levels of clean-up will be used for the soils underneath the concrete pad and immediately adjacent to the pad.

This closure plan also calls for concrete surface to be hydroblasted and water from that activity to be tested as a determinant of whether the concrete is clean. The concrete will be judged to be clean when the concentrations of arsenic and toxaphene in the water are less than the primary drinking water standards. The standard for arsenic is 0.05 ppm and the standard for toxaphene is 0.005 ppm. Since Dinoseb is not a parameter in the primary drinking water standards the Table 8-7 "Health Based Criteria for Systemic Toxicants" and

the reading for Dinoseb in water will be used; that concentration is 0.040 ppm. The standard for atrazine in the hydroblast water is 0.175 mg/l based on a RFD of 0.005 mg/kg-d.

3.0 CLOSURE ACTIVITIES

3.1 Waste Inventory Removal

No waste is stored for more than 90 days. There is very little use of the site at present.

3.2 Pad and Equipment Decontamination

Decontamination of the container storage area will be performed in the manner that is described below.

All surfaces, the pad surface and containment curbing, will be cleaned utilizing a hydroblaster. Heavy duty plastic sheeting will be wrapped around the outside of the section of the container storage area being hydroblasted by attaching the plastic sheeting to supports temporarily assembled for the purpose. A barrier, covered by heavy-duty plastic sheeting, will also be placed across the open end of the container storage area to confine the water that will be generated. The pad will be cleaned three times and vacuumed up by a shop vacuum or equivalent.

The water from the cleaning operations will be disposed of onsite. The water will be transported by truck to the Cedar activated carbon wastewater treatment facility. The water will be pumped directly through the activated carbon and will not enter the surface impoundment. The treated water will be discharged to the Mississippi River under the Cedar NPDES permit.

A representative composite sample containing bits of plastic sheeting dislodged concrete and any other solids generated during the decontamination operations will be sent to a offsite laboratory for Toxicity Characteristic Testing. If the results of TC testing are less than TC trigger levels and the results of the analyses of the concrete samples performed as a part of clean closure are less than the action levels then the waste will be disposed in a commercial solid waste disposal facility that is permitted to accept industrial waste. Otherwise, the waste will be disposed in a hazardous waste facility.

Decontamination of the hydroblaster used in cleaning the container storage area will not be necessary because it will not come into contact with any waste since the waste has been contained in closed 55-gallon drums. The interior of the shop vacuum or equivalent equipment will be triple cleaned. The water will be collected and treated as described in the previous paragraph.

3.3 Contaminated Soil Removal

If soil field analysis indicates high levels of contamination then the concrete in the area of that sample will be removed. The contaminated soil will be exposed and excavated for offsite disposal.

3.4 Proof of Decontamination

3.4.1 Water Sample Collection Procedures. Samples of final hydroblast will be obtained by placing a sample bottle in the water and letting the bottle fill. Care will be taken to avoid disturbing the water by agitation which could introduce excess oxygen. The VOA bottles will be completely filled to eliminate any air space, and they will be immediately capped after filling. Each sample label will contain the following information:

- o Sample number,
- o Sample location,
- o Sample depth (if applicable),
- o Date/time of collection, and
- o Sampler's initials.

3.4.2 Soil Sampling. To confirm that no leaks have occurred, the following procedures will be employed to sample the soil for contamination under the concrete pad. At each of the fourteen proposed sample locations eleven are located over cracks and beneath to the sumps (See Figure 2) For those locations located over concrete, a concrete saw will be used to cut and remove a small section or plug of the concrete pad. Additionally, two samples of concrete from the concrete removed in the hazardous waste container storage area and two samples of concrete removed in the off-specification product storage area will be submitted for separate analysis with the soil samples.

Samples of soil underneath the concrete will be taken utilizing a 1-inch diameter stainless steel tube encased in a 2-foot long stainless steel soil probe. A stainless steel soil probe is attached to extension rods and will be driven six inches into the soil by a hammer attachment. Following the removal of the soil probe, the tube containing the sample will be extracted from the soil probe. The soil sample will be extruded and transferred to sample bottles, approximately labeled, and placed on ice for transport to the laboratory. If the soil probe is unable to obtain a representative sample then a hand auger will be employed. All equipment will be cleaned in accordance with decontamination procedures before collection each sample.

All equipment will initially be decontamination before use and again after each sample is collected. The following decontamination procedures will be employed:

- o Washing in a detergent (Alconox) solution

- o Rinsing with distilled, deionized water
- o Rinsing with pesticide - grade isopropanol
- o Allow to air dry

After decontaminating, the sample equipment will be wrapped in a visqueen cover for protection until its subsequent use. All wash fluids will be containerized for later disposal by Cedar Chemical in their activated carbon wastewater treatment process as previously described.

3.5 Documentation of Sample Acquisition

Additionally, all information pertinent to field observations and sampling will be recorded in the logbook with consecutively numbered pages. Entries in the logbook will include at least the following:

- o Sketch of the container storage area with measurements
- o A grid of the site area
- o Purpose of Sampling
- o Number and approximate volume of samples taken
- o Exact location of sampling point on grid
- o Description of sampling point
- o Date and time of collection
- o Collector's sample identification number(s)
- o References, such as maps or photographs of the sampling site
- o Field observations
- o Weather conditions

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

Proper sample preservation is important in retaining the sample characteristics prior to analysis. Sample preservation is documented on the chain-of-custody form and also in the field logbook. The proposed analytical methods required that the sample be kept on ice until transferred to the laboratory.

Once the sample has been transferred to appropriate laboratory sample container, sample tags will be completed and affixed to the sample container.

3.5.1 Sample Tagging. Each sample will be tagged and sealed properly immediately after collection. Sample tags are necessary to prevent misidentification of samples. The tag will include at least the following information:

- Name of collection
- Date and time of collection
- Place of collection
- Collector's sample number, which uniquely identifies the sample

An example of a sample tag that will be used is shown in Figure 3.

3.5.2 Chain-of-custody. In addition in the field logbook, each sample will be recorded on a chain-of-custody record. An identifying code will be assigned to each sample and this code will be used on the chain-of-custody and in the logbook to ensure that the sample description is identifiable. A brief description of the sampling point will also be placed on the chain-of-custody form.

Chain-of-custody forms will become the permanent records of all sample handling and shipment. If standard sampling procedures are not used, a written justification of each deviation will be placed in the project file. Upon completion of sampling, the sample will

be prepared for shipment in accordance with the applicable sampling instruction, including preservation, labeling, and logging.

The person collecting a sample will initiate document(s) at the source of sample and start the chain-of-custody procedure.

The sample will be kept in limited access or locked storage at the proper temperature until custody is relinquished from the site and formal documentation of the transfer is completed.

Upon each transfer of custody, the person involved will verify sample numbers and condition and will document the sample acquisition and transfer. The field sampler will properly package the samples, indicate and shipping, obtain documentation of the shipment, such as certified mail receipt or bill of lading number, and sample identification records (one of each with the shipment, one of each by mail to the laboratory, and one of each returned with field records).

On transfer of custody of the samples to the transport agency, the field sample custodian will sign and retain a copy of the chain-of-custody, witness the transport company custody signature, and sent two copies of the chain-of-custody with the samples. On arrival at the laboratory, the sample custodian will sign for custody and return a copy of the completed chain-of-custody to Cedar Chemical. Custody procedures will then proceed according to the procedures of the selected testing laboratory.

3.5.3 Evaluation of Sampling Results. The analytical results from Cedar Chemical's sampling efforts will be summarized and evaluated for subsequent review by MBPC. The raw data will be included as an appendix to the report submitted.

3.5.4 Analytical Methods and Parameters. Cedar Chemical proposes to use its onsite laboratory when possible. This laboratory will analyze for Dinoseb, and arsenic. Toxaphene

and atrazine will be analyzed in an offsite laboratory. These parameters were chosen because these were the main products manufactured at the south plant and arsenic is a toxic heavy metal which was part of monosodium methane arsenate. Methods for the field analysis of Dinoseb are not found in SW-846 but copies of methods which Cedar Chemical intends to use are included as Exhibit A. A summary of the parameter and method is as follows:

Toxaphene	EPA SW-846, Method 625
Dinitrobutyl Phenol (Dinoseb)	See Exhibit A
Arsenic	EPA SW-846, Method 7060
Atrazine	gc/ECD, gc/NPD or HPLC

In order to verify the accuracy of Cedar's onsite laboratory four sample splits will be sent to an offsite laboratory. Results from Cedar's laboratory and the offsite laboratory will be compared in the Final Report.

3.6 Equipment Decontamination

Any equipment that has some in direct contact with the material in the storage areas will be deemed contaminated. The waste materials handled are not corrosive, reactive or ignitable. However, special personnel protective equipment will be used and precautions taken when necessary. Product Material Safety Data Sheets are included as Exhibit B.

3.7 Site Restoration

Upon completion of the work the holes will be filled with concrete. The location of the holes will be marked on a map which will be included in the final report. Additionally the sample number will be imprinted in the concrete.

4.0 FINAL REPORT AND CERTIFICATION

After the container storage areas have been decontaminated and any contaminated soil removed Cedar Chemical will submit a final report to the MDEQ for review. This report will contain analytical results from sampling, site investigation information and a draft certification of closure.

Upon approval by the MDEQ that the closure is complete, Cedar Chemical will submit a certification of closure signed by an independent engineer registered in the State of Mississippi. This is a clean closure, therefore, no notice is required for the local land authority.

5.0 CLOSURE COST ESTIMATE

The proposed closure cost estimate provided in Table 1 is based on removal of any contamination in the concrete pad and removal of concrete at fourteen sampling locations for soil testing then disposing any material in a permitted offsite facility.

6.0 CLOSURE SCHEDULE

The "Clean Closure" will be accomplished within 180 days of the date of approval of this plan by the MSDEQ. A detailed schedule is attached as Table 2.

7.0 CONTINGENT CLOSURE PLAN

In the event that it is not possible to meet the clean closure performance standards, a contingent closure plan will be adopted. The contingent closure plan will call for the concrete surfaces to be painted with a concrete sealant and four monitor wells be installed

surrounding the hazardous waste storage area and the off-specification returned drum storage area. All shall be accomplished within 180 days of the closure schedule.

TABLES

TABLE 1

PROPOSED CLOSURE COST ESTIMATE

Item	Unit Cost	Quantity	Subtotal
Concrete Pad Decontamination			
Mobilization			500.00
Temporary framing			1,000.00
Hydroblasting	2,000/day	2	4,000.00
Laboratory Analysis Onsite (1)	N/A	N/A	
Removal of Concrete Plugs	500/day	2	1,000.00
Transportation and Disposal	500/ton	1	500.00
Laboratory Analysis Offsite (2)	350	16	5,600.00
Site Restoration	500/day	1	500.00
Closure Report and Sampling Results and			---
Regulatory Liason and Certification by Registered Engineer	800/day	3	2,400.00
Project Management			
Subject contractor including site visits	800/day	3	2,400.00
Project Liason	800/day	2	1,600.00
Transportation and Expenses			2,000.00
15% Contingency			3,000.00
		(Estimated) TOTAL	24,500.00

(1) Cedar Chemical intends to use its onsite laboratory for rapid field analysis .

(2) Cedar will use an offsite laboratory for decontamination confirmatory analysis

TABLE 2

SCHEDULE OF CLOSURE

Submit Closure Plan to MSDEQ and EPA with modifications in response to March 28, 1991 MSDEQ letter	May 1, 1991
Receive approval to proceed with plan	Day 0
Issue request for quotation for contractor to do the hydroblasting and cut the concrete	Day 15
Receive bids	Day 30
Execute purchase order	Day 45
Start work	Day 75
Complete work and sampling	Day 90
Receive results of sampling	Day 120
Validate data	Day 150
Final Report	Day 180

Table 8-7. (continued)[1]

Constituent	CAS No.	RfD[2] (mg/kg/day)	Soil (mg/kg)	Water (ug/l)	Air (ug/m3)
Dichlorodifluoro-methane	75-71-8	2E-01	2E+04	7E+03	--
1,1-Dichloroethylene	75-35-4	9E-03	7E+02	See MCL	--
Dichloromethane (Methylene chloride)	75-09-2	6E-02	5E+03	2E+03	--
2,4-Dichlorophenol	120-83-2	3E-03	2E+02	1E+02	1E+01
1,3-Dichloropropene	26952-23-8	3E-04	2E+01	1E+01	--
Dieldrin	60-57-1	5E-05	4E+00	2E+00	--
Diethyl phthalate	84-66-2	8E-01	6E+04	3E+04	--
Dimethoate	60-51-5	2E-02	2E+03	7E+02	--
2,4-Dinitrophenol	51-28-5	2E-03	2E+02	7E+01	7E+00
Dinoseb	88-85-7	1E-03	8E+01	4E+01	--
Diphenylamine	127-39-4	3E-02	2E+03	1E+03	--
Disulfoton	298-04-4	4E-05	3E+00	1E+00	--
Endosulfan	115-29-7	5E-05	4E+00	2E+00	2E-01
Endothal	145-73-3	2E-02	2E+03	7E+02	--
Endrin	72-20-8	3E-04	2E+01	See MCL	1E+00
Ethylbenzene	100-41-4	1E-01	8E+03	4E+03	--
Heptachlor	76-44-8	5E-04	4E+01	2E+01	--
Heptachlor epoxide	1024-57-8	1E-05	8E-01	4E-01	--
Hexachlorobuta-diene	87-68-3	2E-03	2E+02	7E+01	--
Hexachlorocyclo-pentadiene	77-47-4	7E-03	6E+02	2E+02	--
Hexachloroethane	67-72-1	1E-03	8E+01	4E+01	--
Hydrogen cyanide	74-90-8	2E-02	2E+03	7E+02	--
Hydrogen sulfide	7783-06-4	3E-03	2E+02	1E+02	--
Isobutyl alcohol	78-83-1	3E-01	2E+04	1E+04	1E+03
Isophorone	78-59-1	2E-01	2E+04	7E+03	--
Lindane (hexa-chlorocyclohexane)	58-89-9	3E-04	2E+01	See MCL	--
Maleic hydrazide	108-31-6	5E-01	4E+04	2E+04	--
Methacrylonitrile	126-98-7	1E-04	8E+00	4E+00	--
Methomyl	16752-77-5	3E-02	2E+03	1E+03	--
Methyl ethyl ketone	78-93-3	5E-02	4E+03	2E+03	--
Methylisobutyl-ketone	108-10-01	5E-02	4E+03	2E+03	--

Note: These criteria are subject to change and will be confirmed by the regulatory agency prior to use.

APPENDIX C—RANGE OF CONCENTRATIONS FOR ESTABLISHING MEDIA PROTECTION STANDARDS FOR CARCINOGENS—Continued

Constituent name	Class	MaxAir (ug/m 3)	MinAir (ug/m 3)	Max-Water (mg/L)	MinWater (mg/L)	MaxSoil (mg/kg)	MinSoil (mg/kg)
Styrene	C						
1,1,1,2-Tetrachloroethane	C	1E+01	1E-01	1E-01	3E+03	3E+03	3E+01
1,2,4,5-Tetrachlorobenzene	D						
1,1,1,2-Tetrachloroethane	C	1E+01	1E-01	1E-01	1E-03	3E+03	3E+01
1,1,2,2-Tetrachloroethane	C	2E-00	2E-02	2E-02	2E-04	4E+02	4E-00
Tetrachloroethylene	B2	1E+02	1E-00	7E-02	7E-04	1E+03	1E+01
2,3,4,6-Tetrachlorophenol	D						
Tetraethyl lead	D						
Tetraethyldithiopyrophosphate	D						
Thallic oxide	D						
Thallium acetate	D						
Thallium carbonate	D						
Thallium chloride	D						
Thallium nitrate	D						
Thallium sulfate	D						
Thiosemicarbazide	D						
Thiram	D						
Toluene	D						
Toxaphene	B2	3E-01	3E-03	3E-03	3E-05	6E+01	6E-01
1,2,4-Trichlorobenzene	D						
1,1,1,Trichlorpethane	D						
1,1,2-Trichloroethane	C	6E-00	6E-02	6E-02	6E-04	1E+03	1E+01
Trichloroethylene	B2			3E-01	3E-03	6E+03	6E+01
Trichloromonofluoromethane	D						
2,4,5-Trichlorophenol	D						
2,4,6-Trichlorophenol	B2	2E+01	2E-01	2E-01	2E-03	4E+03	4E+01
2,4,5-Trichlorophenoxyacetic acid	D						
1,2,3-Trichloropropane	D						
Vanadium pentoxide	D						
Xylenes	D						
Zinc cyanide	D						
Zinc phosphide	D						

Appendix D: Recommended Exposusre Assumptions for Use in Deriving Action Levels

(Sections 264.521 (a)(2); (b); (c)(3); and (d))

1. In deriving action levels for hazardous constituents in ground-water, assume a water intake of 2 liters/day for 70 kg adult/70 year lifetime exposure period.

2. In deriving action levels for hazardous constituents in air, assume air intake of 20 cubic meters/day for 70 kg adult/70 year lifetime exposure period.

3. In deriving action levels for hazardous constituents in soil, which are known or suspected to be carcinogens, assume soil intake of 0.1 gram/day for 70 kg adult/70 year lifetime exposure period.

4. In deriving action levels for hazardous constituents in soil, other than those which are known or suspected to be carcinogens, assume soil intake of 0.2 gram/day for 16 kg child/5 year exposure period (age 1–6).*

5. In deriving action levels for hazardous constituents in surface water designated by the State for use as a drinking water source, assume a water intake of 2 liters/day for 70 kg adult/70 year lifetime exposure period, unless intake of aquatic organisms is also of concern.

*Not to be averaged over a 70-year lifetime.

Appendix E: Examples of Calculations of Action Levels

I. Governing Equations for Calculating Action Levels

A. *Systemic Toxicants*

$C_m = [RfD * W]/[I * A]$

where:

C_m = action level in medium (units are medium-dependent);
RfD = reference dose (mg/kg/day);
W = body weight (kg);
I = intake assumption (units are medium-dependent); and
A = absorption factor [1] (*dimensionless*).

B. *Carcinogenic Constituents*

$C_m = [R * W * LT]/[CSF * I * A * ED]$

where:

C_m = action level in medium (units are medium-dependent);
R = assumed risk level (dimensionless) (10^{-6} for class A & B; 10^{-5} for class C carcinogens);
W = body weight (kg);
LT = assumed lifetime (years);
CSF = carcinogenic slope factor $(mg/kg/day)^{-1}$;
I = intake assumption (units are medium-dependent);
A = absorption factor (dimensionless); and
ED = exposure duration (years).

