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Hazardous Waste Ground-Water Task Force Evaluation of Koppers Tie Plant Grenada, Mississippi

US Environmental Protection Agency

Mississippi Department of Natural Resources

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HAZARDOUS WASTE GROUND WATER TASK EVALUATION
OF KOPPERS CO., INC.
GRENADA, MISSISSIPPI

UPDATE

The Hazardous Waste Ground Water Task Force (Task Force), in conjunction with the Mississippi Department of Natural Resources (MSDNR), evaluated the ground water monitoring system at the Koppers Tie Plant facility in Grenada, Mississippi during the week of May 19, 1986. Several deficiencies pertaining to the RCRA ground water monitoring system were noted during the evaluation. S.E. Matthews, project coordinator for the evaluation, compiled a report that detailed these deficiencies and summarized results from water quality samples collected from RCRA monitoring wells at the facility.

The purpose of the Task Force evaluation was to determine the adequacy of Kopper's ground water monitoring program with regard to State and Federal ground water monitoring requirements. Specifically, the objectives of the evaluation were to:

> Determine compliance with 40 CFR Part 265 interim status ground water monitoring requirements and the State's counterpart regulations.
>
> Evaluate the ground water monitoring program described in the facility's RCRA Part B Permit application for compliance with 40 CFR 270.14(c) requirements and the State's counterpart regulations.
>
> Determine if hazardous waste or hazardous waste constituents have entered the ground water beneath the facility.

This update chronicles activities at the Koppers facility following the Task Force evaluation and actions taken by the MSDNR and EPA Region IV regarding RCRA ground water monitoring at the facility.

In August 1986, the MSDNR served a Commission Order on Koppers regarding ground water monitoring deficiencies and assessed a penalty of $20,000. Koppers entered a plea of nolo contendere to the changes and paid the penalty.

In October 1986, MSDNR ordered Koppers to submit an assessment plan that would address the hydrogeology of the site. Information gathered during the assessment was to provide data capable of determining if either the RCRA regulated surface impoundment or the sprayfield had adversely affected ground water beneath the facility. In November 1986, MSDNR issued a Commission Order with a compliance schedule to gather information for the assessment plan.

In January 1987, Koppers submitted the "Report of Findings, Hydrogeologic Investigation" for the surface impoundment and the sprayfield. Based on technical reviews conducted by Task Force members, it was the consensus that more hydrogeologic characterization was needed for the site.

In March 1987, MSDNR advised Koppers by letter, of the ground water information which should be included in their Part B submittal on April 15, 1987, and that a site specific sampling and analysis plan should be submitted.

In April 1987, Koppers submitted additional hydrogeologic information in their Part B. This information was subsequently reviewed by the Task Force and the following conclusions were made:

- Koppers has still not adequately defined site hydrogeology, in that very little site specific geology is available and no vertical hydraulic gradient has been established.
- Koppers proposed ground water monitoring system is unacceptable. Well R-1 is improperly constructed. Well R-10 shows penatachlorophenol contamination and is screened in a silty material different from the geologic settings other wells are screened in.
- Additional clustered wells would be advisable because the constituents of concern have a high specific gravity and tend to sink. Also, based on the latest ground water elevation data Koppers should consider a clustered well on the west side of the unit.
- Koppers should submit a site specific sampling and analysis plan.

Mississippi is currently reviewing the Part B for adequacy and completeness and will issue required notices upon completion of their review.

Koppers is proceeding with an investigation to identify sources and extent of contamination on the site. This will include additional geologic and hydrogeologic investigations.

During the task force evaluation the flyash land farm was identified as a RCRA regulated unit. This was later confirmed by MSDNR and EPA Region IV. On March 25, 1987, MSDNR issued an order to Koppers which required them to cease using the unit; submit a closure plan; install a ground water monitoring system, which complies with Part 265 Subpart F of the Mississippi Hazardous Waste Management Regulations; and submit a Part B post-closure application or a demonstration of clean closure.

This order is currently under litigation.

Koppers was also ordered to submit a report which demonstrates conclusively whether or not K001 sludge has been applied to or has accumulated on its spray field. MSDNR is currently reviewing this report.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
HAZARDOUS WASTE GROUND WATER TASK FORCE

GROUND WATER MONITORING EVALUATION

KOPPERS TIE PLANT
GRENADA, MISSISSIPPI

MARCH 1987

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GRENADA, MISSISSIPPI
ESD PROJECT #86-292

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INTRODUCTION

Task Force Effort

Operations at hazardous waste treatment, storage and disposal (TSD) facilities are regulated by the Resource Conservation and Recovery Act (RCRA P.L. 94-850). Regulations promulgated pursuant to RCRA (40 CFR Parts 260 through 265, effective on November 19, 1980 and subsequently modified) address hazardous waste site operations including monitoring of ground water to ensure that hazardous waste constituents are not released to the environment. The regulations for TSD facilities are implemented (for EPA administered programs) through the hazardous waste permit program outlined in 40 CFR Part 270.

The Administrator of the Environmental Protection Agency (EPA) established a Hazardous Waste Ground Water Task Force (Task Force) to evaluate the level of compliance with ground water monitoring requirements at commercial off-site and selected on-site TSD facilities and address the cause of noncompliance. The Task Force is comprised of personnel from EPA Headquarters Core Team, Regional Offices and the States.

There will be eight Task Force evaluations conducted in Region IV during FY-86 and FY-87. Evaluations have been conducted at both of the region's two off-site commercial facilities. Six evaluations will be conducted at private, on-site facilities. The evaluation of Koppers was the second private on-site investigation in Region IV and was conducted the week of May 19, 1986.

Objectives of the Evaluation

The principal objective of the inspection at Koppers Tie Plant was to determine compliance of the RCRA surface impoundment and the sprayfield with the requirements of 40 CFR Part 265, Subpart F - Ground Water Monitoring and to determine compliance with related requirements of the Part 265 interim status regulations and the state's counterpart regulations. The ground water monitoring program described in the RCRA Part B permit application was also evaluated for compliance with Part 270.14(c) and potential compliance with Part 264. Recent amendments to RCRA require that facilities seeking a RCRA permit also address solid waste management units at the facilities; therefore, any ground water monitoring wells associated with solid waste management units at the facility were to be sampled to provide data and information to be used during the permit review process.

The Koppers Tie Plant inspection was coordinated by the Region IV United States Environmental Protection Agency (EPA), Environmental Services Division and included participation by the EPA Headquarters Core Team, Region IV EPA Waste Management Division and the Mississippi Department of Natural Resources, Bureau of Pollution Control. In general, the evaluation involved a review of State, Federal and facility records, a facility inspection, a laboratory evaluation and ground water sampling and analysis.