[1] Assumed to be 1 for this appendix, based upon the assumption that the human absorption rate will be the same as the rate in the study upon which the RfD or CPF was developed.

II. Example Calculations for Hazardous Constituents in Air

A. *Systemic Toxicants*

Example calculation for 2,4-dinitrophenol:

$C_a = [0.002\ (mg/kg/d) * 1000\ (\mu g/mg) * 70(kg)]/[20\ (m^3/d) * 1] = 7.0\ \mu g/m^3$

where:

C_a = action level in air ($\mu g/m^3$)
RfD = 0.002 mg/kg/day
W = 70 kg adult
I = 20 m^3/day
A = 1

B. *Carcinogenic Constituents*

Example calculation for 1,1,2,2-tetrachloroethane:

$C_a = [10^{-6} * 1000\ (\mu g/mg) * 70\ (yrs) * 70\ (kg)]/[0.20\ (mg/kg/day)^{-1} * 20\ (m^3/day) * 1 * 70\ (yrs)] = .175\ \mu g/m$

where:

C_a = action level in air ($\mu g/m^3$)
R = 10^{-6} (1,1,2,2-Tetrachloroethane is a Class C carcinogen)
W = 70 kg adult
LT = 70 year lifetime
CSF = 0.20 $(mg/kg/day)^{-1}$
I = 20 m^3/day
A = 1
ED = 70 year exposure duration

III. Sample Calculation for Hazardous Constituents in Water

A. *Systemic Toxicants*

Sample calculation for toluene:

$C_w = [0.30\ (mg/kg/day) * 70\ (kg)]/[2\ (L/day) * 1] = 10.5\ mg/L$

where:

C_w = action level in water (mg/L)

develop and conduct these further Regulatory Impact Analyses.

The new analyses will be conducted in accordance with the existing Agency guidance on Regulatory Impact Analysis and the draft Regulatory Impact Analysis Guidance published in the 1988 Regulatory Program of the United States. The analyses will explicitly examine the costs, health and environmental benefits, and technological limitations for the key regulatory requirements contained in the proposal—especially for the several alternative approaches to ground water remediation outlined in the proposed rule. This analysis will also estimate the aggregate impacts, identified above, for sites eligible for remediation under this rule and for those sites which are listed on the NPL, and will, therefore, look to this rule as an ARAR, under the provisions of CERCLA. Upon completion of the revised analyses, EPA will solicit comment on the results of the analyses and the methodology used to derive them. The Agency will then assess these comments, along with comments which will have been received previously on the proposed rule. Through these actions EPA will ensure that the net social benefits (including environmental and health benefits) of the rule proposed today are maximized, taking into account costs, technological limitations, risks, and realistic assessments of both actual and reasonably expected uses of each site. If the revised RIA, together with the comments received, demonstrate that the rule proposed today does not achieve this outcome, the Agency will make appropriate modifications to the final rule, or if necessary, will repropose the rule.

B. Regulatory Flexibility Act

The Regulatory Flexibility Act requires Federal agencies to fully analyze the economic effects of regulations on small entities. The Agency analyzed the economic impacts for the regulatory options that are most similar to today's proposed rule (*i.e.*, "Immediate Cleanup to Health-Based Standards" and "Flexible Cleanup to Health-Based Standards").

The RIA assumes that a small business is significantly impacted if its excess of cash flow over ten percent of its total liabilities is insufficient to meet corrective action costs, or if its net income is insufficient to meet its corrective action costs.

For the alternative analyzed, it was found that small firms encounter more severe impacts from the corrective action requirements than large firms. The options most similar to the proposed rule result in incremental impacts (*i.e.*, relative to the baseline) on approximately 9 to 11 percent of small businesses owning RCRA facilities.

Based on the Agency's guidelines for implementing the Regulatory Feasibility Act, the results of the analysis as summarized above, suggest that the proposed rule does not impose significant impacts on small entities.

C. Paperwork Reduction Act

The information collection requirements in this proposed rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq*. Reporting and recordkeeping burden on the public for this collection is estimated at 42,497 hours for the 674 respondents, with an average of 1.151 hours per response. (Burden estimates should include all aspects of the collection effort and may include time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, completing and reviewing the collection of information, *etc.*)

If you wish to submit comments regarding any aspect of the collection of information, including suggestions for reducing the burden, or if you would like a copy of the information collection request (please reference ICR #1451), contact Rick Westlund, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460 (202-382-2745); and Tim Hunt, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

List of Subjects in 40 CFR Parts 264, 265, 270, and 271

Administrative practice and procedure, Corrective action, Hazardous waste; Insurance, Reporting and recordkeeping requirements.

Dated: July 5, 1990.

William Reilly,

Administrator.

XI. Supplementary Documents

APPENDIX A.—EXAMPLES OF CONCENTRATIONS MEETING CRITERIA FOR ACTION LEVELS

[Section 264.521(a)(2)(i-iv)]

Constituent name	Class	Air(ug/m^3)	Water (mg/L)	Soils (mg/kg)
Acetone	D		4E-00	8E+03
Acetonitrile	D		2E-01	5E+02
Acetophenone	D	2E-01	4E-00	8E+03
Acrylamide	B2	8E-04	8E-06	2E-01
Acrylonitrile	B1	1E-02	6E-05	1E-00
Aldicarb	D		5E-02	1E+02
Aldrin	B2	2E-04	2E-06	4E-02
Allyl alcohol	D		2E-01	4E+02
Aluminum phosphide	D		1E-02	3E+01
Aniline	B2		6E-03	1E+02
Antimony	D		1E-02	3E+01
Arsenic	A	7E-05	(1)	8E+01
Asbestos (2)	A	2E-02		
Barium cyanide	D		2E-00	6E+03
Barium, ionic	D	4E-01	(1)	4E+03
Benzidine	A	2E-05	2E-07	3E-03
Beryllium	B2	4E-04	8E-06	2E-01
Bis(2-ethylhexyl)phthlate	B2		3E-03	5E+01
Bis(chloroethyl)ether	B2	3E-03	3E-05	6E-01
Bromodichloromethane (3)	B2		3E-05	5E-01
Bromoform (3)	D		7E-01	2E+03
Bromomethane	D	3E+01	5E-02	1E+02
Butyl benzyl phthalate	C		7E-00	2E+04

Woodward-Clyde Consultants

CHAIN-OF-CUSTODY-RECORD

COLLECTOR'S SAMPLE NUMBERS:

SAMPLE COLLECTION:

Location of Sample: _____

Project Number and Name: _____

Collector's Name: _____ Telephone: ( )

Company Name: _____

Address: _____

Witness: _____ Company Name: _____

Date Sampled: _____ Time: _____

FIELD INFORMATION

Type of Sample: Liquid Gas Sludge Soil Other (Specify) _____

Container Size: _____ Container Type: _____

Field Notes: _____

_____

Transporter: _____ Airbill/Invoice: _____

SAMPLE TRANSFER (Original must be retained with sample at all times)

1.	Relinquished by:	(Name)	(Organization)	(Date/Time)
	Received by:	(Name)	(Organization)	(Date/Time)
2.	Relinquished by:	(Name)	(Organization)	(Date/Time)
	Received by:	(Name)	(Organization)	(Date/Time)
3.	Relinquished by:	(Name)	(Organization)	(Date/Time)
	Received by:	(Name)	(Organization)	(Date/Time)

TERMINATION OF CHAIN-OF-CUSTODY:

Authorized by: _____ Date: _____ Time: _____

Company Name: _____

Sample Disposition: Storage _____ Disposal _____ Other _____

FIGURE 4.

EXAMPLE OF SAMPLE TAG

SAMPLE I.D. [ ]

PROJECT NUMBER _____

PROJECT NAME _____

EXACT SAMPLING LOCATION _____

FIELD TESTS	MATERIAL SAMPLED		PRESERVATIVE	
OVA	SOLID WASTE	☐	NONE	☐
pH	LIQ. WASTE	☐	ICE	☐
SALINITY	SOIL	☐	H_2SO_4	☐
S. COND.	G. WATER	☐	HNO_3	☐
TEMP	S. WATER	☐	OTHER	☐
OTHER	OTHER	☐		

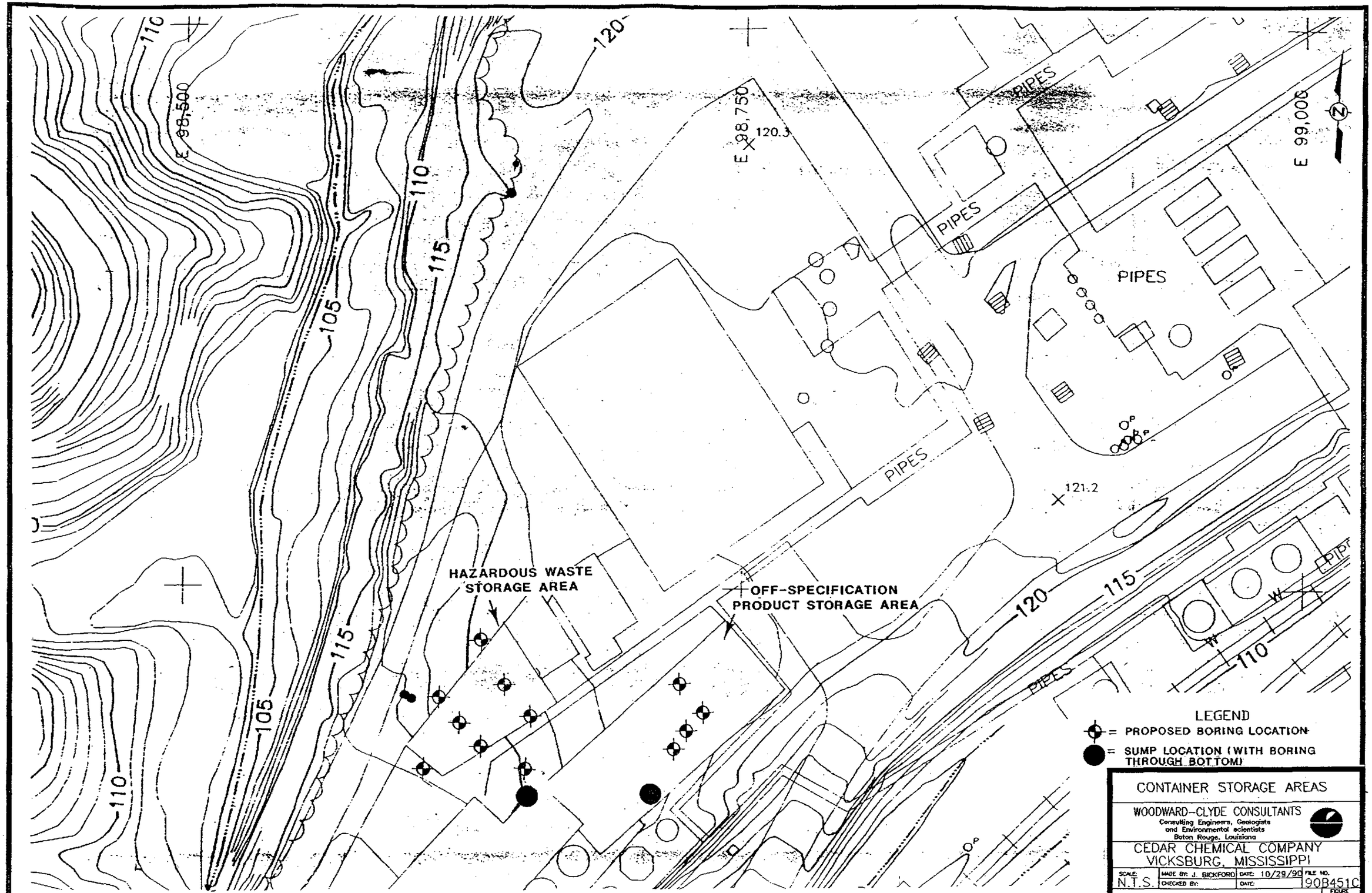
REMARKS _____

WEATHER _____ TIME _____

SIGNATURE _____ DATE _____

FIGURE 3.

FIGURES



E 98,500
E 98,750
E 99,000
120.3
121.2
PIPES
HAZARDOUS WASTE STORAGE AREA
OFF-SPECIFICATION PRODUCT STORAGE AREA
LEGEND
= PROPOSED BORING LOCATION
= SUMP LOCATION (WITH BORING THROUGH BOTTOM)
CONTAINER STORAGE AREAS
WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental scientists
Baton Rouge, Louisiana
CEDAR CHEMICAL COMPANY
VICKSBURG, MISSISSIPPI
SCALE: N.T.S.
MADE BY: J. BICKFORD
DATE: 10/29/90
CHECKED BY:
DATE:
FILE NO. 90B451C
PROPOSED SAMPLE LOCATIONS
FIGURE 2

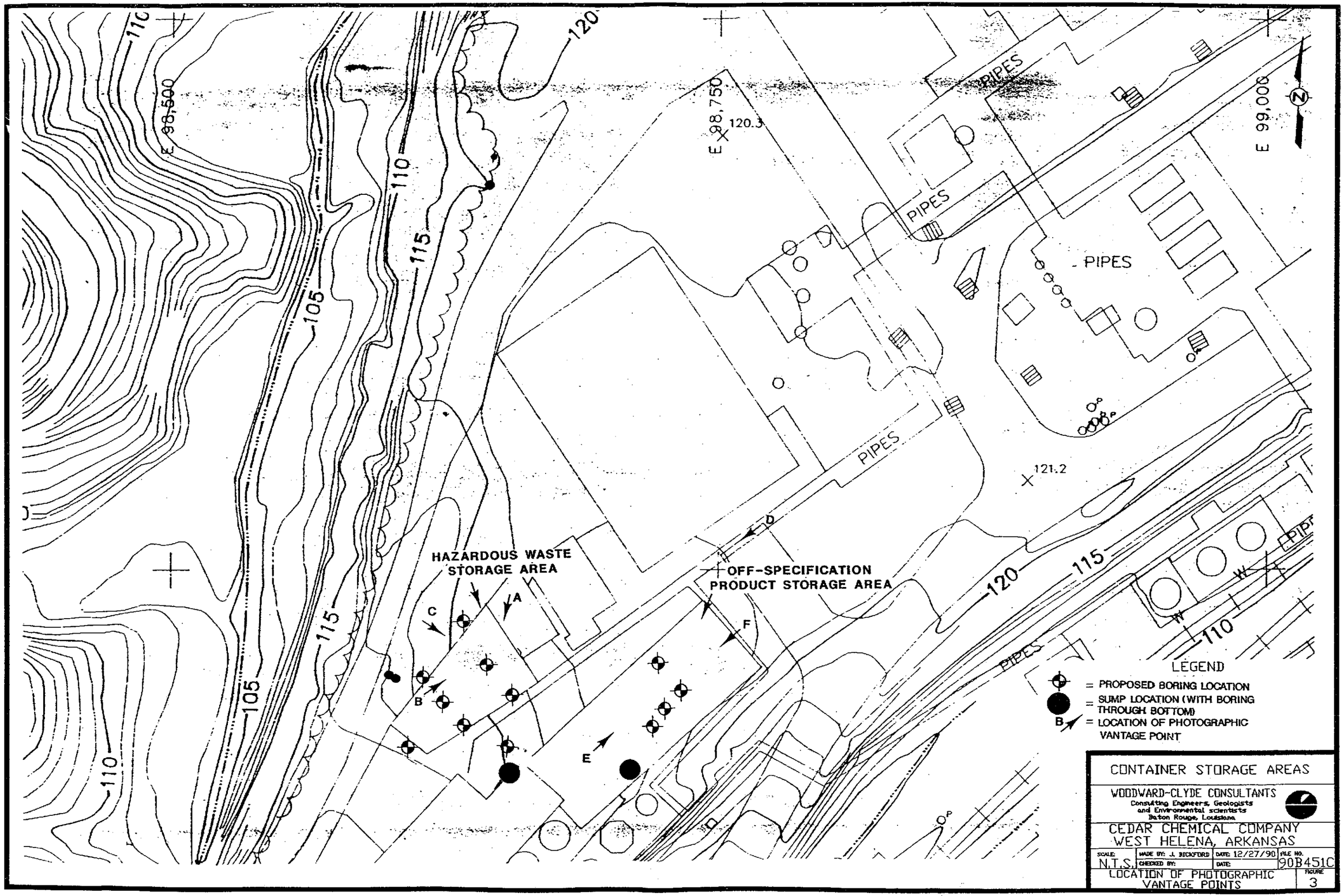
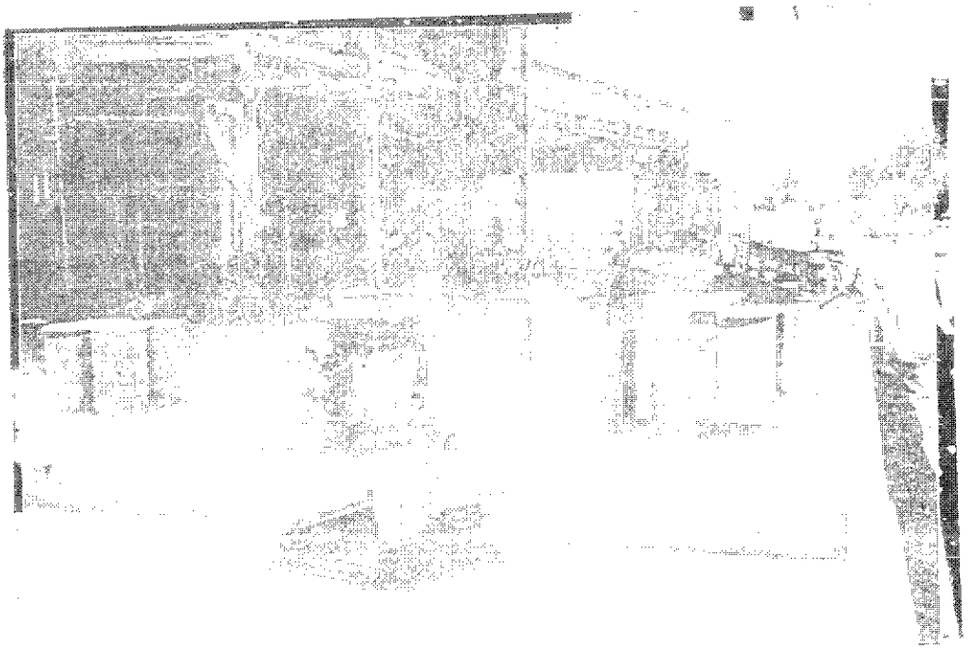
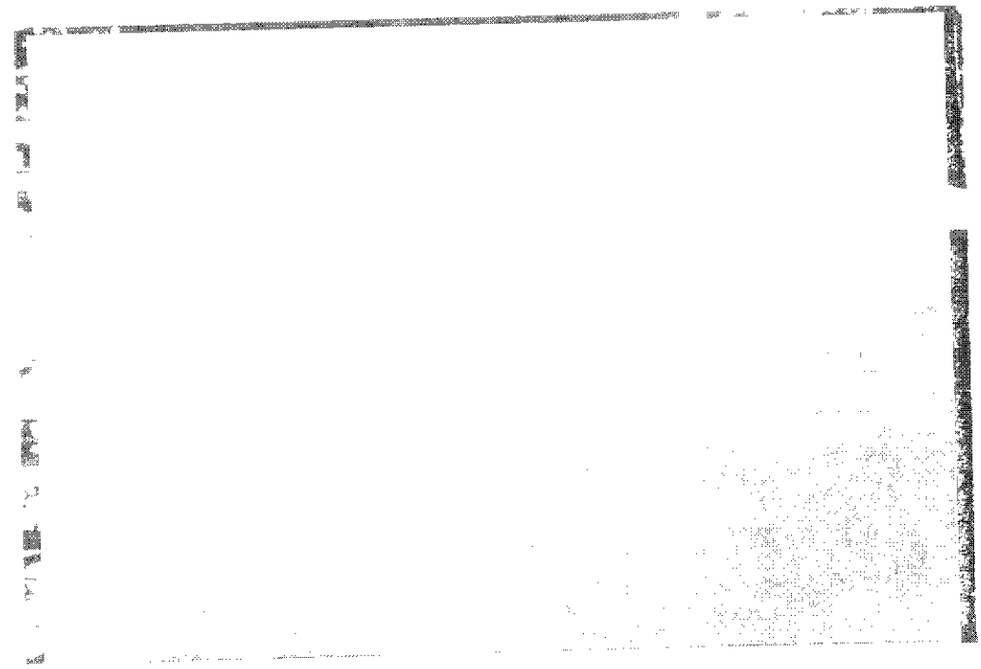