BACKGROUND

Locale/General

The Koppers Tie Plant facility is located about five miles southeast of Grenada, Mississippi. The site is situated about halfway between U.S. Highway 51 and the Batupan Bogue (see Figure 1). The facility uses creosote and pentachlorophenol-in-oil in the pressure treatment of wood products for railroad cross ties, utility poles and pilings. The hazardous wastes produced by this facility are K001, U051, and F027 and consist of bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol (K001), and waste creosote (U051) or certain waste pentachlorophenol (F027). The waste management units at the facility are a drum storage area, a surface impoundment and a sprayfield. For purposes of the Task Force inspection, the ground water monitoring systems at the surface impoundment and the sprayfield were evaluated for compliance with the 40 CFR Part 265, Subpart F, 270.14 (c) and 264 regulations.

Wood treating has been carried out in this locale since 1903. Koppers took over the operation in the 1930's.

The facility has RCRA interim status (EPA ID# MSD 007 027 543). In January 1984, a preliminary RCRA Part B permit application was submitted to the Mississippi Department of Natural Resources (MSDNR) for review. The State of Mississippi has final RCRA authorization for permit issuance.

MSDNR was granted RCRA Phase I interim authorization on January 7, 1981 which allows the State to enforce State-promulgated regulations in lieu of Federal regulations promulgated under RCRA (40 CFR Parts 260 through 265). RCRA activities at this site have, therefore, been governed by State regulations.

Phase II, A and B interim authorization was granted on August 31, 1982. Phase II C was granted April 26, 1983. The state received final authorization on June 27, 1984 for all aspects of RCRA except for the 1984 amendments.

Since the preliminary Part B submittal, there have been several revisions as a result of MSDNR, and to a lesser extent, EPA Region IV reviews. The latest version of the Part B was submitted January 1986 and has been reviewed.

Several deficiencies were noted. An order was issued in August 1986 to correct these deficiencies. The facility has received several Notices of Deficiency (NOD's) and Commission Orders from MSDNR for inadequate Part B submittals and for non-compliance with 40 CFR Part 265 Subpart F regulations.

SUMMARY OF FINDINGS AND CONCLUSIONS

The Task Force investigated the interim status ground water monitoring program implemented by Koppers Tie Plant. The consensus opinion of the Task Force was that this program is not in compliance with 40 CFR Part 265, Subpart F and the State counterpart regulations, which are the equivalent regulations to 40 CFR Part 265, Subpart F. The information submitted to date is also insufficient to satisfy the requirements of 40 CFR Part 270.14(c).

This investigation revealed that two ground water monitoring programs have been implemented at the surface impoundment since November 19, 1981. The basis for changing the original program was to change the ground water monitoring system from a detection to an assessment phase. This change resulted in the installation of a new RCRA system that consisted of wells R-5 to R-9, with R-5 being designated the new upgradient well. For reasons described in this report, this well is inadequate as an upgradient well.

The investigation also revealed inadequacies in the area of hydrogeologic characterization. The facility has begun an Alternate Concentration Limit (ACL) evaluation, but has developed relatively no information to prove their premise that an attenuation mechanism can be used at this site. The Task Force investigation also revealed that some water quality data from the sprayfield had not been submitted to MSDNR or EPA for review, and that the sampling and analysis plan is incomplete.

Analytical results of ground water samples collected from the RCRA monitoring systems at the surface impoundment and the sprayfield indicate some ground water degradation had occurred at the site. The lack of a complete hydrogeologic chracterization makes it difficult to establish the on-site source of the contamination. In addition, there is a concern that surface water degradation is occurring due to the discharge of contaminated ground water. An oily sheen was noted floating on a tributary to Batupan Bogue running through the property. Oily liquid was seen oozing from the banks into this tributary.

The following is a more detailed summary of the inspection findings and conclusions.

COMPLIANCE WITH INTERIM STATUS REQUIREMENTS

Inadequate Hydrogeological Characterization (40 CFR Part 265.91)

Koppers has not adequately characterized the hydrogeology of the site. It is the consensus of the Task Force that Koppers Tie Plant should be required to:

(1) Adequately characterize the geology of the site, at a minimum,

  a. define the uppermost aquifer.
  b. define the vertical and lateral extent of the base of the uppermost aquifer and any confining beds contained within and below that aquifer.
  c. prepare a stratigraphic section, fence diagram, etc. of the geology underlying the surface impoundment and sprayfield.

(2) Adequately characterize the ground water hydrology of the site, at a minimum,

  a. conduct a pumping test(s) to determine if interconnection exists between the various aquifers underlying the site,
  b. install a series of nested piezometers to adequately determine the potentiometric surface at the surface impoundment and sprayfield.
  c. determine the influence of precipitation, nearby pumpage, etc. on water levels and hydraulic gradients.
  d. survey all wells relative to mean sea level (MSL).
  e. design and implement an investigatory plan capable of demonstrating the absence or presence of dense non-aqueous phase liquids beneath the regulated unit. If dense non-aqueous phase liquids are found to have escaped from the regulated unit, Koppers should accomplish the following tasks:
    1. determine the direction of non-aqueous phase liquid migration. Base this determination on aquifer properties, contaminant mobility characteristics and the availability of migratory pathways beneath the site. Note that migrating pathways for dense non-aqueous phase liquids may consist of structural contours of aquitard units, planes or channels of permeability variations within the aquifer, root zones, lithologic contact planes, buried pipelines, etc.
    2. determine the rate of non-aqueous phase liquid migration. Base this determination on consideration of contaminant properties such as density, viscosity, and the surface tension, capillary pressures and pore radii of the media, as well as subsurface structural gradients and hydraulic gradients.

(3) Provide all previously requested data not submitted with the 1-7-86 Part B submittal, specifically,

  a. potentiometric water level data and maps,
  b. water quality analyses,
  c. map showing all solid waste management units,
  d. most recent report(s) on the sprayfield - include water quality, geologic logs, etc.,
  e. recent pumping data for production wells on-site
  f. revision of Part B for the sprayfield.

Improper Monitoring System (40 CFR Part 265.91)

It appears from water quality data that the new upgradient well R-5 at the surface impoundment is not representative of background water quality. It is located near a heavy traffic area and is close to stacks of treated lumber. It is also downgradient from an old wastewater pond which is classified as a solid waste management unit (SMU). A new upgradient well must be installed at the surface impoundment to collect background data on water quality that has not been affected by the facility as per 40 CFR Part 265.91 (a)(1)(i) and (ii) regulations.

40 CFR 265.278 requires an unsaturated zone monitoring system around the sprayfield. The system would provide valuable information as to the adequacy of treatment and potential contaminant migration.

Failure to Address Effects of Possible Confining Units (40 CFR Part 265.91)

Existing geotechnical data indicate the presence of a clay unit underlying the site. The thickness and continuity of this clay have not been determined. This clay may or may not be a confining unit between the upper saturated zone and underlying aquifers. Interconnection between the aquifers underlying the site should be addressed. At the time of the inspection, the uppermost aquifer had been defined only through a literature review.

Monitoring Well Construction Deficiencies (40 CFR Part 265.91(c))

After reviewing the monitoring well construction data, several deficiencies were noted. The following comments and questions need to be addressed by the facility, so that a determination can be made as to the adequacy of the well construction:

1. What method was used to drill the surface impoundment wells? Was any type of drilling fluid used in any of the wells?

2. What are the elevations of all the wells relative to MSL (mean sea level)?

3. Why was PVC casing chosen over teflon-coated or stainless steel considering that organics are of primary concern at this facility?

4. What are the dimensions of the sand pack? Were any sieve analyses run on the sand pack? Could an adequate sand pack explain the high turbidity?

5. Is the annular space adequately sealed?

6. How long were the wells developed? Were the wells developed until pH, temperature and specific conductance stabilized?

7. Are any of the wells capped at the bottom?

8. There is a possibility of contamination by placing cuttings from the well on top of the sand pack. What measures were taken to prevent this?

Inadequate Groundwater Sampling and Analysis Plan (40 CFR Part 265.92)

The sampling and analysis plan that has been submitted is not site-specific for this facility. The plan should be rewritten to reflect the actual procedures followed at this Koppers facility. Also, there is no reference to a specific analytical procedure for each parameter or constituent which are analyzed or measured. These procedures are required to be included in the sampling and analysis plan by 265.92 (a) (3).

Preparation, Evaluation and Response (40 CFR Part 265.93)

Because the facility is in assessment, a specific plan for a ground water quality assessment program is required. The plan for this facility is not adequate to meet the 40 CFR 265.93 requirements. Specifically, the sampling and analytical methods must be specified by the facility as per 265.93 (d) (3)(ii) regulations. Also, the extent and rate of migration of hazardous waste into the ground water must be determined as per 265.93(d)(4)(i). During the Task Force inspection, no historical water quality data for the surface impoundment for 1985 was available for review. From discussions with facility personnel, it was stated that there had been no quarterly monitoring for the surface impoundment since the latter part of 1985. This is in conflict with the requirements of 265.93(d)(7)(i) that requires a facility to continue a ground water quality assessment program on a quarterly basis that, at a minimum, determines the rate and extent of hazardous waste constituents in the ground water and the concentration of the hazardous constituents in the ground water.

Annual Report 265.94 (b)(2)

Koppers is required to submit an annual report containing the results of the Ground Water Quality Assessment program that should include the rate of migration of hazardous waste constituents in the ground water during the reporting period. At the time of the Task Force inspection, an Annual Report had not been submitted that characterized the horizontal and vertical extent of the plume(s).

Laboratory Evaluation

To be issued at a later date as an addendum.

Monitoring Data Analysis

All data from analysis of samples collected during the task force inspection was evaluated and considered usuable except for the antimony and much of the arsenic results. Pesticide, herbicide and dioxin data was considered to be unreliable.

A review of the data indicates ground water degradation has occurred at the facility. Upgradient well R-5 showed the most metals, extractable and purgeable compounds. Several wells, specifically R-1, R-4, R-5 and R-7 at the surface impod of 50 ug/l.
Their presence or the concentrations at which they were detected suggest they are either not naturally occurring or are above background concentrations in this area.

TECHNICAL REPORT

INVESTIGATIVE METHODS

The Task Force evaluation of the Koppers site consisted of:

- A review and evaluation of records and documents from EPA Region IV, MSDNR and Koppers Tie Plant.
- A facility on-site inspection conducted May 19-21, 1986.
- An off-site analytical laboratory evaluation.
- Sampling and subsequent analysis and data evaluation for the ground water monitoring systems at the surface impoundment and the sprayfield.

Records/Documents Review and Evaluation

Records and documents from EPA Region IV and the MSDNR offices, compiled by an EPA contractor (PRC), were reviewed prior to the on-site inspection. The first day of the inspection (May 19, 1986), the Task Force met with Mr. Rock Clayton, Plant Manager for Koppers Tie Plant, and Mr. Dave King, Environmental Officer. Mr. Clayton was helpful in giving a general overview of the plant and locating past solid waste management units.

The next two days were spent with Mr. Martin Schlesinger, Koppers Corporate office, and Mr. Brad Peebles, consultant from Law Environmental Services. Neither had been to the facility before and could offer little in the way of information. There were very few on-site facility records available for review. It was explained that most information was kept at the Koppers Corporate office in Pittsburgh, PA or at the consulting firm. Mr. Schlesinger and Mr. Peebles reviewed the material that had been copied from EPA Region IV and MSDNR files and could add little to what had been copied. The last day of the inspection, Mr. Ken Lindval gave the Task Force a tour of the plant.

Facility Inspection

The facility inspection, conducted May 19-21, 1986, included identification of waste management units, identification and assessment of waste management operations and pollution control practices and verification of location of ground water monitoring wells.

Company representatives were interviewed to identify records and documents of interest, answer questions about the documents and explain (1) facility operations (past and present), (2) site hydrogeology, (3) ground water monitoring system rationale, (4) the ground water sampling and analysis plan and (5) laboratory procedures for obtaining data on ground water quality. Because ground water samples are analyzed by an off-site laboratory, personnel from these facilities will also be interviewed regarding sample handling and analysis, and document control.

Laboratory Evaluation

The off-site laboratory facility handling ground water samples will be evaluated regarding its respective responsibilities under the Koppers ground water sampling and analysis plan. Analytical equipment and methods, quality assurance procedures and documentation will be examined for adequacy. Laboratory records will be inspected for completeness, accuracy and compliance with State and Federal requirements. The ability of the laboratory to produce quality data for the required analyses will be evaluated. The evaluation results will be issued at a later date as an addendum.

Ground Water Sampling and Analysis

Sampling Locations

Water samples were collected from wells R-1, R-4, R-5, R-7 and R-9 at the surface impoundment, and from wells SF-1, SF-2 and SF-4 at the sprayfield. The selection of these eight wells for sampling was based on well locations to provide areal coverage both up and downgradient at the surface impoundment and the sprayfield. The locations are identified in Figure 2.