E 98,500
E 98,750
E 99,000
120.3
121.2
PIPES
PIPES
PIPES
PIPES
PIPES
PIPES
HAZARDOUS WASTE STORAGE AREA
OFF-SPECIFICATION PRODUCT STORAGE AREA
A
B
C
D
E
F
105
110
115
120
LEGEND
= PROPOSED BORING LOCATION
= SUMP LOCATION (WITH BORING THROUGH BOTTOM)
= LOCATION OF PHOTOGRAPHIC VANTAGE POINT
CONTAINER STORAGE AREAS
WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental scientists
Baton Rouge, Louisiana
CEDAR CHEMICAL COMPANY
WEST HELENA, ARKANSAS
SCALE: N.T.S.
MADE BY: J. BICKFORD
CHECKED BY:
DATE: 12/27/90
DATE:
FILE NO. 90B451C
LOCATION OF PHOTOGRAPHIC VANTAGE POINTS
FIGURE 3

FIGURE 4

PHOTOGRAPHS OF HAZARDOUS WASTE STORAGE AREA
(REFER TO FIGURE 3 FOR VANTAGE POINTS)



A



B

FIGURE 5
PHOTOGRAPHS OF HAZARDOUS WASTE STORAGE AREA
(REFER TO FIGURE 3 FOR VANTAGE POINTS)

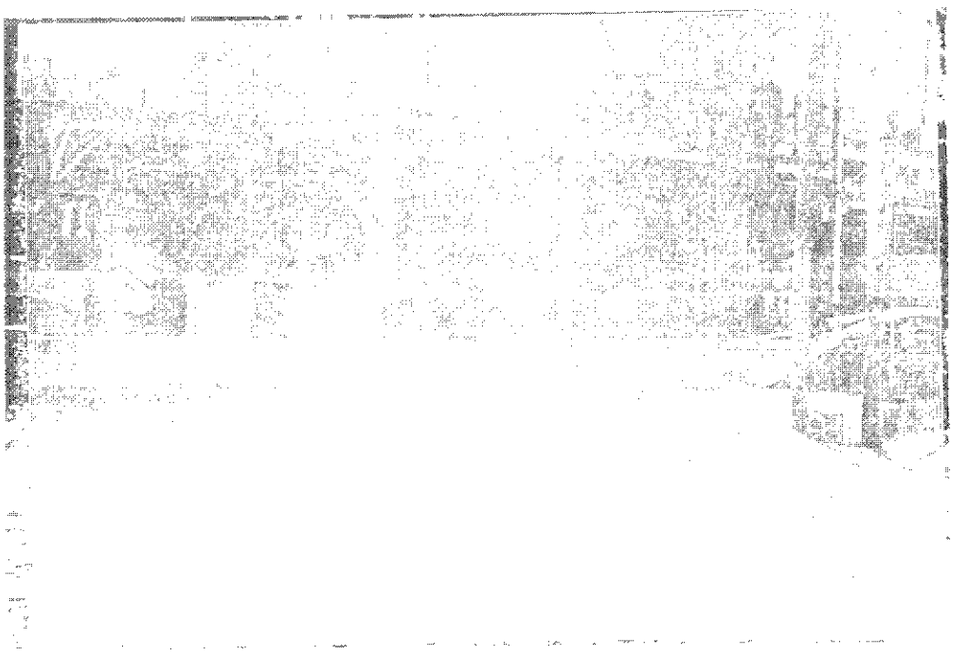


FIGURE 6

PHOTOGRAPHS OF OFF-SPECIFICATION
PRODUCT STORAGE AREA
(REFER TO FIGURE 3 FOR VANTAGE POINTS)

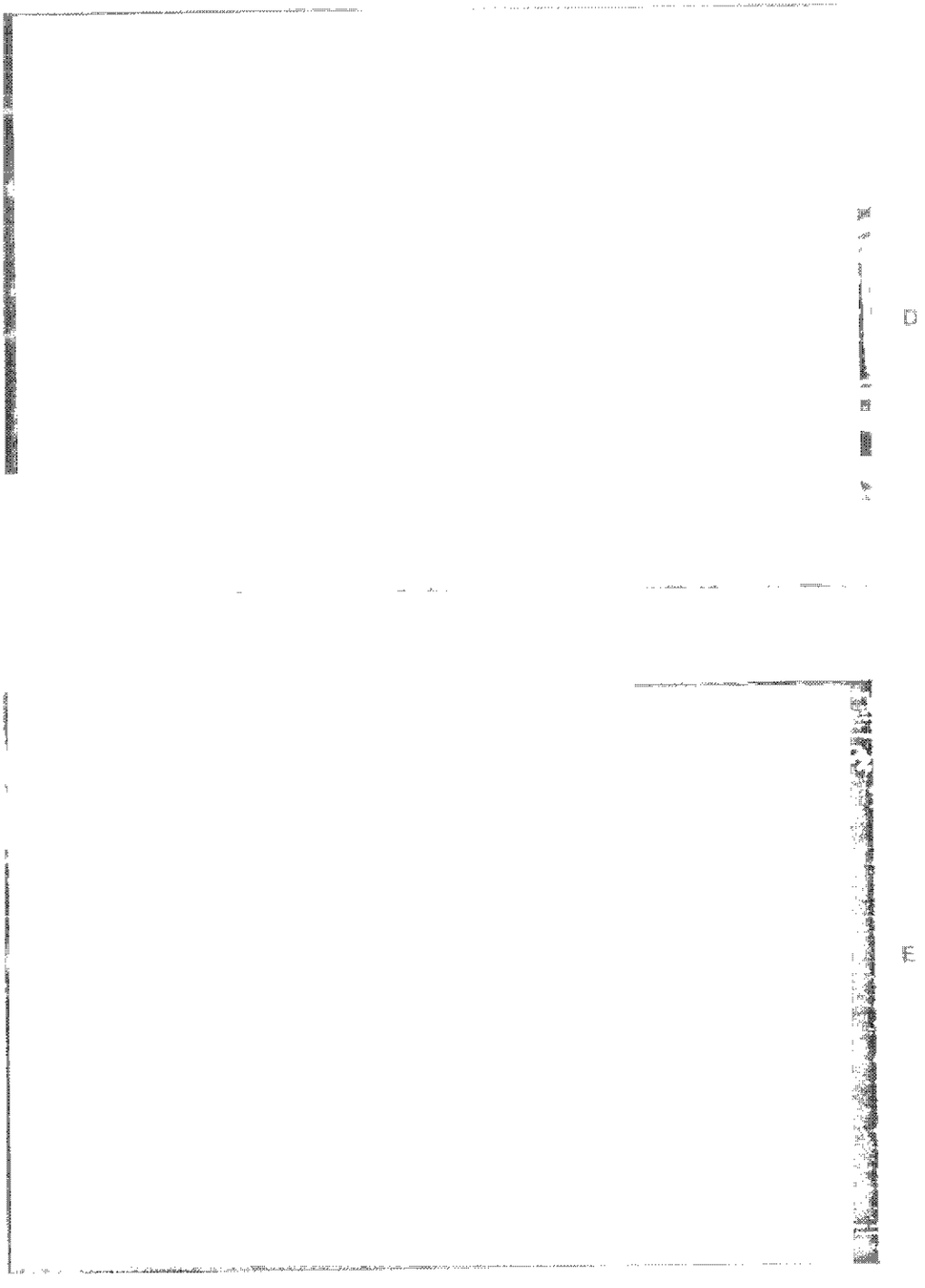


FIGURE 7

PHOTOGRAPHS OF OFF-SPECIFICATION

PRODUCT STORAGE AREA

(REFER TO FIGURE 3 FOR VANTAGE POINTS)

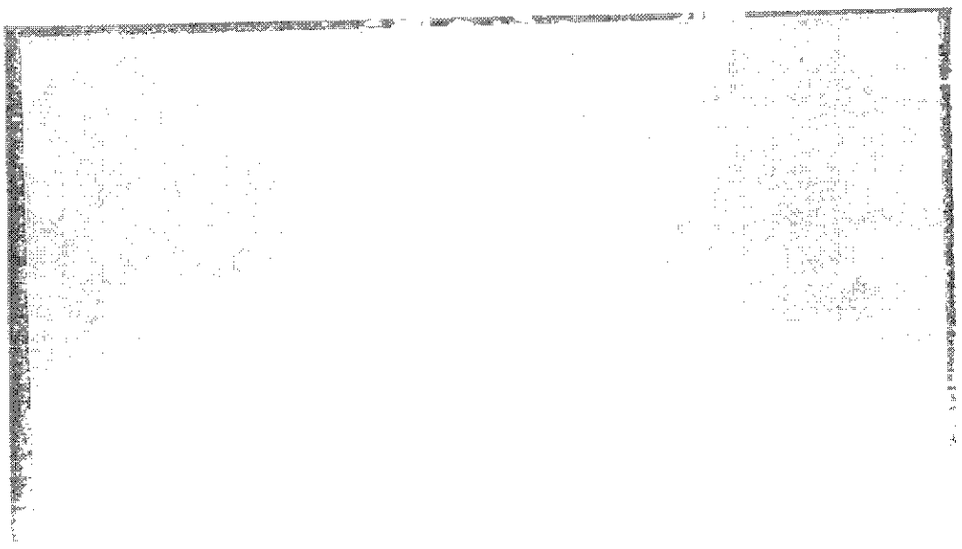


EXHIBIT A

CEDAR CHEMICAL DINOSEB TEST METHOD

Dinoseb in Soil - Spectrophotometric Method

A. Sample Preparation

1. Slurry 10 grams of soil in 100 mls of water in a 250 ml beaker.
2. Make alkaline to pH > 10 with NaOH.
3. Place stirring bar in beaker and stir for 15 minutes.
4. Filter slurry through glass fiber filter paper and wash with two successive 50 ml portions of water.
5. Make up to standard volume in volumetric flask.

B. Sample Analysis

1. Prepare a 10 ppm standard solution of Dinoseb from stock solution.
2. Dilute the 10 ppm standard 2:1 and 5:1 in clean volumetric glassware to give three concentrations for preparation of a standard curve.
3. Read the absorbances of the standards and plot the values to prepare the standard curve.
   a. Set the spectrophotometer at 380 nm wavelength.
   b. Prepare a blank by acidifying a portion of the unknown sample to pH 3 or less to remove color.
   c. Zero and span the instrument to 0 and 100 % transmittance with the blank and a light blocker.
   d. After reading the standards and preparing a standard curve, read the unknown sample. If the sample absorbance is too high, dilute a portion to a known volume and read again.
   e. Compare the absorbance of the unknown to the standards to determine the concentration of Dinoseb in extract from the soil sample. Adjust calculations for aliquoting.
   f. From the dry weight of the sample and the amount of Dinoseb in the extract, calculate the concentration in the soil sample.

This method is a suitable screen for the presence and general quantitation of Dinoseb. Interferences from other compounds having similar absorption curves is possible. More exact determinations should be made using gas-liquid chromatographic techniques.

EXHIBIT B

MATERIAL SAFETY DATA SHEETS FOR PRODUCTS

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

For latest data, consult manufacturer.

STREET ADDRESS
2100 Poplar Avenue

Prepared by: M. S. Bernard

Date: 5/27/86

CITY, STATE, ZIP CODE
Memphis, TN 38137

CHEMICAL NAME, TRADE NAME AND SYNONYMS
Toxaphene technical 90%

FORMULA OF PRIMARY COMPONENTS (STRUCTURAL)

$C_{10}H_{10}Cl_8$ 67-69% chlorine

Section 2 INGREDIENTS	%	TLV (units)
Active Ingredient: Chlorinated camphene	90.0	
Inert Ingredients: Xylene type solvents	10.0	

Section 3 PHYSICAL DATA

BOILING POINT (°F)	212	SPECIFIC GRAVITY (H_2O = 1)	1.525
VAPOR PRESSURE (mmHg at 20° C)	1	% VOLATILE BY VOLUME	10 @ 100°C
VAPOR DENSITY (air = 1)	N/A	COLOR AND ODOR	brown, chlorine
SOLUBILITY IN WATER	1ppm	PHYSICAL STATE	thick liquid

Section 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) °F 212°F. TCC

FLAMMABLE LIMITS STP L.F.L. N/D U.F.L. N/D

EXTINGUISHING MEDIA: WATER FOG [X] FOAM [ ] ALCOHOL FOAM [X] CO_2 [X] DRY CHEMICAL [ ] OTHER

SPECIAL FIRE FIGHTING PROTECTIVE EQUIPMENT
Self-contained air supply

UNUSUAL FIRE AND EXPLOSION HAZARDS
Noxious fumes (hydrogen chloride) produced under fire conditions.

Confine water used in fire fighting from entering water supplies.

Section 5 REACTIVITY DATA

STABILITY: Stable [X] FIRE CONDITIONS [ ]

CONDITIONS TO AVOID: May burn under extreme heat.

INCOMPATIBILITY (Materials to avoid): [ ] WATER [ ] ACID [ ] BASE [ ] CORROSIVE* [ ] OXIDIZING MATERIAL [ ] OTHER

HAZARADOUS DECOMPOSITION PRODUCTS
Noxious fumes under fire conditions. Hydrogen chloride and others.

CONDITIONS TO AVOID

10-26-90 14:00

Section 6 HEALTH HAZARD DATA

L INGESTION
igh single dose oral toxicity. LD50 male rats 69 mg/kg.

NTACT
derate irritation may occur.

J CONTACT
May cause moderate irritation.

S N ABSORPTION
bsorbed through skin, high toxicity. LD50 rats 1075 mg/kg.

ALATION (TLV OR SUGGESTED CONTROL FIGURE)
ACGIH TLV for toxaphene is 0.5mg/m³

ECTS OF OVEREXPOSURE
nausea, depression, convulsions, and death.

FIRST AID PROCEDURES
yes:Flush with water 30 minutes. Consult physician. Skin:Wash with soap and water 15 minutes.

Ingestion:Toxic by ingestion. Induce vomiting if victim is alert. Clear airway. Control

convulsions. Contact physician immediately.

Section 7 SPILL OR LEAK PROCEDURES

S TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
se proper safety equipment. Absorb spill with absorbent, inert material such as oil-sorb.

nike area for large spills. Keep out of streams and water supplies.

OSAL METHOD
Dispose of in non-crop areas away from water supplies or in an approved landfill

n accordance with State, Federal, and local regulations.

Section 8 SPECIAL PROTECTION INFORMATION

VENTILATION	LOCAL EXHAUST	SPECIAL
required	MECHANICAL (General) To control TLV of toxaphene	OTHER

PIRATORY PROTECTION (Specify Type)
None normally needed with adequate ventilation. During spraying use organic vapor respirator.

PROTECTIVE CLOTHING
Impervious gloves, boots, and apron, and clean body-covering clothing.

PROTECTION
☐ NOT NORMALLY NECESSARY ☐ SAFETY GLASSES WITHOUT SIDE SHIELDS ☐ SAFETY GLASSES WITH SIDE SHIELDS OR ☒ CHEMICAL WORKERS GOGGLES

☐ GAS TIGHT GOGGLES OR EQUIVALENT ☐ OTHER:

OTHER PROTECTIVE EQUIPMENT
Eye wash fountain and wash facilities at work area.

Section 9 SPECIAL PRECAUTIONS OR OTHER COMMENTS

CAUTIONS TO BE TAKEN IN HANDLING AND STORING
Do not get in eyes, on skin or on clothing. Keep out of reach of children.

ER PRECAUTIONS
Avoid breathing spray mists or vapors. Keep away from heat or flame.

xtremely toxic to fish, keep out of streams, lakes, and other bodies of water.

(REACY)

10-26-90 14:01

VERTAC CHEMICAL CORPORATION

MATERIAL SAFETY DATA SHEET

Section 1 NAME & PRODUCT

MANUFACTURER'S NAME
ac Chemical Corporation

ADDRESS
Poplar Avenue

CITY, STATE, ZIP CODE
is, TN 38137

For latest data, consult manufacturer.

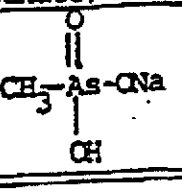
IN CASE OF EMERGENCY TELEPHONE
1-800-424-9300

Prepared by: M. S. Bernard

Date: 10/17/84

CHEMICAL NAME, TRADE NAME AND SYNONYMS
rtac MSMA 800, 8#/gal Monosodium Acid Methanearsonate, MSMA

FORMULA OF PRIMARY COMPONENTS (STRUCTURAL)



Section 2 INGREDIENTS

	%	TLV (units)
dium Acid Methane Arsonate	58.5	
Inert Ingredients	41.5	

Section 3 PHYSICAL DATA

BOILING POINT (°F)		SPECIFIC GRAVITY (H_2O = 1)	1.648
VAPOR PRESSURE (mmHg at 20° C)	Low	% VOLATILE BY VOLUME	40.7
VAPOR DENSITY (air = 1)	N/A	COLOR AND ODOR	Very light yellow
SOLUBILITY IN WATER	Miscible	PHYSICAL STATE	Clear Liquid

Section 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED)
Aqueous Solution - No Flash

FLAMMABLE LIMITS STP
L.F.L. U.F.L.

EXTINGUISHING MEDIA: WATER FOG [X] FOAM [X] ALCOHOL FOAM [X] CO_2 [X] DRY CHEMICAL [X] OTHER

SPECIAL FIRE FIGHTING PROTECTIVE EQUIPMENT
-contained breathing apparatus, chemical gloves and boots

UNUSUAL FIRE AND EXPLOSION HAZARDS
r EXTREME conditions such as strong acidic environment and strong heat, arsine gas (poisonous gas) may be produced.

Section 5 REACTIVITY DATA

STABILITY

CONDITIONS TO AVOID
Extreme heat and strong acid

FIRE CONDITIONS

INCOMPATIBILITY (Materials to avoid)
[ ] WATER [ ] ACID [ ] BASE [ ] CORROSIVE* [ ] OXIDIZING MATERIAL
[ ] OTHER

Section 6 HEALTH HAZARD DATA

NO...ICN Acute Oral LD50 Rats 1359mg/kg

...ACT Mild Irritant

...ACT Mild to none irritation, depending on individual's sensitivity.

...BSORPTION Not absorbed

...NTITLV OR SUGGESTED CONTROL FIGURE) Not normally a problem

...S OF OVEREXPOSURE Subacute: salty taste, burning in throat, colicky stomach pains. headache, vomiting, diarrhea, stupor, convulsions

...D PROCEDURES Eyes: flush with water. Consult physician if irritation persists. Wash with soap and water. Oral Ingestion: empty stomach by vomiting or ...ion. Lavage with 3 liters isotonic saline. BAL (Dimeroaprol) is antidotal; ...er in 3mg/kg body weight every 4 hours.

Section 7 SPILL OR LEAK PROCEDURES

TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

spill and transfer to suitable container. Absorb remaining free liquid with ...bant.

...ETHOD

local pollution control authorities or EPA office.

Section 8 SPECIAL PROTECTION INFORMATION

...ATION	LOCAL EXHAUST	SPECIAL
	Not normally required	
	MECHANICAL (General)	OTHER

...RY PROTECTION (Specify Type)

...ally required

...IVE CLOTHING

...loves, boots, chemical goggles

...CTION NORMALLY ...ESSARY ☐ SAFETY GLASSES WITHOUT SIDE SHIELDS ☒ SAFETY GLASSES WITH SIDE SHIELDS OR ☐ CHEMICAL WORKERS GOGGLES

...TIGHT GOGGLES EQUIVALENT ☐ OTHER:

...OTECTIVE EQUIPMENT

...equired

Section 9 SPECIAL PRECAUTIONS OR OTHER COMMENTS

...ONS TO BE TAKEN IN HANDLING AND STORING

...ndard procedures for chemical handling

...ECAUTIONS

...ay from foods, feeds, seeds, fertilizers, insecticides, and fungicides.

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.: 56077-5

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137

Emergency Phone Number: 1-800-424-9300
Information Phone Number: 1-601-636-1251
Prepared by: M. S. Bernard

SECTION II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

INGREDIENT	OSHA PEL	ACGIH TLV	PERCENT
Dinoseb Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	95.00
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, CO_2, 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. LD_{50} 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. LD_{50} 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.

ergency 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.

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

DATE: 4/20/89 PAGE 1

PRODUCT NAME: POTATO TOP KILLER 300

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137, USA

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
Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-76	n/d	0.3mg/m³	30.2
Toluene CAS # 108-88-3	200ppm	100ppm	

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	above 212	Specific Gravity	approx 0.990	Vapor Density(Air=1)	n/d
Vapor Pressure(mmHg.)	below 20	Evaporation Rate	n/d	Melting point	n/a
Solubility in Water:	Emulsifiable				
Appearance and Odor	Brown liquid. Organic acid odor.				

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 84°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media: Water Fog, Foam, CO_2, and Dry Chemical
Special Fire Fighting Procedures: Self contained air supply recommended. Confine water used in fire fighting.
Unusual Fire and Explosion Hazards: Noxious fumes (Oxides of Nitrogen) may form. Vapors may ignite. Dinoseb undergoes rapid exothermic decomposition at 190°C.

SECTION V REACTIVITY DATA

Stability: Stable in normal use and storage.
Conditions to Avoid: Heating above 100°C. Avoid ignition sources. Product undergoes rapid exothermic decomposition at 190°C.
Incompatibility: Strong Acids and Strong Oxidizers.
Hazardous Decomposition By-products: 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
Ingestion: Highly Toxic
Skin: Readily Absorbed

Continued on page 2.

Health Hazards(Acute and Chronic): Oral Ingestion: High single dose toxicity. Acute Oral LD_{50} (rats) 58 mg/kg for Dinoseb.

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. Stains skin yellow.

Skin Absorption: Readily absorbed through skin. highly toxic. Dermal LD_{50} (guinea pigs) 100-200 mg/kg for Dinoseb.

Inhalation: May be irritating. Control vapor or dust levels to recommended levels for Dinoseb and Toluene.

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

Signs and symptoms of Exposure: Yellow stained skin. Increased body temperature and metabolic rate. fatigue, sweating, and thirst.

Medical Conditions Generally Aggreveted by Exposure: None known.

Emergency and First Aid Procedures:

Oral Ingestion: Toxic by ingestion. Induce vomiting then give 2 teaspoons of baking soda in water and seek medical help immediately.

Eye Contact: Flush immediately with continuous irrigation of water for at least 30 min. Seek medical consultation immediately. Stain for evidence of corneal injury. Treat if injuried by instilling antibotic steriod preparation frequently.

Skin Contact: Promptly wash skin with plenty of soap and water for a least 15 min. while removing contaminated clothing. Consult physician. Wash clothing before reuse.

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

NOTE TO PHYSICIAN: No known antidote. Treat symptomatically. Keep patient quient in cool place. If feverish, cool with cold compresses or by immersion in cool water.

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps To Be Taken In Case Material Is Released or Spilled:
Use proper safety equipment. Sweep-up material with the aid of an inert absorbant material such as oil-dry. Keep out of streams and water supplies. Contact Chemtrec for assistence.

Waste Disposal Method:
Incineration is recommended. Check with regulatory authorities for landfill disposal regulations.

Precautions To Be Taken in Handling and Storage:
Do not get on skin, on clothing, or in eyes. Keep out of reach of children.

Other Precautions:
Avoid breathing vapors. Keep away from flame.

SECTION VIII CONTROL MEASURES

Respiratory Protection: None normally needed. During use and handling use dust mask or respirator as conditions warrant.

Ventilation: Recommended to control TLV of Dinoseb and Toluene.

Protective Gloves: Impervious rubber gloves.

Eye Protection: Chemical worker's goggles or full face shield.

Other Protective Clothing or [illegible] body-covering clothing

Work [illegible]

THE INFORMATION HEREIN IS [illegible] NO WARRANTY, EXPLICIT OR IMPLIED.

Chemical Name

Common Name

Manufacturer

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

PRODUCT NAME: PREMERGE 3 DATE: 08/15/86 PAGE 1
EPA REG. NO.: 56077-13

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137

Emergency Phone Number: 1-800-424-9300
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 Alkanolamine Salts Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	50.70
Methanol CAS # 67-56-1	200ppm	200ppm	15.00

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	above 212	Specific Gravity	1.130
Vapor Pressure(mm Hg.)	50	Melting Point(°F)	n/a
Vapor Density(Air=1)	n/a	Evaporation Rate	n/d

Solubility in Water: Infinite
Appearance and Odor: Brown liquid, sweet alcohol odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 85°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO_2, 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. Meterial 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 Avoid ignition sources.
Incompatibility: Strong Acids 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: Moderate Single Dose Oral Toxicity. LD_{50} Male Rats 170 mg/kg, Female Rats 130 mg/kg. May be fatal if swallowed. May cause blindness.
Eye Contact: May cause severe irritation and corneal injury, possible permanent impairment of vision.
Skin Contact: May cause slight irritation, colors skin yellow.
Skin Absorption: Readily absorbed through skin, high toxicity.
Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m³. ACGIH TLV for methanol is 200ppm.

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

Signs and Symptoms of Exposure:
Fatigue, sweating, thirst, and fever (due to Dinoseb) plus optic nerve injury and blindness, CNS depression, drunkenness, nausea, anesthesia, and vomiting (due to methanol).

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 impairment of vision.
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 TLV of methanol.

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.

Chemical Name

Common Name

Manufacturer

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

DATE: 08/15/86 PAGE 1

PRODUCT NAME: PREMERGE PLUS
EPA REG. NO.: 56077-16

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137

Emergency Phone Number: 1-800-424-9300
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 Sodium Salt Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	11.50
Naptalam Sodium Salt Naptalam (N-1-naphthylphthalamic acid) CAS # 132-66-1	n/d	n/d	22.30

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	188	Specific Gravity	1.150
Vapor Pressure(mm Hg.)	12	Melting Point(°F)	n/a
Vapor Density(Air=1)	n/a	Evaporation Rate	0.24
Solubility in Water:	Infinite		
Appearance and Odor:	Brown liquid, sweet odor		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): above 212°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO_2, 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. Dinoseb 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. Dinoseb undergoes rapid exothermic decomposition at 190°C. Avoid ignition sources.
Incompatibility: Strong Acids 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: Absorbed
Ingestion: Moderate Toxicity

Health Hazards (Acute and Chronic):
Oral Ingestion: Moderate Single Dose Oral Toxicity. LD_{50} Male Rats 232 mg/kg. May be fatal if swallowed.
Eye Contact: May cause moderate irritation and non-permanent corneal injury.
Skin Contact: May cause slight irritation. stains skin yellow.
Skin Absorption: Readily absorbed through skin. moderate toxicity. LD_{50} Rabbits above 400mg/kg.
Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m^3.

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

Signs and Symptoms of Exposure:
Yellow staining of skin. profuse sweating. thirst. fever. excessive fatigue. and hypothermia.

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.
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 vapor levels to guidelines.

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.

Chemical Name

Common Name

Manufacturer

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

PRODUCT NAME: SELECTIVE WEED KILLER DATE: 08/15/86 PAGE 1
EPA REG. NO.: 56077-11

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137
Emergency Phone Number: 1-800-424-9300
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 Ammonium Salt Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	13.70
Isopropanol CAS # 67-56-1	400ppm	400ppm	

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	175	Specific Gravity	0.860
Vapor Pressure(mm Hg.)	35	Melting Point(°F)	n/a
Vapor Density(Air=1)	n/a	Evaporation Rate	n/d

Solubility in Water: Infinite
Appearance and Odor: Brown liquid, alcohol odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 66°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO_2, 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 Acids 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: Moderate Toxicity

Health Hazards (Acute and Chronic):
- Oral Ingestion: Moderate Single Dose Oral Toxicity. LD_{50} Male Rats 205 mg/kg, Female Rats 178 mg/kg. May be fatal if swallowed.
- Eye Contact: May cause moderate irritation and corneal injury.
- Skin Contact: May cause slight irritation, colors skin yellow.
- Skin Absorption: Readily absorbed through skin, moderate toxicity. LD_{50} Rabbits 212mg/kg.
- Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m^3. ACGIH TLV for isopropanol is 400ppm.

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

Signs and Symptoms of Exposure:
Yellow staining of skin, profuse sweating, thirst, fever, excessive fatigue, and hypothermia.

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

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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 vapor levels to guidelines.

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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CLOSURE PLAN

HAZARDOUS WASTE CONTAINER STORAGE AREA
OFF-SPECIFICATION PRODUCT STORAGE AREA

SOUTH PLANT

CEDAR CHEMICAL CORPORATION
VICKSBURG CHEMICAL DIVISION

for:

Cedar Chemical Corporation
Memphis, Tennessee

January 1991

Woodward-Clyde Consultants

Consulting Engineers, Geologists, and Environmental Scientists
2822 O'Neal Lane, Baton Rouge, LA 70896

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A	Cedar Chemical Dinoseb Test Method
B	Material Safety Data Sheets for Products

1.0 INTRODUCTION

This workplan defines the activities to be executed by Cedar Chemical Corporation at its facility in Vicksburg, Mississippi pursuant to closure of a container storage area. The workplan or closure plan is consistent with RCRA rules and regulations.

1.1 Description of the South Plant

The Vicksburg Chemical Division of Cedar Chemical Corporation is located in Warren County, Mississippi along the Mississippi River immediately on the south limits of the City of Vicksburg. (See Figure 1). The address is:

Cedar Chemical Corporation

Vicksburg Chemical Division

Post Office Box 3

Rifle Range Road

Vicksburg, Mississippi 39180

The facility is a manufacturer of chemicals. The plant site is divided physically and functionally into a "north plant" and a "south plant". The north plant is primarily a manufacturer of potassium nitrate and additionally manufactures by-products chlorine and nitrogen tetroxide. The south plant formerly manufactured chlorinated pesticides and nitrogen based herbicides. The South Plant presently manufacturers nitric acid, which is used entirely as a raw material in the north plant.

The south plant contained the manufacturing operations for production of the following products:

- o Atrazine
- o Toxaphene
- o Dinitrobutyl phenol (dinoseb)
- o Monosodium methane arsenate

1.2 History of the South Plant

All pesticide plants were shut down by 1986 and have been partially dismantled. Any non-deminimus spills from toxaphene would have been handled as a hazardous waste (P123). The monosodium methane arsenate plant generated listed RCRA waste K031, a by-product salt. The by-product salt cake was directly discharged into a "roll-off sludge container". When the container was full (2-4 days) it was transported by a hazardous waste transporter to a hazardous waste landfill. The plant was designed such that there was intended to be no effluent with all spills, etc. retained and recycled to the process.

The dinitrobutyl phenol (Dinoseb) plant produced process wastewater that was hazardous by virtue of characteristic (D002). The waste was pumped to 1-3 day storage and was transported by a hazardous waste transporter to off-site disposal by hazardous waste deep well injection. At times the manufactured process wastewater was neutralized with ammonia and pumped to a 1.6 million gallon storage tank. The water did not exhibit the characteristic of a hazardous waste at this time and was pumped through activated carbon prior to discharged to the 3 million gallon surface impoundment.

The hazardous waste container storage area and off-specification product storage area were in operation from 1976 to 1986 (Figure 2). The hazardous waste container storage area stored contaminated debris, trash and waste product material in 55-gallon drums. The off-

specification product storage area stored 55-gallon drums and 5-gallon pails of product returned from clients which could be put back into the manufacturing process and recovered.

1.3 Description of the Container Storage Area's

The two container storage areas which are to be closed are two distinct sections or area's of a continuous concrete area in the South Plant. This area is a six-inch (minimum) poured 3,000 psi reinforced concrete slab with sumps, curbs, containment areas (See Figure 2).

The hazardous waste container storage stored trash and debris contaminated with products or byproducts produced at the South Plant. This area also stored off-specification product which could not be reclaimed or recycled into new product. These wastes were typically stored in 55-gallon drums. The area is trapezoid in shape, approximately 30 feet by 46 feet by 14 feet by 40 feet. Photographs and maps of the area have been included as Figures 3, 4 and 5.

The off-specification product storage area is a covered area immediately adjacent to the hazardous waste storage area but separated by curbs. This is a 2,000 Square Foot area roughly 28 feet by 70 feet which stored off-specification product until it could be returned to the manufacturing process and recycled into new product. This area stored an assortment of 55-gallon drums, and 5-gallon pails and 1 gallon containers. Photographs and maps of the area have been included as Figures 3, 6 and 7.

1.4 Description of Wastes Stored

The container storage area's stored off-specification products, waste products or trash and debris contaminated with the following chemical compounds:

Toxaphene	(P123)
Dinitrobutyl phenol (dinoseb)	(P020)
Monosodium Methane Arsenate (MSMA)	(K031)

2.0 CLOSURE PERFORMANCE STANDARD

This closure plan is based upon closure of both container storage areas with no wastes or contamination remaining in place above the health based action levels published by the EPA for corrective action at hazardous waste management facilities. These health based clean-up action levels are described in the Friday, July 27, 1990 Federal Register for toxaphene and arsenic. From "Appendix C- Range of Concentrations for Establishing Media Protection Standards for Carcinogens", the range for toxaphene is soil is from 0.6 ppm to 60.0 ppm. From "Appendix A - Examples of Concentrations Meeting Criteria for Action Levels", the reading for arsenic in soils is 80.0 ppm. Health based clean-up action levels are also described in Volume 1 of the RCRA Facility Investigation Guidance Document. From Table 8-7 "Health Based Criteria for Systemic Toxicants", the reading for Dinoseb in soil in 80.0 ppm. Appropriate tables from these documents are attached to this plan. This closure plan is intended to result in a "clean" closure which will eliminate the need for post-closure maintenance and care. The levels of clean-up will be used for the soils underneath the concrete pad and immediately adjacent to the pad.

This closure plan also calls for concrete surface to be hydroblasted and water from that activity to be tested as a determinant of whether the concrete is clean. The concrete will be judged to be clean when the concentrations of arsenic and toxaphene are less than the primary drinking water standards. The standard for arsenic is 0.05 ppm and the standard for toxaphene is 0.005 ppm. Since Dinoseb is not a parameter in the primary drinking water standards the Table 8-7 "Health Based Criteria for Systemic Toxicants" and the reading for Dinoseb in water will be used; that concentration is 0.040 ppm.

3.0 CLOSURE ACTIVITIES

3.1 Waste Inventory Removal

No waste is stored for more than 90 days. There is very little use of the site at present.

3.2 Pad and Equipment Decontamination

Decontamination of the container storage area will be performed in the manner that is described below.

All surfaces, the pad surface and containment curbing, will be cleaned utilizing a hydroblaster. Heavy duty plastic sheeting will be wrapped around the outside of the section of the container storage area being hydroblasted by attaching the plastic sheeting to supports temporarily assembled for the purpose. A barrier, covered by heavy-duty plastic sheeting, will also be placed across the open end of the container storage area to confine the water that will be generated. The pad will be cleaned three times and vacuumed up by a shop vacuum or equivalent.