Samples were taken by an EPA contractor and sent to EPA contractor laboratories for analysis. EPA Region IV requested and received four sample splits. MSDNR and Koppers declined to split samples for independent analysis. Data from sampling analysis will be reviewed to further evaluate the Koppers ground water monitoring program and identify possible contaminants in the ground water. An analytical data summary of the results from the samples collected for the Task Force is presented as Tables 7 and 8. Actual analytical data is available from EPA Region IV.

WASTE MANAGEMENT UNITS AND OPERATIONS

Surface Impoundment Description

The RCRA waste management facility is a wastewater treatment lagoon (surface impoundment) that is about one-half acre in size and has a maximum operating depth of about 7 feet. Although the surface impoundment has no documented liner, it was constructed in the near-surface clays and silts present at the site. The surface impoundment has been in operation since the mid-1970's. (See Figure 3).

The impoundment is an irregular-shaped rectangle which measures 284' x 95' from top of dike to top of dike. It is surrounded by a 4-foot high metal mesh and 2 feet of barbed wire fence with warning signs posted. The bottom of the impoundment is about 10' below the top of the dike (berm) with side slopes of 1:3. The gross surface area at top of the dike is 26,980 ft^2. Koppers estimates 2,500 pounds or 312 gallons (100 percent solids) of sludge will be collected each year and stored on the bottom of the impoundment. The facility estimates a life of about 62 years under present conditions.

The surface impoundment was constructed in the early 1970's by excavating soil from within the containment area and using the excavated material in the perimeter dike. No design drawings or documentation of construction procedures were available for review. Verbal history indicates that the impoundment was excavated in natural clay soils and the surface mechanically compacted.

The ground elevation just beyond the downstream toe of the dike ranges from about 206 to 209 feet. The impoundment has a bottom elevation of about 202 and 203 ft and the crest of the dike is generally at elevation 211 to 212 ft with what appears to be emergency spillway in the southwest corner at elevation 210.4 feet. The dike has a crest width ranging from about 9 to 17 ft with about 12 ft being most typical. The dike is only about 5 ft high above the outside ground level. Upstream (inside) slopes range from about 2.3 to 3.3 horizontal to 1 vertical and downstream (outside) slopes range from about 1.5 to 2.8 horizontal to 1 vertical.

The maximum elevation of the fluctuating water level is about 209 feet. The water level in the impoundment is controlled by plant operations. Both the inflow to and the outflow from the impoundment can be regulated so that the maximum water elevation is not exceeded. Typically, the water level is well below the maximum elevation. Thus, there is a minimum freeboard of 2 ft except at the emergency spillway.

Law Engineering Testing Company personnel observed the conditions of the surface impoundment dike on several occasions in mid-to late-1984. The following is a summary of their inspection conducted August 2, 1984.

The dike crest and downstream slope are covered with grass and in the denser wooded areas with pinestraw. Trees up to about 5 inches in diameter are scattered around the dike, especially along the north and east sides. No evidence of seeps or significant surface erosion was observed by Law Engineering personnel. At the time of the site visits, the water level was at about elevation 205 ft, which is below the lowest outside grade.

Based on soil borings drilled through and outside but adjacent to the dike, clayey silts and silty clays were used to construct the dike. Generally, foundation soils consist of clayey silts and silty clays to elevations ranging from about 202 to 195 feet. The upper clayey soils are underlain by sands with traces of silt. No unusually soft or wet zones were noted on the boring records. The water level in the borings through the crest of the dike was at about elevation 187 ft, well below the bottom of the dike and impoundment. The water level in the borings outside the dike was likewise at about elevation 187 feet.

When the impoundment water level is at its maximum (elevation 209 ft) it is only 3 ft above the lowest adjacent outside grade (elevation 206 ft). Assuming a dike crest elevation of 211 ft and width of 12 ft and 2 horizontal to 1 vertical slopes, the horizontal distance from the uppermost water-dike contact through the dike to the downstream dike slope is 20 feet. Typically, within the geotechnical engineering profession a 5 ft high earth dike retaining 3 ft of water would not be evaluated for potential slope in stability by soil shear. Because of the geometry of the dike, any slope failures would essentially be surface sloughs. The dike has been in operation for 10 years or more and no such sloughs were observed by Law Engineering personnel. Preliminary calculations showed that even if very low strength parameters for the dike material are assumed, calculated factors of safety against dike shear failure are well above the normal criterion of 1.5.

Normally trees in the size range of those on this dike (up to about 5 inches in diameter) should be removed to enhance inspection and maintenance and to prevent roots of the eventually larger trees from developing potential seepage channels within the embankment. However, because of the geometry of this dike, the size of the trees, and because of regulatory requirements that the dike will be removed in less than four years, it was Law Engineering's opinion that the trees should be left in place. They believe that the usefulness of the trees to help control surface erosion outweighs potential disadvantages of leaving the trees in place. The facility intends to close the impoundment by November 1988.

The surface impoundment generates only one type of waste, K001 (bottom sediment sludge from the treatment of wastewaters from wood preserving processes using creosote or pentachlorophenol). The amount and schedule of K001 received varies with the level of business the treating plant handles. The hydraulic capacity of the surface impoundment is about 867,680 gallons. After a long hydraulic detention time, wastewaters from this process generate a small amount of bottom sediment sludge. The surface impoundment acts as a polishing pond to remove oil from the effluent. The impoundment is preceded by a mechanical oil/water separator and flow equalization which recaptures product and minimizes the amount of creosote which flows into the impoundment and becomes waste. Wastewater from the impoundment is pumped to a sprayfield for treatment. All flow between these unit processes are piped and valved (see Figure 4).

Sprayfield Description

The sprayfield is located on the north-northwest section of the property. It is about four acres in size and surrounded by a low berm (one to 3 feet) that controls run-on/run-off. The ground surface slope is estimated to range from zero to 3 percent. The field is covered with non-food chain vegetation that includes bermuda grass, smart weed, panic grass and a broad leaf weed dock. There are six willow trees located within the sprayfield.

The sprayfield was constructed upon native soils. These soils were considered relatively uniform over the entire sprayfield as verified by four hand auger borings conducted outside the perimeter of the sprayfield. The Grenada series is a member of the fine silty mixed theimic Ochreptic Fragindalf subgroup. The Grenada series soils are moderately well drained and are characterized by a firm, dense subsurface horizon, a fragipan, at approximately the two foot depth. The auger borings indicated the fragipan can be 30 inches or more in thickness. The surface soil overlying the fragipan is friable as well as the underlying soil layer which has a silt loam texture. The permeability of the friable silt loam layer is considered moderately slow. The fragipan has slow to very slow permeability. Due to slow permeability of the fragipan, a temporary perched water table may occur above this dense layer. One hand auger boring, on the north side of the sprayfield, revealed free water at the 30 inch depth and relative dry conditions at deeper depths.

The sprayfield receives wastewater after it has been pretreated by two separate processes. The production process includes two oil/water separators which operate in series. The first separator receives an oil/water mixture and a flocculation agent. The solids are removed, pentachlorophenol and oil are recovered and recycled back to the process before the wastewater passes into the second separator. Here creosote is removed and recycled back to the process. The wastewater effluent is then pumped to the surface impoundment. Treatment occurs in the surface impoundment where biological processes degrade organic constituents in the wastewaters and long term hydraulic detention allows for oils to separate by gravity.

Effluent from the surface impoundment is periodically pumped to the sprayfield. The frequency of pumping depends upon water levels within the surface impoundment and climatic conditions. Spraying does not occur during rainfall. The maximum application rate would be 1,800 gallons per day sprayed in one 15 minute period. During periods of high evaporation the facility (surface impoundment) will operate for days or weeks at a time between applications of effluent to the sprayfield.

There has been much discussion between the facility, US-EPA and the Mississippi Department of Natural Resources as to whether this sprayfield is a RCRA regulated unit. Until the facility proves there are no hazardous waste constituents in the land treatment unit, EPA will regard the sprayfield as a hazardous waste treatment unit. On November 8, 1985, Koppers submitted a revised Part A as protective filing that included the sprayfield. Ground water monitoring wells were installed around the sprayfield in August 1985.

Solid Waste Management Units

There was very little information on the solid waste management units for the Koppers Tie Plant. According to facility personnel, there were two wastewater/settling ponds, each less than one acre in size, that were closed out before November 1980. The ponds were dug out and landfarmed but no analyses have been run to verify clean closure.

There is a three-acre landfarm that began operations when the two wastewater/settling ponds were closed. The landfarm still receives some flyash residue from the boiler process which burns U051 and F027 waste. According to 261.3 (c)(2)(i), the ash resulting from the boiler is also considered a hazardous waste. This would make the landfarm a regulated unit and subject to interim status regulations that would include meeting the requirements of 40 CFR Part 265 Subpart F.

There is also a waste pile at the north end of the yard that receives debarking/cut wood ends and waste wood. It has been in existence for many years and is still used today.

Throughout the facility are evidences of black oily materials, possibly spills or runoff. The drip tracks are considered as solid waste management units by EPA. Figure 5 shows the approximate location of the solid waste management units.

It appears that there has been a release to ground water based on water-quality data derived from the RCRA monitoring wells, particularly R-5, and the oily discharge oozing from the banks into the tributary on the property. The solid waste management information supplied by Koppers is insufficient and the following data is needed to understand the potential for releases:

1) Analysis of historical air photographs;
2) Description of past processes used at the facility;
3) An estimate of the volume of creosote and pentachlorophenol that has been used at the plant. These figures could be derived from purchasing records.

It was noted during the inspection that the following could be considered as potential solid waste management units:

penta sump
creosote sump
old separator
cooling pond
sumps 1,2 and 4
emergency pond
industrial boiler

The facility should be required to submit information on the above - mentioned units that would determine whether or not these actually are solid waste management units.

FACILITY OPERATIONS

The Koppers Tie Plant operations in Grenada, Mississippi include wood treating facilities, a drum storage area, a surface impoundment and a sprayfield which are used to treat wastewater streams and provide a no discharge system for treated effluent. An in-plant process boiler also uses high BTU spent residues for fuel. All of the waste associated with this facility are derived from a common source which is the pressure treatment of wood products (primarily railroad ties and telephone poles) with creosote and pentachlorophenol-in-oil. The hazardous waste produced by this facility, K001, U051 and F027, consist of bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol (K001), and waste creosote (U051) or certain waste pantachlorophenol (F027). The solids wastes handled at this facility include, in addition to the above, soil contaminated with creosote or pentachlorophenol, unreclaimable oil from process storage tanks, and door pit waste from the treatment area. The door-pit waste consists of wood chips, dirt and oil residues.

The Koppers Tie Plant uses creosote and pentachlorophenol-in-oil in the pressure treatment of wood products for railroad cross ties, utility poles and pilings. The raw materials include creosote, petroluem oil, pentachlorophenol and wood. Raw materials and treated products arrive and leave by rail and truck.

Generally, wood comes to the plant pre-sized. It is seasoned at the plant by air drying, steaming or the "Boultron" process.

Once the wood is sized, it is pressure treated in a cylinder. Generally, the wood is loaded on to tram cars which are pushed into the cylinder using a small locomotive, lift truck, or similar equipment. The cylinder door is sealed via a pressure tight door, and a vacuum is applied to remove most of the air from the cylinder and wood cells. Treating solutionj is then pumped into the cylinder and pressure applied. At the end of the process, the excess treating solution is pumped out of the cylinder and back to storage for re-use. A final vacuum is then pulled and any additional solution on the wood or in the cylinder is pumped to storage for re-use. The cylinder door is opened and the trams, loaded and treated wood, are pulled from the cylinder.

The container storage area receives three types of waste, U051 (creosote), F027 (certain pentachlorophenol wastes) and K001 (bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol). The U051 comes from cleaning of storage tanks, and process equipment. These cleanings occur on an as needed basis. The K001 comes from cleaning of the surface impoundment and the oil/waste separator. This cleaning also occurs on an as needed basis. F027 is generated when pentachlorophenol is discarded.

REGIONAL GEOLOGY/HYDROGEOLOGY

To date, there has been little site-specific work done for the Koppers Tie Plant facility. According to the Law Environmental consultant Brad Peebles, a detailed assessment of the geology and hydrology would be undertaken the summer of 1986. Results from the study are to include a site-specific map of ground water divides, swales, etc.; a summary of all components of flow; an ACL report to include preliminary values of contaminant constituents with decay, dispersion and dilution factors; pumping influences and seasonal variations on the potentiometric surface; a model of the ground water regime; soil analyses, and water quality analyses.

The hydrogeological and ground water flow discussion in this report are based on findings reported by the Koppers consultants, Law Engineering of Marietta, Georgia as a section of the Part B for this facility (February 27, 1985, revised 8/9/85).

Geology

The site is located in Grenada County and the loessal hills physiographic area.

Grenada County can be divided into three physiographic areas: (from west to east) th thinning progressively
to the east. (Grenada County Soil Survey, 1967).

The loessal hills are silty and the mantle of loess in Grenada County is about 30 ft thick at its extreme western edge thinning progressively to the east. (Grenada County Soil Survey, 1967).

The following discussion on the hydrogeology of Grenada County is based on studies by Newcome and Bettandorff (1973).