The water from the cleaning operations will be disposed of onsite. The water will be transported by truck to the Cedar activated carbon wastewater treatment facility. The water will be pumped directly through the activated carbon and will not enter the surface impoundment. The treated water will be discharged to the Mississippi River under the Cedar NPDES permit.

The heavy duty plastic sheeting and any other solids generated during the decontamination operations will be sampled by wipe test and then placed in a 55-gallon drum. Alternatively the plastic sheeting can be triple rinsed. If necessary, the drum will be disposed of as a hazardous waste at a RCRA regulated treatment/disposal facility.

Decontamination of the hydroblaster used in cleaning the container storage area will not be necessary because it will not come into contact with any waste since the waste has been contained in closed 55-gallon drums. The interior of the shop vacuum or equivalent equipment will be triple cleaned. The water will be collected and treated as described in the previous paragraph.

3.3 Contaminated Soil Removal

If soil field analysis indicates high levels of contamination then the concrete in the area of that sample will be removed. The contaminated soil will be exposed and excavated for offsite disposal.

3.4 Proof of Decontamination

3.4.1 Water Sample Collection Procedures. Samples of final hydroblast will be obtained by placing a sample bottle in the water and letting the bottle fill. Care will be taken to avoid disturbing the water by agitation which could introduce excess oxygen. The VOA bottles will be completely filled to eliminate any air space, and they will be immediately capped after filling. Each sample label will contain the following information:

- Sample number,
- Sample location,
- Sample depth (if applicable),
- Date/time of collection, and
- Sampler's initials.

3.4.2 Soil Sampling. To confirm that no leaks have occurred, the following procedures will be employed to sample the soil for contamination under the concrete pad. At each of the

fourteen proposed sample locations, eleven are located over cracks and adjacent to the sumps (See Figure 2). For those locations located over concrete, a concrete saw or jack-hammer and oxy-acetylene torch will be used to cut and remove a small section or plug of the concrete pad. Additionally, two samples of concrete from the concrete removed in the hazardous waste container storage area will be submitted for separate analysis with the soil samples.

Samples of soil underneath the concrete will be taken utilizing a 1-inch diameter butyrate plastic liner encased in a 2-foot long stainless steel soil probe. A stainless steel soil probe is attached to extension rods and will be driven six inches into the soil by a hammer attachment. Following the removal of the soil probe, the butyrate liners containing the sample will be extracted from the soil probe. The soil sample will be extruded and transferred to sample bottles, approximately labeled, and placed on ice for transport to the laboratory. If the soil probe is unable to obtain a representative sample then a hand auger will be employed. All equipment will be cleaned in accordance with decontamination procedures before collection each sample.

All equipment will initially be decontamination before use and again after each sample is collected. The following decontamination procedures will be employed:

- Washing in a detergent solution
- Rinsing with clean water (distilled)
- Rinsing with methanol
- Rinsing with clean water (distilled)

After decontaminating, the sample equipment will be wrapped in a visqueen cover for protection until its subsequent use. All wash fluids will be containerized for later disposal by Cedar Chemical in their activated carbon wastewater treatment process as previously described.

3.5 Documentation of Sample Acquisition

Additionally, all information pertinent to field observations and sampling will be recorded in the logbook with consecutively numbered pages. Entries in the logbook will include at least the following:

- Sketch of the container storage area with measurements
- A grid of the site area
- Purpose of Sampling
- Number and approximate volume of samples taken
- Exact location of sampling point on grid
- Description of sampling point
- Date and time of collection
- Collector's sample identification number(s)
- References, such as maps or photographs of the sampling site
- Field observations
- Weather conditions

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

Proper sample preservation is important in retaining the sample characteristics prior to analysis. Sample preservation is documented on the chain-of-custody form and also in the field logbook. The proposed analytical methods required that the sample be kept on ice until transferred to the laboratory.

Once the sample has been transferred to appropriate laboratory sample container, sample tags will be completed and affixed to the sa sample container.

3.5.1 Sample Tagging. Each sample will be tagged and sealed properly immediately after collection. Sample tags are necessary to prevent misidentification of samples. The tag will include at least the following information:

- Name of collection
- Date and time of collection
- Place of collection
- Collector's sample number, which uniquely identifies the sample

An example of a sample tag that will be used is shown in Figure 3.

3.5.2 Chain-of-custody. In addition in the field logbook, each sample will be recorded on a chain-of-custody record. An identifying code will be assigned to each sample and this code will be used on the chain-of-custody and in the logbook to ensure that the sample description is identifiable. A brief description of the sampling point will also be placed on the chain-of-custody form.

Chain-of-custody forms will become the permanent records of all sample handling and shipment. If standard sampling procedures are not used, a written justification of each deviation will be placed in the project file. Upon completion of sampling, the sample will be prepared for shipment in accordance with the applicable sampling instruction, including preservation, labeling, and logging.

The person collecting a sample will initiate document(s) at the source of sample and start the chain-of-custody procedure.

The sample will be kept in limited access or locked storage at the proper temperature until custody is relinquished from the site and formal documentation of the transfer is completed.

Upon each transfer of custody, the person involved will verify sample numbers and condition and will document the sample acquisition and transfer. The field sampler will properly package the samples, indicate and shipping, obtain documentation of the shipment, such as certified mail receipt or bill of lading number, and sample identification records (one of each with the shipment, one of each by mail to the laboratory, and one of each returned with field records).

On transfer of custody of the samples to the transport agency, the field sample custodian will sign and retain a copy of the chain-of-custody, witness the transport company custody signature, and sent two copies of the chain-of-custody with the samples. On arrival at the laboratory, the sample custodian will sign for custody and return a copy of the completed chain-of-custody to Cedar Chemical. Custody procedures will then proceed according to the procedures of the selected testing laboratory.

3.5.3 Evaluation of Sampling Results. The analytical results from Cedar Chemical's sampling efforts will be summarized and evaluated for subsequent review by MBPC. The raw data will be included as an appendix to the report submitted.

3.5.4 Analytical Methods and Parameters. Cedar Chemical proposes to use its onsite laboratory when possible. This laboratory will analyze for Dinoseb, and arsenic. Toxaphene will be analyzed in an offsite laboratory. These parameters were chosen because these were the main products manufactured at the south plant and arsenic is a toxic heavy metal which was part of monosodium methane arsenate. Methods for the field analysis of Dinoseb are not found in SW-846 but copies of methods which Cedar Chemical intends to use are included as Exhibit A. A summary of the parameter and method is as follows:

Toxaphene	EPA SW-846, Method 625
Dinitrobutyl Phenol (Dinoseb)	See Exhibit A — check w/ Bottle. Mt
Arsenic	EPA SW-846, Method 7060

3.6 Equipment Decontamination

Any equipment that has some in direct contact with the material in the storage areas will be deemed contaminated. The waste materials handled are not corrosive, reactive or ignitable. However, special personnel protective equipment will be used and precautions taken when necessary. Product Material Safety Data Sheets are included as Exhibit B.

3.7 Site Restoration

Upon completion of the work the holes will be filled with concrete.

4.0 FINAL REPORT AND CERTIFICATION

After the container storage areas have been decontaminated and any contaminated soil removed Cedar Chemical will submit a final report to the MDEQ for review. This report will contain analytical results from sampling, site investigation information and a draft certification of closure.

Upon approval by the MDEQ that the closure is complete, Cedar Chemical will submit a certification of closure signed by an independent engineer registered in the State of Mississippi. This is a clean closure, therefore, no notice is required for the local land authority.

5.0 CLOSURE COST ESTIMATE

The proposed closure cost estimate provided in Table 1 is based on removal of any contamination in the concrete pad and removal of concrete at fourteen sampling locations for soil testing then disposing any material in a permitted offsite facility.

6.0 CLOSURE SCHEDULE

The "Clean Closure" will be accomplished within 180 days of the date of approval of this plan by the MDEQ.

7.0 CONTINGENT CLOSURE PLAN

In the event that it is not possible to meet the clean closure performance standards, a contingent closure plan will be adopted. The contintgent closure plan will call for the concrete surfaces to be painted with a concrete sealant and four monitor wells be installed surrounding the hazardous waste storage area and the off-specification returned drum storage area. All shall be accomplished within 180 days of the closure schedule.

TABLES

TABLE 1

PROPOSED CLOSURE COST ESTIMATE

Item	Unit Cost	Quantity	Subtotal
Concrete Pad Decontamination			
Mobilization			500.00
Temporary framing			1,000.00
Hydroblasting	2,000/day	2	4,000.00
Laboratory Analysis Onsite (1)	N/A	N/A	
Removal of Concrete Plugs	500/day	2	1,000.00
Transportation and Disposal	500/ton	1	500.00
Laboratory Analysis Offsite (2)	350	16	5,600.00
Site Restoration	500/day	1	500.00
Closure Report and Sampling Results and			---
Regulatory Liason and Certification by Registered Engineer	800/day	3	2,400.00
Project Management			
Subject contractor including site visits	800/day	3	2,400.00
Project Liason	800/day	2	1,600.00
Transportation and Expenses			2,000.00
15% Contingency			3,000.00
		(Estimated) TOTAL	24,500.00

(1) Cedar Chemical intends to use its onsite laboratory for rapid field analysis

(2) Cedar will use an offsite laboratory for decontamination confirmatory analysis

Table 8-7. (continued)[1]

Constituent	CAS No.	RfD[2] (mg/kg/day)	Soil (mg/kg)	Water (µg/l)	Air (µg/m³)
Dichlorodifluoro-methane	75-71-8	2E-01	2E+04	7E+03	–
1,1-Dichloroethylene	75-35-4	9E-03	7E+02	See MCL	–
Dichloromethane (Methylene chloride)	75-09-2	6E-02	5E+03	2E+03	–
2,4-Dichlorophenol	120-83-2	3E-03	2E+02	1E+02	1E+01
1,3-Dichloropropene	26952-23-8	3E-04	2E+01	1E+01	–
Dieldrin	60-57-1	5E-05	4E+00	2E+00	–
Diethyl phthalate	84-66-2	8E-01	6E+04	3E+04	–
Dimethoate	60-51-5	2E-02	2E+03	7E+02	–
2,4-Dinitrophenol	51-28-5	2E-03	2E+02	7E+01	7E+00
Dinoseb	88-85-7	1E-03	8E+01	4E+01	–
Diphenylamine	127-39-4	3E-02	2E+03	1E+03	–
Disulfoton	298-04-4	4E-05	3E+00	1E+00	–
Endosulfan	115-29-7	5E-05	4E+00	2E+00	2E-01
Endothal	145-73-3	2E-02	2E+03	7E+02	–
Endrin	72-20-8	3E-04	2E+01	See MCL	1E+00
Ethylbenzene	100-41-4	1E-01	8E+03	4E+03	–
Heptachlor	76-44-8	5E-04	4E+01	2E+01	–
Heptachlor epoxide	1024-57-8	1E-05	8E-01	4E-01	–
Hexachlorobuta-diene	87-68-3	2E-03	2E+02	7E+01	–
Hexachlorocyclo-pentadiene	77-47-4	7E-03	6E+02	2E+02	–
Hexachloroethane	67-72-1	1E-03	8E+01	4E+01	–
Hydrogen cyanide	74-90-8	2E-02	2E+03	7E+02	–
Hydrogen sulfide	7783-06-4	3E-03	2E+02	1E+02	–
Isobutyl alcohol	78-83-1	3E-01	2E+04	1E+04	1E+03
Isophorone	78-59-1	2E-01	2E+04	7E+03	–
Lindane (hexa-chlorocyclohexane)	58-89-9	3E-04	2E+01	See MCL	–
Maleic hydrazide	108-31-6	5E-01	4E+04	2E+04	–
Methacrylonitrile	126-98-7	1E-04	8E+00	4E+00	–
Methomyl	16752-77-5	3E-02	2E+03	1E+03	–
Methyl ethyl ketone	78-93-3	5E-02	4E+03	2E+03	–
Methylisobutyl-ketone	108-10-01	5E-02	4E+03	2E+03	–

Note: These criteria are subject to change and will be confirmed by the regulatory agency prior to use.

APPENDIX C—RANGE OF CONCENTRATIONS FOR ESTABLISHING MEDIA PROTECTION STANDARDS FOR CARCINOGENS—Continued

Constituent name	Class	MaxAir (ug/m 3)	MinAir (ug/m 3)	Max-Water (mg/L)	MinWater (mg/L)	MaxSoil (mg/kg)	MinSoil (mg/kg)
Styrene	C						
1,1,1,2-Tetrachloroethane	C	1E+01	1E-01	1E-01	3E+03	3E+03	3E+01
1,2,4,5-Tetrachlorobenzene	D						
1,1,1,2-Tetrachloroethane	C	1E+01	1E-01	1E-01	1E-03	3E+03	3E+01
1,1,2,2-Tetrachloroethane	C	2E-00	2E-02	2E-02	2E-04	4E+02	4E-00
Tetrachloroethylene	B2	1E+02	1E-00	7E-02	7E-04	1E+03	1E+01
2,3,4,6-Tetrachlorophenol	D						
Tetraethyl lead	D						
Tetraethyldithiopyrophosphate	D						
Thallic oxide	D						
Thallium acetate	D						
Thallium carbonate	D						
Thallium chloride	D						
Thallium nitrate	D						
Thallium sulfate	D						
Thiosemicarbazide	D						
Thiram	D						
Toluene	D						
Toxaphene	B2	3E-01	3E-03	3E-03	3E-05	6E+01	6E-01
1,2,4-Trichlorobenzene	D						
1,1,1,Trichloroethane	D						
1,1,2-Trichloroethane	C	6E-00	6E-02	6E-02	6E-04	1E+03	1E+01
Trichloroethylene	B2			3E-01	3E-03	6E+03	6E+01
Trichloromonofluoromethane	D						
2,4,5-Trichlorophenol	D						
2,4,6-Trichlorophenol	B2	2E+01	2E-01	2E-01	2E-03	4E+03	4E+01
2 4,5-Trichlorophenoxyacetic acid	D						
1,2,3-Trichloropropane	D						
Vanadium pentoxide	D						
Xylenes	D						
Zinc cyanide	D						
Zinc phosphide	D						

Appendix D: Recommended Exposusre Assumptions for Use in Deriving Action Levels

(Sections 264.521 (a)(2); (b); (c)(3); and (d))

1. In deriving action levels for hazardous constituents in ground-water, assume a water intake of 2 liters/day for 70 kg adult/70 year lifetime exposure period.

2. In deriving action levels for hazardous constituents in air, assume air intake of 20 cubic meters/day for 70 kg adult/70 year lifetime exposure period.

3. In deriving action levels for hazardous constituents in soil, which are known or suspected to be carcinogens, assume soil intake of 0.1 gram/day for 70 kg adult/70 year lifetime exposure period.

4. In deriving action levels for hazardous constituents in soil, other than those which are known or suspected to be carcinogens, assume soil intake of 0.2 gram/day for 16 kg child/5 year exposure period (age 1–6).*

5. In deriving action levels for hazardous constituents in surface water designated by the State for use as a drinking water source, assume a water intake of 2 liters/day for 70 kg adult/70 year lifetime exposure period, unless intake of aquatic organisms is also of concern.

*Not to be averaged over a 70-year lifetime.

Appendix E: Examples of Calculations of Action Levels

I. Governing Equations for Calculating Action Levels

A. *Systemic Toxicants*

$C_m = (RfD * W)/(I * A)$

where:

C_m = action level in medium (units are medium-dependent);
RfD = reference dose (mg/kg/day);
W = body weight (kg);
I = intake assumption (units are medium-dependent); and
A = absorption factor [1] (dimensionless).

B. *Carcinogenic Constituents*

$C_m = [R * W * LT]/[CSF * I * A * ED]$

where:

C_m = action level in medium (units are medium-dependent);
R = assumed risk level (dimensionless) (10^{-6} for class A & B; 10^{-5} for class C carcinogens);
W = body weight (kg);
LT = assumed lifetime (years);
CSF = carcinogenic slope factor (mg/kg/day)$^{-1}$;
I = intake assumption (units are medium-dependent);
A = absorption factor (dimensionless); and
ED = exposure duration (years).

[1] Assumed to be 1 for this appendix, based upon the assumption that the human absorption rate will be the same as the rate in the study upon which the RfD or CPF was developed.

II. Example Calculations for Hazardous Constituents in Air

A. *Systemic Toxicants*

Example calculation for 2,4-dinitrophenol:

$C_a = [0.002\ (mg/kg/d) * 1000\ (\mu g/mg) * 70(kg)]/[20\ (m^3/d) * 1] = 7.0\ \mu g/m^3$

where:

C_a = action level in air ($\mu g/m^3$)
RfD = 0.002 mg/kg/day
W = 70 kg adult
I = 20 m^3/day
A = 1

B. *Carcinogenic Constituents*

Example calculation for 1,1,2,2-tetrachloroethane:

$C_a = [10^{-6} * 1000\ (\mu g/mg) * 70\ (yrs) * 70\ (kg)]/[0.20\ (mg/kg/day)^{-1} * 20\ (m^3/day) * 1 * 70\ (yrs)] = .175\ \mu g/m$

where:

C_a = action level in air ($\mu g/m^3$)
R = 10^{-5} (1,1,2,2-Tetrachloroethane is a Class C carcinogen)
W = 70 kg adult
LT = 70 year lifetime
CSF = 0.20 $(mg/kg/day)^{-1}$
I = 20 m^3/day
A = 1
ED = 70 year exposure duration

III. Sample Calculation for Hazardous Constituents in Water

A. *Systemic Toxicants*

Sample calculation for toluene:

$C_w = [0.30\ (mg/kg/day) * 70\ (kg)]/[2\ (L/day) * 1] = 10.5\ mg/L$

where:

C_w = action level in water (mg/L)

develop and conduct these further Regulatory Impact Analyses.

The new analyses will be conducted in accordance with the existing Agency guidance on Regulatory Impact Analysis and the draft Regulatory Impact Analysis Guidance published in the 1988 Regulatory Program of the United States. The analyses will explicitly examine the costs, health and environmental benefits, and technological limitations for the key regulatory requirements contained in the proposal—especially for the several alternative approaches to ground water remediation outlined in the proposed rule. This analysis will also estimate the aggregate impacts, identified above, for sites eligible for remediation under this rule and for those sites which are listed on the NPL, and will, therefore, look to this rule as an ARAR, under the provisions of CERCLA. Upon completion of the revised analyses, EPA will solicit comment on the results of the analyses and the methodology used to derive them. The Agency will then assess these comments, along with comments which will have been received previously on the proposed rule. Through these actions EPA will ensure that the net social benefits (including environmental and health benefits) of the rule proposed today are maximized, taking into account costs, technological limitations, risks, and realistic assessments of both actual and reasonably expected uses of each site. If the revised RIA, together with the comments received, demonstrate that the rule proposed today does not achieve this outcome, the Agency will make appropriate modifications to the final rule, or if necessary, will repropose the rule.

B. Regulatory Flexibility Act

The Regulatory Flexibility Act requires Federal agencies to fully analyze the economic effects of regulations on small entities. The Agency analyzed the economic impacts for the regulatory options that are most similar to today's proposed rule (*i.e.*, "Immediate Cleanup to Health-Based Standards" and "Flexible Cleanup to Health-Based Standards").

The RIA assumes that a small business is significantly impacted if its excess of cash flow over ten percent of its total liabilities is insufficient to meet corrective action costs, or if its net income is insufficient to meet its corrective action costs.

For the alternative analyzed, it was found that small firms encounter more severe impacts from the corrective action requirements than large firms. The options most similar to the proposed rule result in incremental impacts (*i.e.*, relative to the baseline) on approximately 9 to 11 percent of small businesses owning RCRA facilities.

Based on the Agency's guidelines for implementing the Regulatory Feasibility Act, the results of the analysis as summarized above, suggest that the proposed rule does not impose significant impacts on small entities.

C. Paperwork Reduction Act

The information collection requirements in this proposed rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* Reporting and recordkeeping burden on the public for this collection is estimated at 42,497 hours for the 674 respondents, with an average of 1.151 hours per response. (Burden estimates should include all aspects of the collection effort and may include time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, completing and reviewing the collection of information. *etc.*)

If you wish to submit comments regarding any aspect of the collection of information, including suggestions for reducing the burden, or if you would like a copy of the information collection request (please reference ICR #1451), contact Rick Westlund, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460 (202-382-2745); and Tim Hunt, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

List of Subjects in 40 CFR Parts 264, 265, 270, and 271

Administrative practice and procedure, Corrective action, Hazardous waste; Insurance, Reporting and recordkeeping requirements.

Dated: July 5, 1990.

William Reilly,

Administrator.

XI. Supplementary Documents

APPENDIX A.—EXAMPLES OF CONCENTRATIONS MEETING CRITERIA FOR ACTION LEVELS

[Section 264.521(a)(2)(i-iv)]

Constituent name	Class	Air(ug/m^3)	Water (mg/L)	Soils (mg/kg)
Acetone	D		4E-00	8E+03
Acetonitrile	D		2E-01	5E+02
Acetophenone	D	2E-01	4E-00	6E+03
Acrylamide	B2	8E-04	8E-06	2E-01
Acrylonitrile	B1	1E-02	6E-05	1E-00
Aldicarb	D		5E-02	1E+02
Aldrin	B2	2E-04	2E-06	4E-02
Allyl alcohol	D		2E-01	4E+02
Aluminum phosphide	D		1E-02	3E+01
Aniline	B2		6E-03	1E+02
Antimony	D		1E-02	3E+01
Arsenic	A	7E-05	(1)	8E+01
Asbestos (2)	A	2E-02		
Barium cyanide	D		2E-00	6E+03
Barium, ionic	D	4E-01	(1)	4E+03
Benzidine	A	2E-05	2E-07	3E-03
Beryllium	B2	4E-04	8E-06	2E-01
Bis(2-ethylhexyl)phthlate	B2		3E-03	5E+01
Bis(chloroethyl)ether	B2	3E-03	3E-05	6E-01
Bromodichloromethane (3)	B2		3E-05	5E-01
Bromoform (3)	D		7E-01	2E+03
Bromomethane	D	3E+01	5E-02	1E+02
Butyl benzyl phthalate	C		7E-00	2E+04

Woodward-Clyde Consultants

CHAIN-OF-CUSTODY-RECORD

COLLECTOR'S SAMPLE NUMBERS:

SAMPLE COLLECTION:

Location of Sample: _____

Project Number and Name: _____

Collector's Name: _____ Telephone: ( )

Company Name: _____

Address: _____

Witness: _____ Company Name: _____

Date Sampled: _____ Time: _____

FIELD INFORMATION

Type of Sample: Liquid Gas Sludge Soil Other (Specify) _____

Container Size: _____ Container Type: _____

Field Notes: _____

Transporter: _____ Airbill/Invoice: _____

SAMPLE TRANSFER (Original must be retained with sample at all times)

1.	Relinquished by:	(Name)	(Organization)	(Date/Time)
	Received by:	(Name)	(Organization)	(Date/Time)
2.	Relinquished by:	(Name)	(Organization)	(Date/Time)
	Received by:	(Name)	(Organization)	(Date/Time)
3.	Relinquished by:	(Name)	(Organization)	(Date/Time)
	Received by:	(Name)	(Organization)	(Date/Time)

TERMINATION OF CHAIN-OF-CUSTODY:

Authorized by: _____ Date: _____ Time: _____

Company Name: _____

Sample Disposition: Storage _____ Disposal _____ Other _____

FIGURE 4.

EXAMPLE OF SAMPLE TAG

SAMPLE I.D. [ ]

PROJECT NUMBER _____

PROJECT NAME _____

EXACT SAMPLING LOCATION _____

FIELD TESTS	MATERIAL SAMPLED		PRESERVATIVE	
OVA	SOLID WASTE	☐	NONE	☐
pH	LIQ. WASTE	☐	ICE	☐
SALINITY	SOIL	☐	H_2SO_4	☐
S. COND.	G. WATER	☐	HNO_3	☐
TEMP.	S. WATER	☐	OTHER	☐
OTHER	OTHER	☐		

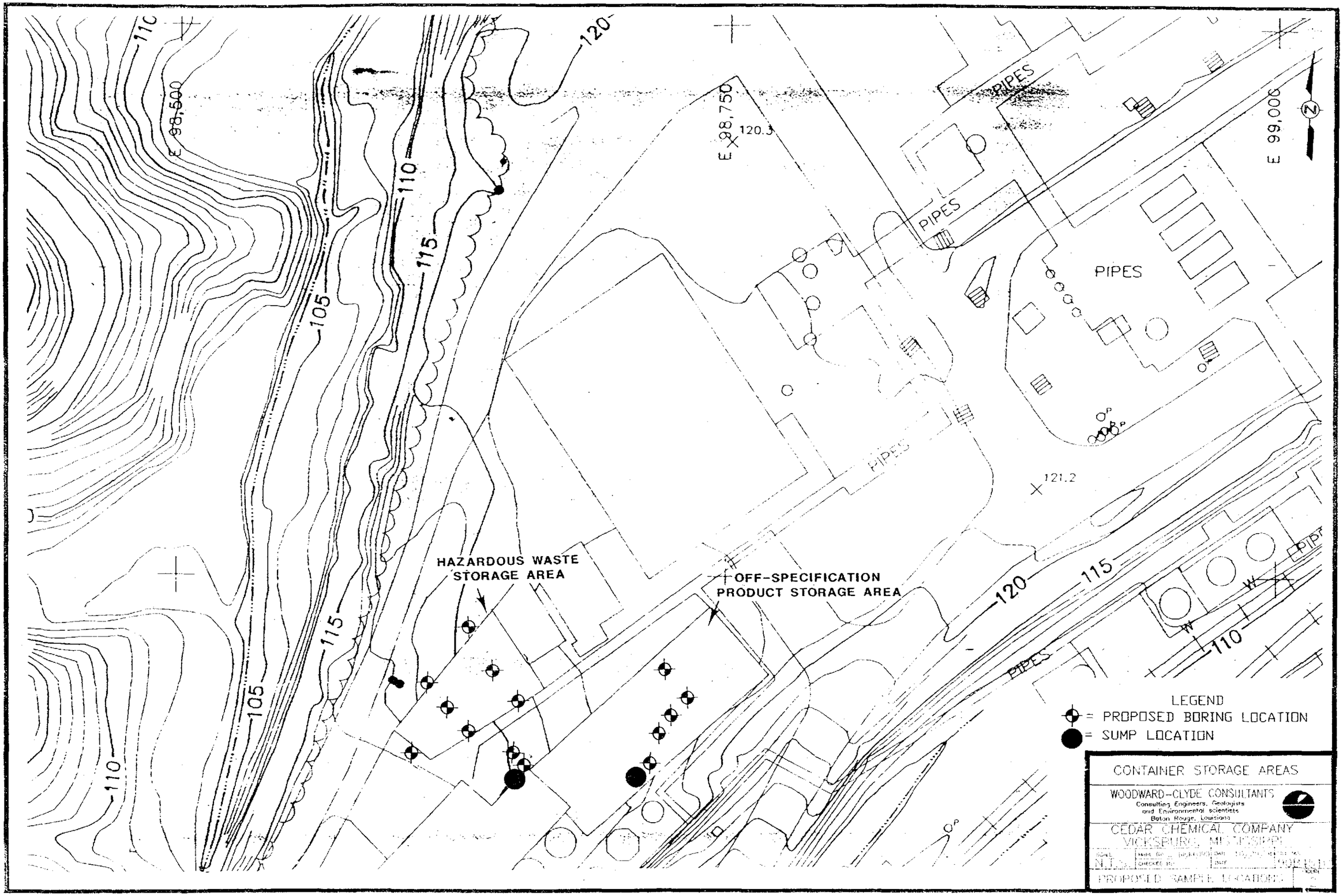
REMARKS _____

WEATHER _____ TIME _____

SIGNATURE _____ DATE _____

FIGURE 3.

FIGURES


E 98,500
E 98,750
E 99,000
120.3
121.2
PIPES
PIPES
PIPES
PIPES
PIPES
PIPES
105
110
115
120
HAZARDOUS WASTE
STORAGE AREA
OFF-SPECIFICATION
PRODUCT STORAGE AREA
LEGEND
= PROPOSED BORING LOCATION
= SUMP LOCATION
CONTAINER STORAGE AREAS
WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists
and Environmental scientists
Baton Rouge, Louisiana
CEDAR CHEMICAL COMPANY
VICKSBURG, MISSISSIPPI
PROPOSED SAMPLE LOCATIONS

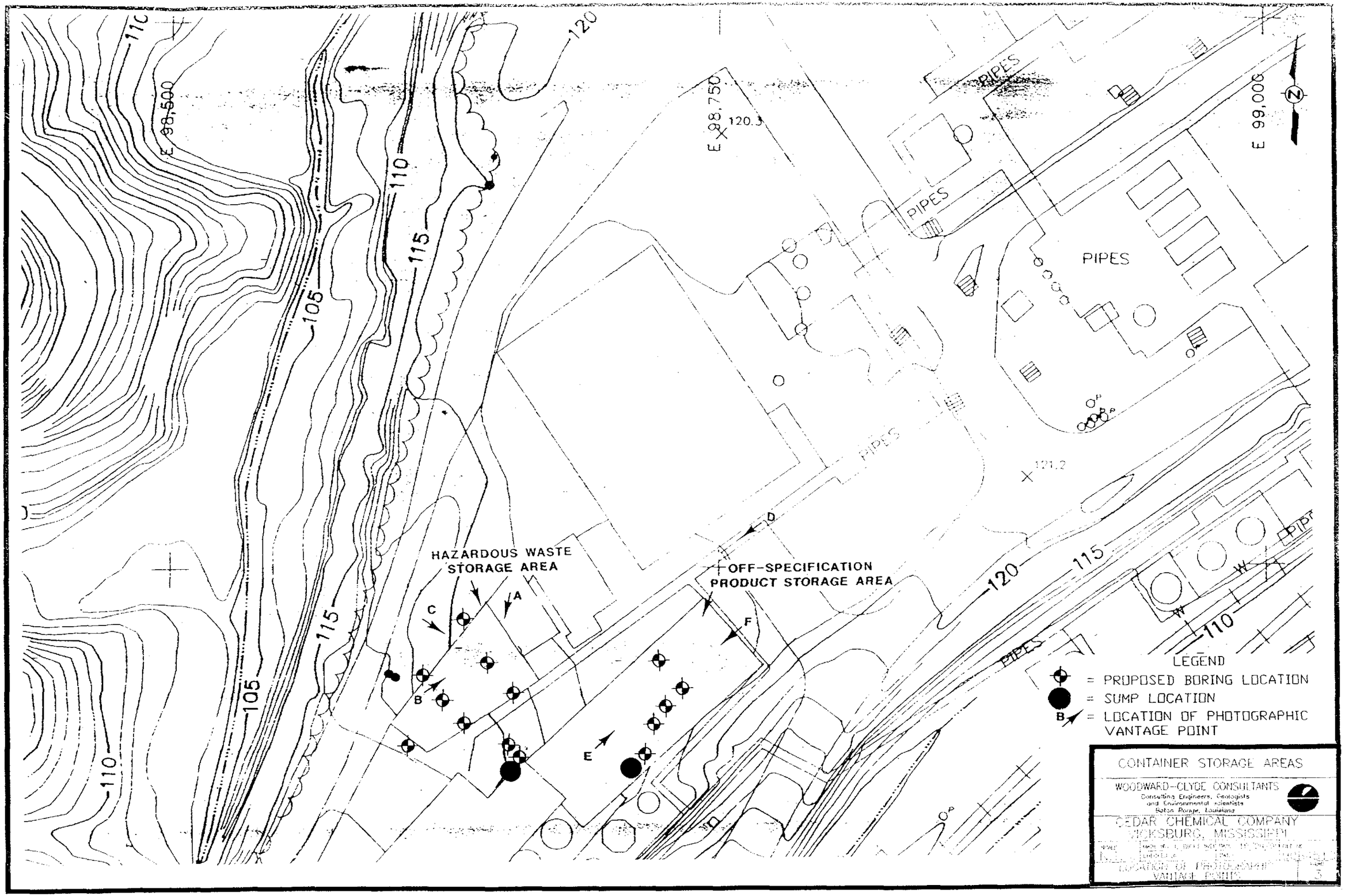

E 98,500
E 98,750
E 99,000
120.3
121.2
PIPES
PIPES
PIPES
PIPES
PIPES
PIPES
110
115
120
105
HAZARDOUS WASTE
STORAGE AREA
OFF-SPECIFICATION
PRODUCT STORAGE AREA
A
B
C
D
E
F
LEGEND
= PROPOSED BORING LOCATION
= SUMP LOCATION
= LOCATION OF PHOTOGRAPHIC VANTAGE POINT
CONTAINER STORAGE AREAS
WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists
Baton Rouge, Louisiana
CEDAR CHEMICAL COMPANY
VICKSBURG, MISSISSIPPI
LOCATION OF PHOTOGRAPHIC VANTAGE POINTS
3

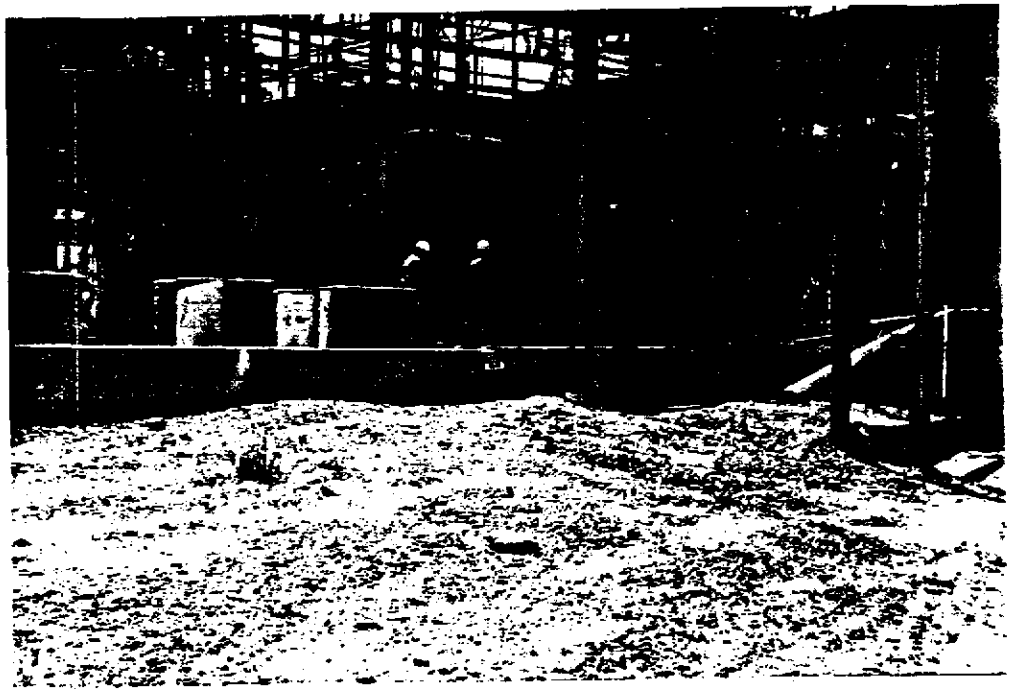
FIGURE 4

PHOTOGRAPHS OF HAZARDOUS WASTE STORAGE AREA
(REFER TO FIGURE 3 FOR VANTAGE POINTS)

A

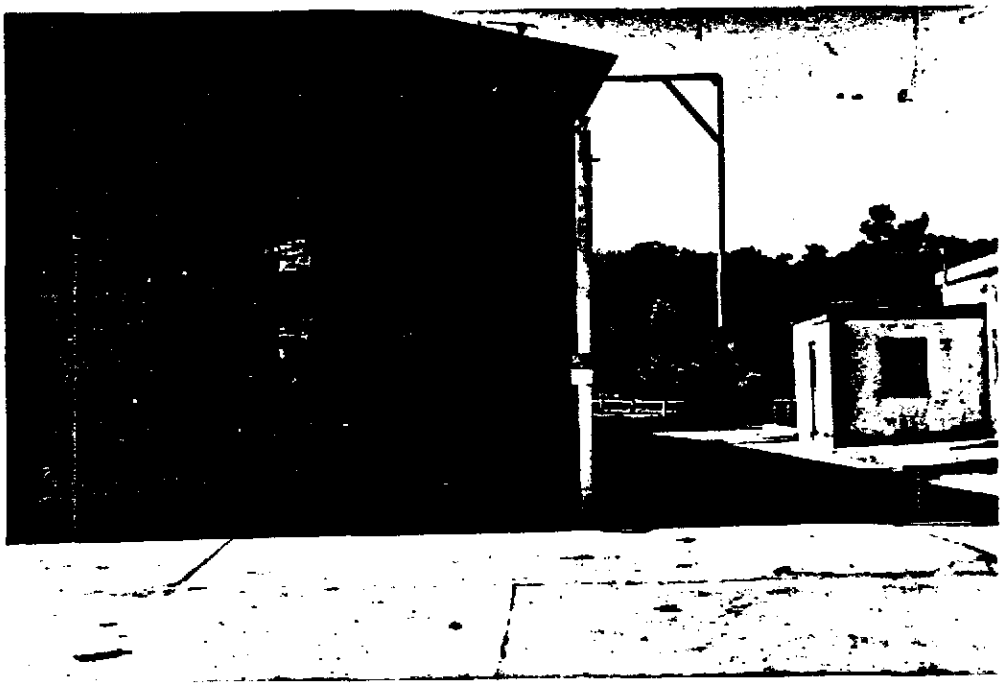
B

FIGURE 5
PHOTOGRAPHS OF HAZARDOUS WASTE STORAGE AREA
(REFER TO FIGURE 3 FOR VANTAGE POINTS)