The formations exposed in this area range in age from Upper Cretaceous to Holocene and crop out in nearly north-south bands. The general dip direction of these formations, with the exception of flat lying surface deposits, is westward toward the Mississippi embayment which is the regional controlling structure.

All of the rocks in the area are sedimentary in origin and consist primarily of clay, chalk, loess, and gravel. Wide lowlands were formed by the eroding of thick clay or chalk beds. Where sandy units crop out, they are generally deeply dissected and constitute both in-take and discharge areas for the ground water reservoir.

The Tertiary aquifers are the main fresh water supply for most of the wells in Grenada County.

The Tertiary aquifers present in Grenada County include in ascending order the Lower Wilcox, Minor Wilcox, Meridian Upper Wilcox, Winona Sand, and the Sparta Sand (See Table 1) (Newcome and Bettandorff).

The uppermost aquifer in the Tie Plant area based on geohydrologic sections by C. A. Spiers (1977) is the Winona-Tallahatta which is part of the Claiborne Group of Eocene Age.

The basal unit of the Claiborne Group is the Tallahatta formation which includes, in ascending order, the Meridian Sand, Basic City Shale, and Nashoba Sand Members. (Spiers, 1977)

The Meridian Sand Member is a part of the Tallahatta Formation but it forms a separate aquifer with the sand beds in the upper part of the Wilcox Group named the Meridian Upper Wilcox aquifer (Spiers, 1977). Clay beds which commonly occur above and below the Meridian Upper Wilcox aquifer generally restrict vertical movement of water in and out of the aquifer except in some areas where the clay beds are thin or more permeable and separation is poor. In these areas the water in the Meridian Upper Wilcox can be influenced by the water in the Wilcox Group below and can influence the water in the overlying Tallahatta aquifer (Wasson, 1980). Regionally, the overlying Zilpha Clay hydraulically separates the Winona Sand aquifer from the next shallower aquifer, the Sparta Sand. The Winona-Tallahatta aquifer is recharged principally by precipitation in the outcrop area (Spiers, 1977).

The regional flow of water in the central and northwestern parts of the aquifer including Grenada County is down the dip in a westerly and southwesterly direction toward the Mississippi River alluvial plain (Newcome and Bettandorff, 1973).

The Winona-Tallahatta aquifer is the source of water for hundreds of small yield domestic wells and stock wells less than 200 ft deep (Spiers, 1977). Production rates as high as 700 gpm have been reported and the water quality in the aquifer is reported as generally good with the exception of high iron concentration and intensity of color. Water for domestic use is obtained from bored or dug wells and springs (Spiers, 1977).

Hydrogeology of RCRA Facility Area

The undisturbed soils encountered in this area are the result of deposition of sediments in a former marine environment. The typical marine soils vary from sands, silts and clays to interbedded deposits of sand, silt and clay. In some low lying areas near present streams or drainage features the originally deposited soils may be overlain by geologically younger water deposited (alluvial) soils.

Alluvial soils are fairly widespread to the far east around the Batupan Bogue based on the Grenada County Soil Survey. Although the thickness of these alluvial deposits is not known they are usually relatively thin.

Nine borings were drilled around the surface impoundment (R-1 through R-4 in March, 1982, and R-5 through R-9 in July, 1984). Borings SF-1 through SF-4 were drilled around the sprayfield in August, 1985.

A 12-inch thick surface layer of topsoil was encountered at boring R-5. Boring R-1 penetrated approximately 2 feet of man-made fill.

Beneath the topsoil layer encountered in R-5 and the fill in R-1 and from the surface in remaining borings, silts and clays were encountered to depths of 6 to 15.5 feet. These materials are probably loess deposits. Loess deposits are generally homogeneous, non-stratified, unindurated and consist predominately of silt with subordinate amounts of very fine sand and clay.

Beneath the loess deposits, very fine to coarse sands with traces of silt and clay were encountered to the boring termination depths of approximately 30 to 33 feet. These soils probably belong to the Nashoba Sand Member of the Claiborne Group.

Boring R-6 encountered a fine to medium sand layer containing silt and clay at 15.5 to 20.5 ft underlain by a clay and silt lense with traces of fine sand to 20.5 to 25.5 feet.

The occurrence, location and movement of ground water at the site is controlled by the interaction of several factors including: recharge areas, hydrologic characteristics of the geologic units, hydraulic gradients, man-made influences, and the proximity of discharge areas such as creeks and the Batupan Bogue. The regional flow direction of the ground water in the Winona-Tallahatta Aquifer is to the west and southwest. However, ground water flow in the RCRA facility area, based on available data, is generally north-northeasterly toward the Batupan Bogue. It should be noted that the available data indicated relatively flat gradients and very small ground water elevation differences between wells. Also, the ground water flow directions could be affected by local influences such as large scale pumping operations (City of Grenada) and discharge areas (Batupan Bogue).

Based on the consultant's understanding of the hydrogeology of the area, the Batupan Bogue is a local discharge drainage feature. It is Law Engineering's opinion that ground water from the RCRA facility area flows toward the Batupan Bogue which eventually discharges into the Yalobusha River. It is the opinion of the Task Force that there is not enough data to support this.

The Winona-Tallahatta aquifer in which the monitoring wells are screened, is hydraulically separated from the next shallower aquifer by clay, but could be locally influenced by the next deeper aquifer, the Meridian-Upper Wilcox. The actual depth of the uppermost aquifer at the site is unknown.

Field permeability tests were performed in all nine wells. The permeability tests were performed using a SE 1000 Hydrologic Monitor with an in-situ pressure transducer and a slug. Permeability calculations ranged from 6 x 10^{-3} to 1 x 10^{-2} cm/sec based on data recorded during the field testing.

Ground Water Flow Directions and Rates

Ground water gradients at the site are controlled by the topography, lithology, elevation of recharge and discharge areas, and possibly nearby pumping. Ground water elevations were determined by measuring the top of well casing elevation with a survey instrument, measuring the water level in the boring well and computing the elevation of the ground water at the time of measurement. Directions of ground water flow were determined between wells by comparing the ground water elevation at those locations. Ground water elevation will fluctuate with seasonal and rainfall variations and with changes in the water level in adjacent drainage features.

Hydraulic gradients were determined by the facility by dividing the difference in ground water elevation at two locations by the horizontal distance between the two locations. Computed hydraulic gradients range from 0.00038 to 0.0022, the steeper gradients occurring generally to the south of the surface impoundment.

In addition to hydraulic gradients (i), the rates of ground water movement (v) are a function of permeability (k) and effective porosity (n), as indicated by the equation $v = ki/n$. The effective porosity can be expected (based on Fetter, 1981) to range from about 0.24 for the fine sands to about 0.27 for the coarse sands. Based on typical values of hydraulic gradient, permeability and porosity in the site area, ground water movement in the fine to coarse sands can be expected to be on the order of a few tenths of a foot per day and 40 to 60 feet per year.

Adequacy of Hydrogeologic Characterization

The major sources of hydrogeologic information pertaining to the Koppers Tie Plant facility are the facility RCRA Part B and the facility ground water monitoring reports, (both of which contain essentially the same information), and monitoring well logs for the surface impoundment and sprayfield. Collectively, these sources address the hydrogeology in a general manner and do not present much in the way of site-specific data on the physical properties of the aquifers and associated confining units (i.e. vertical and horizontal hydraulic properties, detailed lithology and stratigraphy). It is the consensus opinion of the Task Force that Koppers has not fully characterized the hydrogeology of the site, and that the following steps should be taken by the facility to provide the necessary data to resolve the hydrogeologic issues:

1. Conduct additional borings for defining the vertical and lateral extent of confining clay(s); is this unit continuous across the site and can it be considered a true confining unit; what is the thickness of the unit? Conduct sieve analyses on all lithologic units encountered during coring; determine porosity of cores;

2. Prepare a stratigraphic section, fence diagram, etc. of the geology underlying the surface impoundment and sprayfield;

3. Define the various aquifers underlying the site; conduct pumping tests to determine if interconnection exists between the aquifers;

4. Install a series of nested piezometers throughout the thickness of the uppermost aquifer to adequately determine the potentiometric surface at the surface impoundment and sprayfield and to define the presence and magnitude of vertical gradients;

5. Survey all wells relative to mean sea level (MSL).

The following information should be submitted to resolve the above issues:

- potentiometric water level data and maps
- water quality analyses
- map showing all SMU units
- most recent report(s) on the sprayfield - include water quality, geologic logs, etc.
- recent pumping data for production wells on-site
- revision of Part B for the sprayfield.

GROUND WATER MONITORINC PROGRAM DURING INTERIM STATUS

Ground water monitoring at the Koppers Tie Plant facility has been conducted under State interim status regulations. The following is an evaluation of the monitoring program between November 1981, when the ground water monitoring provisions of the RCRA regulations became effective, and May 1986 when the Task Force investigation was conducted.

Regulatory Requirements

Ground water monitoring at this site is now regulated by the Mississippi Hazardous Waste Management Regulations (MHWMR), which are the State equivalent of 40 CFR Part 265, Subpart F, which were to be implemented by November 19, 1981.

The State of Mississippi received RCRA Phase I interim authorization in January 1981. At that time, the State regulations became enforceable in lieu of the Federal regulations. The State interim status ground water monitoring' requirements are found in MHWMR 265.90 - 265.94 Subpart F.

MHWMR Part 265 Subpart F

RCRA ground water monitoring at the site was regulated by the Mississippi equivalent regulations to 40 CFR Part 265, Subpart F. Table 2 outlines the parameters to be sampled and analyzed. All the parameters are to be monitored quarterly for one year to establish background concentrations for each parameter. During this period, four replicate measurements are to be obtained for each parameter in Category 3 for each sampling event.

After the first year, Category 3 parameters are to be monitored semi-annually, while Category 2 parameters are to be monitored annually.

Compliance History

The compliance history for the Koppers Tie Plant regarding ground water monitoring has been a long one. The following is a chronological summary of that history.

2-82: to 10-83:	Four wells (R-1, R-2, R-3, R-4) are installed as the RCRA monitoring system around the surface impoundment. Quarterly sampling began that same month. Information pertaining to this system was included as part of the January 1984 preliminary Part B application. The first four quarters of data (March, June, September, December) did not contain all of the required 265.93(b)(1)(2) (3) parameters. Only pH, TOC, COD, phenols, PCP, specific conductance, arsenic, chromium, hexavalent chromium and copper were analyzed for. The semi-annual results (June, October 1983) were for the 265.93(b) (2) (3) parameters. A student's t-test for the 1982-1983 data indicated no significant differences.
7-83:	Part B call-in
1-84:	Part B received
3-84:	Both MS DNR and EPA note during their review of the Part B that the application is incomplete. Points specific to the ground water monitoring plan included: lack of detailed well location; lack of well construction details; drilling methods and well development not included; elevations for well screens not included, R-1 (background well) unsuitable; lack of 265.93 (b)(1)(2) (3) parameters; invalid student's t-test, etc. The first NOD for the Part B was issued March 1984.
5-8-84:	A facility inspection by MS DNR in April 1984 noted areas of non-compliance with the 265 Subpart F regulations. These deficiencies are then conveyed to the facility on this date.
5-19-84:	Commission Order No. 705-84 was issued to the facility to correct the Part B deficiencies, including those pertaining to ground water monitoring. Revisions were due by 6-15-84.
6-84:	A revised student's t-test of the 1982-83 data was submitted by Koppers that indicated some significant differences.

7-84: MS DNR reminds the facility that information pertaining to the surface impoundment well system had not been submitted. Koppers was directed to submit a revised Part B by 9-12-84 and a proposed plan for a new monitoring system by 7-15-84.

7-16-84: Ground water assessment plan submitted for five new wells at the surface impoundment.

7-17-84: Wells R-5, R-6, R-7, R-8, R-9 installed. MS DNR directs both the old and new wells to be sampled four times on a bimonthly basis.

7-24-84: A written complaint was served against the facility on the grounds that they failed to notify the Executive Director in a timely manner of its findings indicating ground water contamination or submit a ground water assessment plan in a timely manner.

8-8-84: Commission Order No. 746-84 was issued against the facility for the above-mentioned violations and a penalty of $4000.00 was assessed.

8-13-84: Commission Order No. 705-84 was amended. Koppers was ordered to submit a complete Part B including information pertaining to ground water monitoring by 9-12-84 and to implement the ground water assessment plan.

8-84: Law Engineering retained to work on the Part B for Koppers, in particular to address the hydrogeological conditions at the site.

9-25-84: Written complaint served against the facility based on the violation of Commission Order No. 705-84 -ie- the facility had failed to submit a complete Part B on the date required.

10-10-84: Commission Order No. 772-84 issued and a penalty of $10,000.00 assessed for failure to submit a complete Part B by the time specified. A complete Part B was directed to be issued by January 31, 1985.

11-84 to 12-84: Law Engineering submits monthly reports on the status of the Part B, particularly those elements pertaining to ground water. Little work was done at the site during this time due to delays in procurring a topographic map of the site. Lab analyses from the bimonthly sampling were not available due to lab delays.