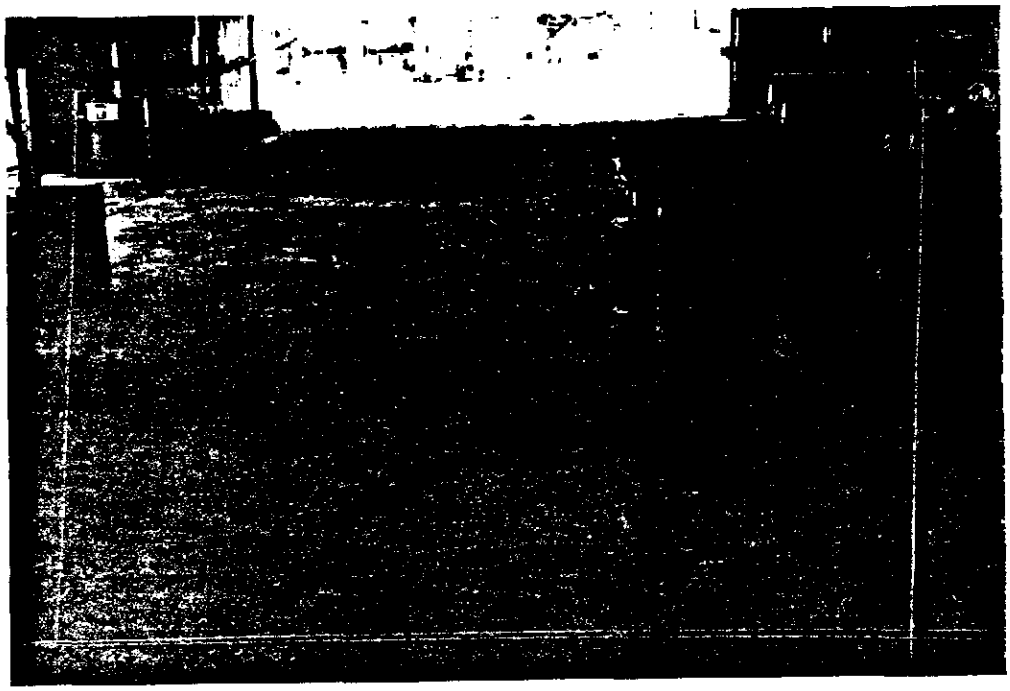


C

FIGURE 6
PHOTOGRAPHS OF OFF-SPECIFICATION
PRODUCT STORAGE AREA
(REFER TO FIGURE 3 FOR VANTAGE POINTS)



D



E

FIGURE 7
PHOTOGRAPHS OF OFF-SPECIFICATION
PRODUCT STORAGE AREA
(REFER TO FIGURE 3 FOR VANTAGE POINTS)

F

EXHIBIT A

CEDAR CHEMICAL DINOSEB TEST METHOD

10/20/98 15:35 CEDAR CHEMICAL VICKSBURG DIV. 002

Dinoseb in Soil - Spectrophotometric Method

A. Sample Preparation

1. Slurry 10 grams of soil in 100 mls of water in a 250 ml beaker.
2. Make alkaline to pH > 10 with NaOH.
3. Place stirring bar in beaker and stir for 15 minutes.
4. Filter slurry through glass fiber filter paper and wash with two successive 50 ml portions of water.
5. Make up to standard volume in volumetric flask.

B. Sample Analysis

1. Prepare a 10 ppm standard solution of Dinoseb from stock solution.
2. Dilute the 10 ppm standard 2:1 and 5:1 in clean volumetric glassware to give three concentrations for preparation of a standard curve.
3. Read the absorbances of the standards and plot the values to prepare the standard curve.
   a. Set the spectrophotometer at 380 nm wavelength.
   b. Prepare a blank by acidifying a portion of the unknown sample to pH 3 or less to remove color.
   c. Zero and span the instrument to 0 and 100 % transmittance with the blank and a light blocker.
   d. After reading the standards and preparing a standard curve, read the unknown sample. If the sample absorbance is too high, dilute a portion to a known volume and read again.
   e. Compare the absorbance of the unknown to the standards to determine the concentration of Dinoseb in extract from the soil sample. Adjust calculations for aliquoting.
   f. From the dry weight of the sample and the amount of Dinoseb in the extract, calculate the concentration in the soil sample.

This method is a suitable screen for the presence and general quantitation of Dinoseb. Interferences from other compounds having similar absorption curves is possible. More exact determinations should be made using gas-liquid chromatographic techniques.

EXHIBIT B

MATERIAL SAFETY DATA SHEETS FOR PRODUCTS

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

For latest data, consult manufacturer.

STREET ADDRESS: 5100 Poplar Avenue

CITY, STATE, ZIP CODE: Memphis, TN 38137

Prepared by: M. S. Bernard

Date: 5/27/86

CHEMICAL NAME, TRADE NAME AND SYNONYMS: Toxaphene technical 90%

FORMULA OF PRIMARY COMPONENTS (STRUCTURAL)

$C_{10}H_{10}Cl_8$ 67-69% chlorine

Section 2 INGREDIENTS

	%	TLV (units)
Active Ingredient: Chlorinated camphene	90.0	
Inert Ingredients: Xylene type solvents	10.0	

Section 3 PHYSICAL DATA

BOILING POINT (°F)	212	SPECIFIC GRAVITY (H_2O = 1)	1.525
VAPOR PRESSURE (mmHg at 20° C)	1	% VOLATILE BY VOLUME	10 @ 100°C
VAPOR DENSITY (air = 1)	N/A	COLOR AND ODOR	brown, chlorine
SOLUBILITY IN WATER	1ppm	PHYSICAL STATE	thick liquid

Section 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) °F: 212°F. TCC

FLAMMABLE LIMITS STP: L.F.L. N/D U.F.L. N/D

EXTINGUISHING MEDIA: WATER FOG [X] FOAM [ ] ALCOHOL FOAM [X] CO_2 [X] DRY CHEMICAL [ ] OTHER

SPECIAL FIRE FIGHTING PROTECTIVE EQUIPMENT: Self-contained air supply

UNUSUAL FIRE AND EXPLOSION HAZARDS: Noxious fumes (hydrogen chloride) produced under fire conditions.

Confine water used in fire fighting from entering water supplies.

Section 5 REACTIVITY DATA

STABILITY: Stable [X] FIRE CONDITIONS [ ]

CONDITIONS TO AVOID: May burn under extreme heat.

INCOMPATIBILITY (Materials to avoid): [ ] WATER [ ] ACID [ ] BASE [ ] CORROSIVE* [ ] OXIDIZING MATERIAL [ ] OTHER

HAZARADOUS DECOMPOSITION PRODUCTS: Noxious fumes under fire conditions. Hydrogen chloride and others.

CONDITIONS TO AVOID

Section 6 HEALTH HAZARD DATA

...L INGESTION
...single dose oral toxicity, LD50 male rats 69 mg/kg.

EY...TACT
...oderate irritation may occur.

...N CONTACT
May cause moderate irritation.

S...N ABSORPTION
...bsorbed through skin, high toxicity. LD50 rats 1075 mg/kg.

INHALATION (TLV OR SUGGESTED CONTROL FIGURE)
ACGIH TLV for toxaphene is 0.5mg/m³

E...ECTS OF OVEREXPOSURE
...ausea, depression, convulsions, and death.

FIRST AID PROCEDURES
...yes:Flush with water 30 minutes. Consult physician. Skin:Wash with soap and water 15 minutes.

Ingestion:Toxic by ingestion. Induce vomiting if victim is alert. Clear airway. Control

...onvulsions. Contact physician immediately.

Section 7 SPILL OR LEAK PROCEDURES

S...PS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
...se proper safety equipment. Absorb spill with absorbent, inert material such as oil-sorb.

...ike area for large spills. Keep out of streams and water supplies.

...OSAL METHOD
...ispose of in non-crop areas away from water supplies or in an approved landfill

...n accordance with State, Federal, and local regulations.

Section 8 SPECIAL PROTECTION INFORMATION

...VENTILATION	**LOCAL EXHAUST**	**SPECIAL**
	MECHANICAL (General)	**OTHER**
...Required	To control TLV of toxaphene	

...PIRATORY PROTECTION (Specify Type)
None normally needed with adequate ventilation. During spraying use organic vapor respirator.

...PROTECTIVE CLOTHING
...mpervious gloves, boots, and apron, and clean body-covering clothing.

...L PROTECTION
☐ NOT NORMALLY NECESSARY ☐ SAFETY GLASSES WITHOUT SIDE SHIELDS ☐ SAFETY GLASSES WITH SIDE SHIELDS OR ☒ CHEMICAL WORKERS GOGGLES

☐ GAS TIGHT GOGGLES OR EQUIVALENT ☐ OTHER:

...OTHER PROTECTIVE EQUIPMENT
...Eye wash fountain and wash facilities at work area.

Section 9 SPECIAL PRECAUTIONS OR OTHER COMMENTS

...CAUTIONS TO BE TAKEN IN HANDLING AND STORING
Do not get in eyes, on skin or on clothing. Keep out of reach of children.

...ER PRECAUTIONS
...oid breathing spray mists or vapors. Keep away from heat or flame.

Extremely toxic to fish, keep out of streams, lakes, and other bodies of water.

(BACK)

VERTAC CHEMICAL CORPORATION

MATERIAL SAFETY DATA SHEET

Section 1 NAME & PRODUCT

ANUFACTURER'S NAME
ac Chemical Corporation

For latest data, consult manufacturer.

IN CASE OF EMERGENCY TELEPHONE
1-800-424-9300

T ADDRESS
Poplar Avenue

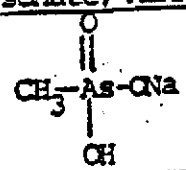
Prepared by: M. S. Bernard

Date: 10/17/84

TY STATE, ZIP CODE
is, TN 38137

ICAL NAME, TRADE NAME AND SYNONYMS
rtac MSMA 800, 8#/gal Monosodium Acid Methanearsonate, MSMA

ULA OF PRIMARY COMPONENTS (STRUCTURAL)



Section 2 INGREDIENTS

	%	TLV (units)
dium Acid Methane Arsonate	58.5	
ert Ingredients	41.5	

Section 3 PHYSICAL DATA

ING POINT (°F)		6 SPECIFIC GRAVITY (H_2O = 1)	1.648
OR PRESSURE (mmHg at 20° c) *	Low	7 % VOLATILE BY VOLUME	40.7
VAPOR DENSITY (air = 1)	N/A	8 COLOR AND ODOR	Very light yellow
UBILITY IN WATER	Miscible	9 PHYSICAL STATE	Clear Liquid

Section 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) °F Aqueous Solution - No Flash

11 FLAMMABLE LIMITS STP L.F.L. U.F.L.

TIN-IISHING MEDIA: [X] WATER FOG [X] FOAM [X] ALCOHOL FOAM [X] CO_2 [X] DRY CHEMICAL [X] OTHER

ECIAL FIRE FIGHTING PROTECTIVE EQUIPMENT
-contained breathing apparatus, chemical gloves and boots

JAL FIRE AND EXPLOSION HAZARDS
r EXTREME conditions such as strong acidic environment and strong heat, arsine gas poisonous gas) may be produced.

Section 5 REACTIVITY DATA

TY			16 CONDITIONS TO AVOID Extreme heat and strong acid
	FIRE CONDITIONS		

NCOMPAT-TY (Materials to void)

[ ] WATER [ ] ACID [ ] BASE [ ] CORROSIVE* [ ] OXIDIZING MATERIAL

[ ] OTHER

Section 6 HEALTH HAZARD DATA

NG[redacted]N
Acute Oral LD50 Rats 1359mg/kg

[redacted]ACT
Mild Irritant

[redacted]ACT
Mild to none irritation, depending on individual's sensitivity.

BSORPTION
Not absorbed

[redacted]NITLV OR SUGGESTED CONTROL FIGURE
Not normally a problem

S OF OVEREXPOSURE Subacute: salty taste, burning in throat, colicky stomach pains. headache, vomiting, diarrhea, stupor, convulsions

AID PROCEDURES Eyes: flush with water. Consult physician if irritation persists. Wash with soap and water. Oral Ingestion: empty stomach by vomiting or [illegible]ion. Lavage with 3 liters isotonic saline. BAL (Dimercaprol) is antidotal; [illegible]er in 3mg/kg body weight every 4 hours.

Section 7 SPILL OR LEAK PROCEDURES

TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
[illegible] spill and transfer to suitable container. Absorb remaining free liquid with [illegible]bant.

A[illegible]METHOD
local pollution control authorities or EPA office.

Section 8 SPECIAL PROTECTION INFORMATION

[illegible]ATION	LOCAL EXHAUST Not normally required	SPECIAL
	MECHANICAL (General)	OTHER

[illegible]RY PROTECTION (Specify Type)
[illegible]ally required

[illegible]IVE CLOTHING
[illegible]loves, boots, chemical goggles

[illegible]CTION [illegible] NORMALLY NECESSARY ☐ SAFETY GLASSES WITHOUT SIDE SHIELDS ☒ SAFETY GLASSES WITH SIDE SHIELDS OR ☐ CHEMICAL WORKERS GOGGLES

[illegible]T TIGHT GOGGLES EQUIVALENT ☐ OTHER:

[illegible]OTECTIVE EQUIPMENT
equired

Section 9 SPECIAL PRECAUTIONS OR OTHER COMMENTS

[illegible]ONS TO BE TAKEN IN HANDLING AND STORING
[illegible]ndard procedures for chemical handling

[illegible]CAUTIONS
[illegible]ay from foods, feeds, seeds, fertilizers, insecticides, and fungicides.

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: 1-800-424-9300
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 Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	95.00
Impurities	n/d	n/d	5.00

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	above 212	Specific Gravity	1.358
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, CO_2, 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. LD_{50} 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. LD_{50} rabbits 80mg/kg.
Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m^3.

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.

ergency 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.

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

DATE: 4/20/89 PAGE 1

PRODUCT NAME: POTATO TOP KILLER 300

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137, USA

Information Phone No.: 1-601-636-1231
Emergency Phone No.: 1-800-424-9300
Prepared by: M. S. Barnard

SECTION II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

INGREDIENTS	OSHA PEL	ACGIH TLV	PERCENT
Dinoseb (2-sec-butyl-4,6-dinitrophenol)	n/d	0.3mg/m³	30.2
CAS # 88-85-78	200ppm	100ppm	
Toluene			
CAS # 108-88-3			

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	above 212	Specific Gravity	approx 0.990	Vapor Density(Air=1)	n/d
Vapor Pressure(mmHg.)	below 20	Evaporation Rate	n/d	Melting point	n/a
Solubility in Water:	Emulsifiable				
Appearance and Odor	Brown liquid. Organic acid odor.				

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 84°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media: Water Fog, Foam, CO_2, and Dry Chemical
Special Fire Fighting Procedures: Self contained air supply recommended. Confine water used in fire fighting.
Unusual Fire and Explosion Hazards: Noxious fumes (Oxides of Nitrogen) may form. Vapors may ignite. Dinoseb undergoes rapid exothermic decomposition at 190°C.

SECTION V REACTIVITY DATA

Stability: Stable in normal use and storage.
Conditions to Avoid: Heating above 100°C. Avoid ignition sources. Product undergoes rapid exothermic decomposition at 190°C.
Incompatibility: Strong Acids and Strong Oxidizers.
Hazardous Decomposition By-products: 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
Ingestion: Highly Toxic
Skin: Readily Absorbed

Continued on page 2.

Health Hazards(Acute and Chronic): Oral Ingestion: High single dose toxicity. Acute Oral LD_{50} (rats) 58 mg/kg for Dinoseb.

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. Stains skin yellow.

Skin Absorption: Readily absorbed through skin, highly toxic. Dermal LD_{50} (guinea pigs) 100-200 mg/kg for Dinoseb.

Inhalation: May be irritating. Control vapor or dust levels to recommended levels for Dinoseb and Toluene.

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

Signs and symptoms of Exposure: Yellow stained skin. Increased body temperature and metabolic rate. fatigue, sweating, and thirst.

Medical Conditions Generally Aggraveted by Exposure: None known.

Emergency and First Aid Procedures:

Oral Ingestion: Toxic by ingestion. Induce vomiting then give 2 teaspoons of baking soda in water and seek medical help immediately.

Eye Contact: Flush immediately with continuous irrigation of water for at least 30 min. Seek medical consultation immediately. Stain for evidence of corneal injury. Treat if injuried by instilling antibotic steriod preparation frequently.

Skin Contact: Promptly wash skin with plenty of soap and water for a least 15 min. while removing contaminated clothing. Consult physician. Wash clothing before reuse.

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

NOTE TO PHYSICIAN: No known antidote. Treat symptomatically. Keep patient quient in cool place. If feverish, cool with cold compresses or by immersion in cool water.

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps To Be Taken In Case Material Is Released or Spilled:
Use proper safety equipment. Sweep-up material with the aid of an inert absorbant material such as oil-dry. Keep out of streams and water supplies. Contact Chemtrec for assistance.

Waste Disposal Method:
Incineration is recommended. Check with regulatory authorities for landfill disposal regulations.

Precautions To Be Taken in Handling and Storage:
Do not get on skin, on clothing, or in eyes. Keep out of reach of children.

Other Precautions:
Avoid breathing vapors. Keep away from flame.

SECTION VIII CONTROL MEASURES

Respiratory Protection: None normally needed. During use and handling use dust mask or respirator as conditions warrent.

Ventilation: Recommended to control TLV of Dinoseb and Toluene.

Protective Gloves: Impervious rubber gloves.

Eye Protection: Chemical worker's goggles or full face shield.

[illegible] Protective Clothing or [illegible] body-covering clothir[illegible]

[illegible]

THE INFORMATION HEREIN IS [illegible] ACCURATE, BUT NO WARRANTY, EXPLICIT OR IMPLIED, [illegible]

Chemical Name

Common Name

Manufacturer

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

PRODUCT NAME: PREMERGE 3 DATE: 08/15/86 PAGE 1
EPA REG. NO.: 56077-13

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137

Emergency Phone Number: 1-800-424-9300
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 Alkanolamine Salts Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	50.70
Methanol CAS # 67-56-1	200ppm	200ppm	15.00

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	above 212	Specific Gravity	1.130
Vapor Pressure(mm Hg.)	50	Melting Point(°F)	n/a
Vapor Density(Air=1)	n/a	Evaporation Rate	n/d

Solubility in Water: Infinite
Appearance and Odor: Brown liquid, sweet alcohol odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 85°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO_2, 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
Avoid ignition sources.
Incompatibility: Strong Acids 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: Moderate Single Dose Oral Toxicity. LD_{50} Male Rats 170 mg/kg, Female Rats 130 mg/kg. May be fatal if swallowed. May cause blindness.

Eye Contact: May cause severe irritation and corneal injury, possible permanent impairment of vision.

Skin Contact: May cause slight irritation, colors skin yellow.

Skin Absorption: Readily absorbed through skin, high toxicity.

Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m³.
ACGIH TLV for methanol is 200ppm.

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

Signs and Symptoms of Exposure:
Fatigue, sweating, thirst, and fever (due to Dinoseb) plus optic nerve injury and blindness, CNS depression, drunkenness, nausea, anesthesia, and vomiting (due to methanol).

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 impairment of vision.
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 TLV of methanol.

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.

Chemical Name

Common Name

Manufacturer

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

DATE: 08/15/86 PAGE 1

PRODUCT NAME: PREMERGE PLUS
EPA REG. NO.: 56077-16

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137

Emergency Phone Number: 1-800-424-9300
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 Sodium Salt Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	11.50
Naptalam Sodium Salt Naptalam (N-1-naphthylphthalamic acid) CAS # 132-66-1	n/d	n/d	22.30

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	188	Specific Gravity	1.150
Vapor Pressure(mm Hg.)	12	Melting Point(°F)	n/a
Vapor Density(Air=1)	n/a	Evaporation Rate	0.24

Solubility in Water: Infinite
Appearance and Odor: Brown liquid, sweet odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): above 212°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO_2, 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. Dinoseb 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. Dinoseb undergoes rapid exothermic decomposition at 190°C. Avoid ignition sources.

Incompatibility: Strong Acids 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: Absorbed
- Ingestion: Moderate Toxicity

Health Hazards (Acute and Chronic):

Oral Ingestion: Moderate Single Dose Oral Toxicity. LD_{50} Male Rats 232 mg/kg. May be fatal if swallowed.

Eye Contact: May cause moderate irritation and non-permanent corneal injury.

Skin Contact: May cause slight irritation, stains skin yellow.

Skin Absorption: Readily absorbed through skin, moderate toxicity. LD_{50} Rabbits above 400mg/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: Yellow staining of skin, profuse sweating, thirst, fever, excessive fatigue, and hypothermia.

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.
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 vapor levels to guidelines.

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.

Chemical Name

Common Name

Manufacturer

CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

PRODUCT NAME: SELECTIVE WEED KILLER DATE: 08/15/86 PAGE 1
EPA REG. NO.: 56077-11

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137

Emergency Phone Number: 1-800-424-9300
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 Ammonium Salt Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS # 88-85-7	n/d	0.3mg/m³	13.70
Isopropanol CAS # 67-56-1	400ppm	400ppm	

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	175	Specific Gravity	0.860
Vapor Pressure(mm Hg.)	35	Melting Point(°F)	n/a
Vapor Density(Air=1)	n/a	Evaporation Rate	n/d

Solubility in Water: Infinite
Appearance and Odor: Brown liquid, alcohol odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 66°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO_2, 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 Acids 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: Moderate Toxicity

Health Hazards (Acute and Chronic):
- Oral Ingestion: Moderate Single Dose Oral Toxicity. LD_{50} Male Rats 205 mg/kg, Female Rats 178 mg/kg. May be fatal if swallowed.
- Eye Contact: May cause moderate irritation and corneal injury.
- Skin Contact: May cause slight irritation, colors skin yellow.
- Skin Absorption: Readily absorbed through skin, moderate toxicity. LD_{50} Rabbits 212mg/kg.
- Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m^3. ACGIH TLV for isopropanol is 400ppm.

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

Signs and Symptoms of Exposure:
Yellow staining of skin, profuse sweating, thirst, fever, excessive fatigue, and hypothermia.

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.
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 vapor levels to guidelines.

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.

MISSISSIPPI RIVER

True North
Mag North
Plant North
55°-32'

OLD U.S. HWY 61

WALNUT RIDGE SUBDIVISION

PROPOSED BORROW AREA

1 - Admin. Bldg.
2 - Storage
3 - Maint. & Whse.
4 - Process
5 - Rx Area
6 - Utilities
7 - Effluent Pond
8 - Cooling Tower
9 - Acid
10 - Sol
11 - Gulf Formaldahyde Plant
12 - Office & Lab
13 - Methyl Para Area
14 - Drumming
15 - Boilers
16 - Tox-Dinitro Area
17 - Atrazine Area

10" C.S. Wastewater Line From Calgon Units To River

10" San Sewer Easement (City of Vicksburg)

ILLINOIS CENTRAL RAILROAD - 100' EASEMENT

WELL No. 2
Top of Well
EL. 105.0

TRACT No. 19
CALVIN JONES

HENNESSEY'S BAYOU

VERTAC CHEMICAL CORP.
VICKSBURG PLANT

PLANT ENTRANCE

T.B.M.
Top of F.F. Dinitro Bldg.
EL. = 111.4 M.S.L.

NORTH PLANT

WELL No. 1
Top of Well
EL. = 109.1

WELL No. 4
Top of Well
EL. = 111.6

RIFLE RANGE ROAD

APPROXIMATE BOUNDARY OF INACTIVE DISPOSAL AREA.

INACTIVE DISPOSAL AREA
(see sheets 2 - 5 for details)

50' Gas Line Easement
(10" ϕ United Gas

STOUT'S BAYOU

INTERIM STATUS SURFACE IMPOUNDMENTS

WELL No. 3
Top of Well
EL. = 97.5

Dr. A. J. MESSINA

HATCHER BAYOU

IMPEL
1.75 Ac.

NEW U.S. HIGHWAY 61

"TBM SQUARE" (see note 2)

NOTE:

1. Information on Plant Layout was obtained from Plat Plan, dated 5-25-79, furnished by VERTAC.
2. Existing Ground Contours were obtained from U.S.G.S. Quadrangle Map - Vicksburg, Miss.
3. Contour Interval is 20 ft., and datum is Mean Sea Level

Quarterly DAD Equalization:
Set of the Subject 4 sheets

NOTES:

1) MAP AND ELEVATIONS PROVIDED BY DISC, MEMPHIS, TN.
2) CORPS OF ENGINEERS BENCHMARK, LOCATED AT THE INTERSECTION OF NEW U.S. HWY 61 AND HATCHER BAYOU, WAS USED TO ESTABLISH ELEVATIONS FOR TOPOGRAPHIC MAP OF INACTIVE DISPOSAL AREA. SEE SHT. 2 & 3 OF THESE PLANS FOR FURTHER DETAILS.
3) EXACT LOCATION OF PROPOSED MONITORING WELLS TO BE DETERMINED IN THE FIELD BY REPRESENTATIVES OF VERTAC AND THE MISSISSIPPI BUREAU OF POLLUTION CONTROL.

LEGEND:

PROPOSED MONITORING WELL LOCATIONS
EXISTING MONITORING WELLS
PROPOSED BORROW AREA FOR SOURCE OF SOIL TO BE USED AS COVER MATERIAL

DATE	REVISIONS	BY

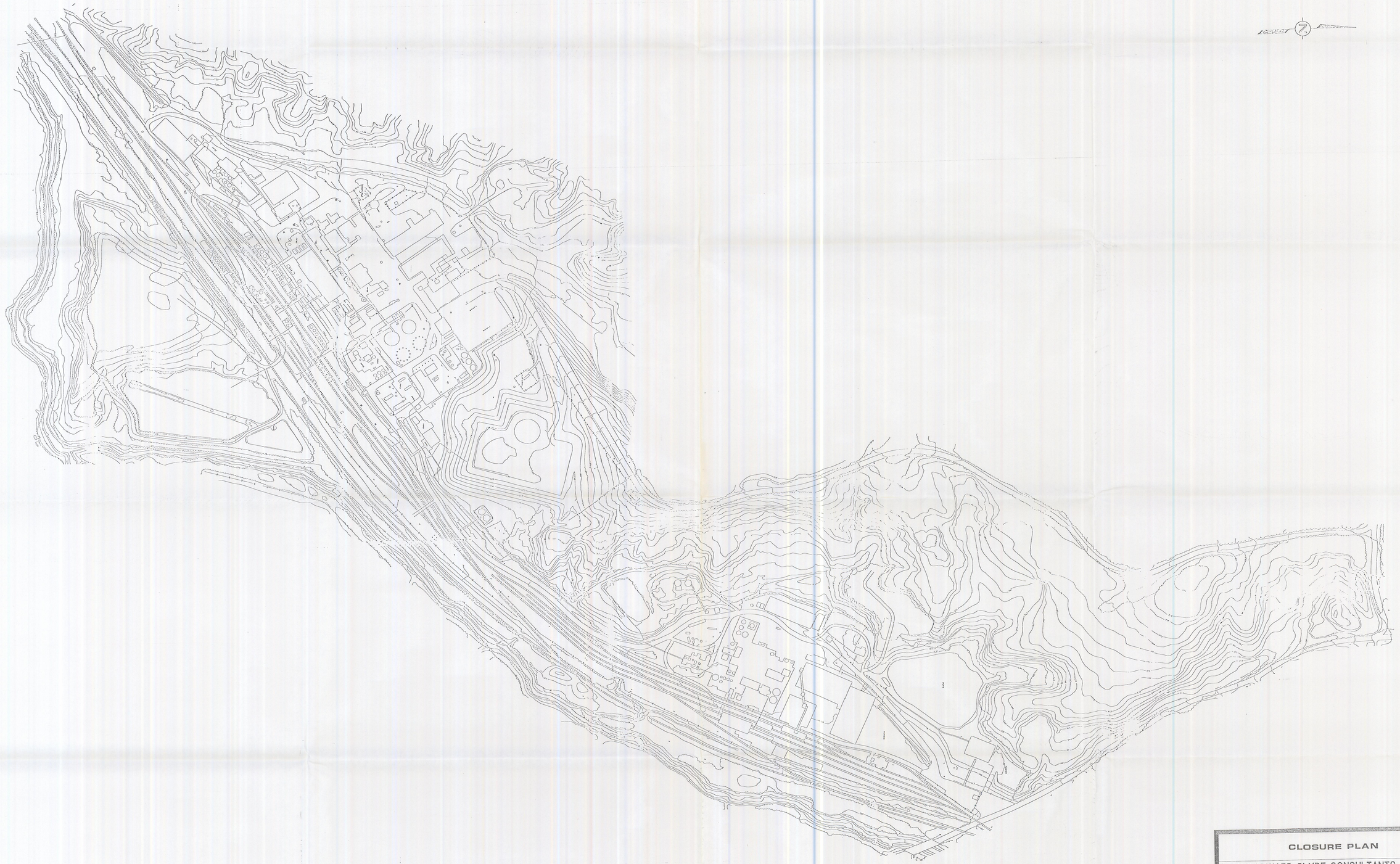
SITE MAP
VERTAC CHEMICAL CORP.
VICKSBURG, MS.

SCALE: 1" = 300'

PREPARED FOR:
VERTAC CHEMICAL CORPORATION

MCI/CONSULTING ENGINEERS, INC.
NASHVILLE & KNOXVILLE, TENNESSEE

PROJ. No. 822 | DATE 1/24/83 | SHEET 1 OF 4



CLOSURE PLAN

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

CEDAR CHEMICAL CORPORATION
VICKSBURG CHEMICAL DIVISION
VICKSBURG, MISSISSIPPI

SCALE:	MADE BY: G. T.	DATE: 10/9/91	FILE NO.
1"=150'	CHECKED BY:	DATE:	90B451C-3

SITE TOPOGRAPHY — FIGURE 1

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)

SCALE
200 0 200 400 FEET

NO.	REVISION	DATE	INITIAL

CLOSURE PLAN—HAZARDOUS WASTE CONTAINER
STORAGE AREA AND OFF-SPECIFICATION PRODUCT STORAGE AREA

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

CEDAR CHEMICAL CORPORATION
VICKSBURG CHEMICAL DIVISION
VICKSBURG, MISSISSIPPI

SCALE:	MADE BY: GT	DATE: 4/6/92	FILE NO.
1"=200'	CHECKED BY:	DATE:	92B007C

LOCATION OF SOLID WASTE MANAGEMENT UNITS — FIGURE 1b

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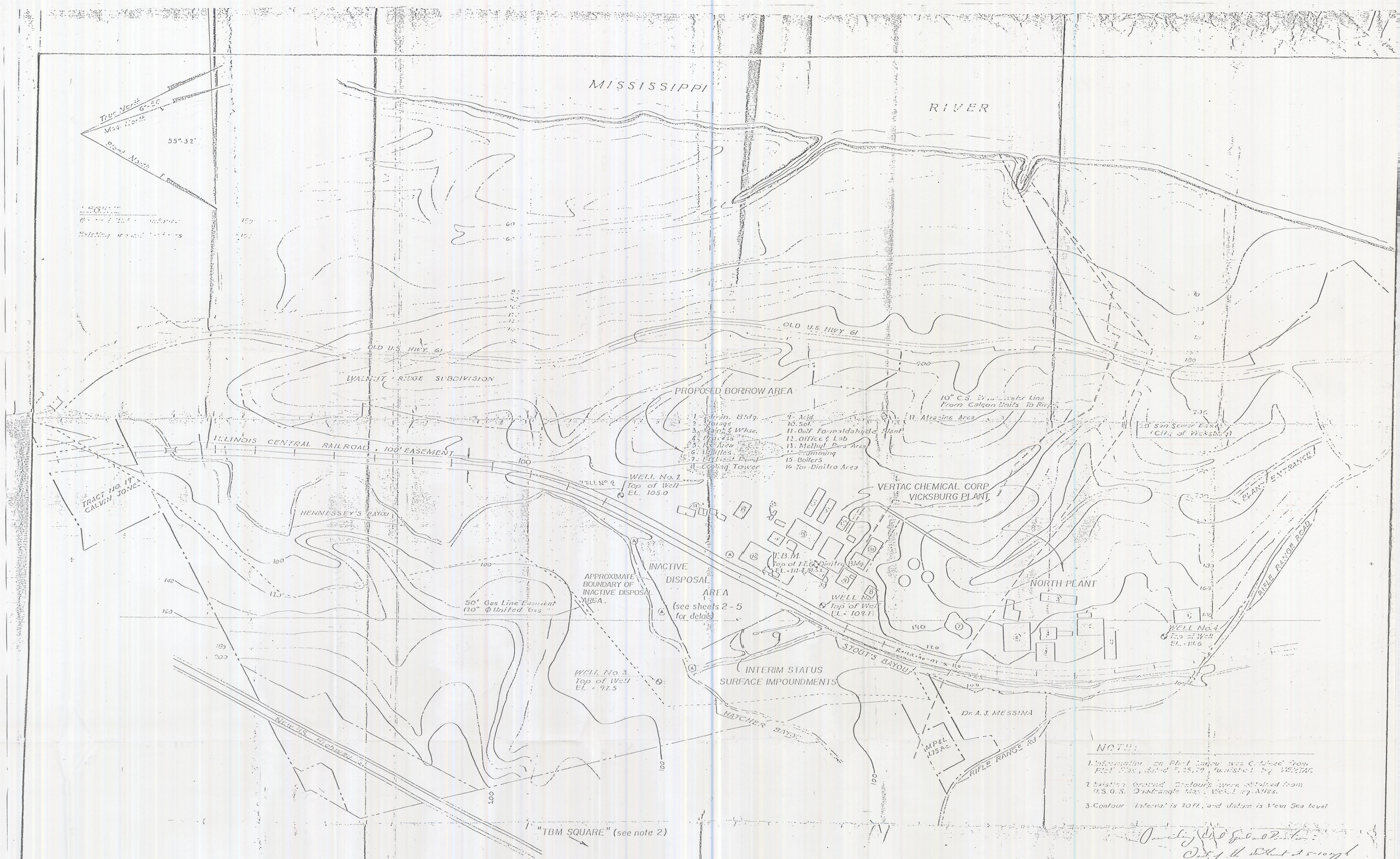

NOTE:

1. Information on Plant Layout was Obtained from Plot Plan, dated 5.25.79, furnished by VERTAC
2. Existing Ground Contours were obtained from U.S.G.S. Quadrangle Map, Vicksburg, Miss.
3. Contour interval is 20 ft., and datum is Mean Sea Level

Quality Control Equipment Position: Out of the Settlement at 5-10 mph

NOTES:

1) MAP AND ELEVATIONS PROVIDED BY DISC, MEMPHIS, TN.

2) CORPS OF ENGINEERS BENCHMARK, LOCATED AT THE INTERSECTION OF NEW U.S. HWY. 61 AND HATCHER BAYOU, WAS USED TO ESTABLISH ELEVATIONS FOR TOPOGRAPHIC MAP OF INACTIVE DISPOSAL AREA. SEE SHT. 2 & 3 OF THESE PLANS FOR FURTHER DETAILS.

3.) EXACT LOCATION OF PROPOSED MONITORING WELLS TO BE DETERMINED IN THE FIELD BY REPRESENTATIVES OF VERTAC AND THE MISSISSIPPI BUREAU OF POLLUTION CONTROL.

LEGEND:

PROPOSED MONITORING WELL LOCATIONS

EXISTING MONITORING WELLS

PROPOSED BORROW AREA FOR SOURCE OF SOIL TO BE USED AS COVER MATERIAL

DATE	REVISIONS	BY

SITE MAP
VERTAC CHEMICAL CORP.
VICKSBURG, MS.

SCALE: 1" = 300'

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PROJ. [illegible] | DATE 1/24/83 | SHEET 1 OF 4