1-17-85 to 2-27-85: A revised Part B was submitted in two parts. Section E on ground water monitoring gives an overview of the geology/hydrology of the site and includes historical water quality data.

3-6-85: MSDNR directed the facility to sample the new well system for Appendix VIII parameters and submit the results by 6-7-85.

3-14-85 Koppers submitted the 3004(u) information regarding potential releases from Solid Waste Management Units (SMU's). The reply was not complete and more information was to be delivered in the "very near future".

5-7-85: MSDNR issued the 2nd NOD regarding the incomplete Part B and orders it to be submitted within 30 days.

5-8-85 MSDNR issued a letter detailing interim status and ground water monitoring violations noted during a 4-16-85 inspection. The company responds by letter 5-24-85 that these problems were being corrected.

7-85: Law Engineering submitted a status report and states that Koppers intends to demonstrate justification for ACL's and that the Exposure Information Report is in progress.

7-9-85: Appendix VIII analyses submitted. A preliminary review of the data shows that upgradient well R-5 often has the highest concentrations of detected parameters.

8-8-85: Appendix VII analyses submitted and again shows that upgradient well R-5 often has the highest concentrations of detected parameters.

8-85: A proposed monitoring system for the sprayfield was submitted for review. Approved by MSDNR 8-13-85. Four wells (SF-1, SF-2, SF-3, SF-4) installed end of August.

9-19-85: Commission Order No. 913-85 issued ordering the facility to submit additional information for the Part B including sprayfield irrigation information, a ground water assessment report, a corrective action plan or ACL proposal and updated cost estimates. All of this was due on or before 11-8-85.

9-27-85: Law Engineering submitted a ground water assessment plan for review which contained much of the information submitted in previous Part B's.

10-22-85: A 3rd NOD was issued to Koppers pertaining to an incomplete Part B regarding ground water. This information was to be addressed by 11-8-85.

11-8-85: Koppers submits a revised Part A to EPA Region IV to include the sprayfield as a protective filing. The facility contends that the sprayfield is not a RCRA regulated unit.

11-25-85: Commission Order No. 951-85 issued regarding the storage of hazardous waste in excess of their interim status design capacity noted from a 10-29-85 MSDNR inspection. This violation was to be corrected by 12-15-85.

12-5-85: Law Engineering submitted a Revised Exposure Information Report to MSDNR that updates the 8-7-85 version submitted to EPA Region IV.

2-28-86: The 1985 Annual RCRA Ground Water Monitoring Report for the sprayfield is submitted to MSDNR for review to satisfy item #2 of the 913-85 order requiring sampling around the sprayfield.

3-12-86: A recodified version of the Part B was submitted to EPA Region IV for review. Region IV contracted the review out and the final was due 6-30-86. MSDNR reviewed the Part B and issued an order (August 1986) regarding the deficiencies.

During the inspection, the Task Force learned that there was some ground water monitoring data that had not been submitted to EPA or MSDNR. An intensive hydrogeologic investigation and ACL study was to be conducted during the summer of 1986. Results were to be sent to EPA and MSDNR for review.

Monitoring Well Data

Surface Impoundment

The interim status monitoring program was instituted at this site in 1982 (See Table 3). Four ground water monitoring wells (R-1 through R-4) were installed in March, 1982. R-1 served as the upgradient well (See Figure 2). Analyses were performed on samples collected from the wells in 1982 and 1983 (See Table 4).

It was determined by the Mississippi Bureau of Pollution Control (MBPC) that the interim status monitoring program being conducted by Koppers was inadequate to meet regulatory requirements. In mid-1984, the MBPC and Koppers agreed to an assessment program that would be implemented at an accelerated schedule. The purposes of the assessment program were to meet some of the deficiencies of the original interim status program and to perform a more comprehensive assessment of the ground water closer to the RCRA facility (surface impoundment). Five new monitoring wells (R-5 through R-9) were installed in July, 1984 with R-5 as the upgradient well (See Figure 2). A program of bi-monthly sampling and analysis was started with the last of the four bi-monthly sampling and analysis episodes completed in February, 1985. Appendix VIII sampling was completed in July 1985.

The wells were installed by inserting a length of PVC pipe (schedule 40 with flush threaded joints) into the borehole. The bottom 10 ft section of the well was a manufactured well screen with 0.01 inch wide openings. Coarse sand backfill was placed around the outside of the pipe to at least 1 ft above the top of the well screen. The coarse sand backfill was used to stabilize the formation and to help yield a less turbid water. The coarse sand used was obtained from a local supply company.

In monitoring wells R-1 through R-4, auger cuttings were placed on top of the sand pack and a bentonite seal was placed on top of the auger cuttings. In wells R-5 through R-9 a bentonite seal (minimum 1 ft thick) was installed on top of the coarse sand backfill to seal the monitoring well at the desired level. The borehole was then grouted with concrete to the ground surface. A steel protective cover was placed over the wells for security.

After the grout had set, the wells were purged by bailing water from the well. This procedure was followed to develop the wells and to determine if they were functioning properly.

Surveying of the well locations and elevations was performed by McRee, Dardaman, Jones and LaCoste, Ltd., of Grenada. The elevations were referenced to the USC & GS Datum.

The location of the screened interval was selected to monitor the ground water in the uppermost water-bearing zone. All nine wells were screened in a sand layer underlying a near surface layer of clay and silt with the exception of R-6 where about half of the screened interval is in clay and silt. Copies of the monitoring wells logs have been included in Appendix B.

Sprayfield

Ground water contours were available for the southern end of the Koppers property near the existing impoundments, and this data was used to place the four monitoring well locations with respect to the sprayfield. Drilling operations for the four wells were completed in late August 1985 (See Table 3). All monitoring wells were drilled using hollow stem augers with split-spoon soil samples collected every 2.5 feet to the termination depth. Wells were constructed of 2-inch inside diameter flush threaded PVC riser and 10 feet of manufactured PVC screen having a slot size of 0.010 inches. The screened interval was placed such that approximately 8 feet were below the encountered water table with 2 feet above to allow for seasonal fluctuations.

Coarse sand was placed in the annulus around the screen to act as a formation stabilizer; this sand extends approximately 2 feet above the screened interval. A bentonite seal was placed above the coarse sand. The remaining annulus was sealed with a cement/bentonite grout. At the ground surface, a protective steel casing with locking cap was installed around the PVC casing. To prevent surface water ponding and infiltration near the well casing, a sloping cement collar was constructed around the protective casing. The soils beneath the sprayfield, as determined by the ground water monitoring well logs are generally characterized by: clay and silty clay for the first 11 to 18.5 feet; sand and silt are present with traces of clay (in one instance a gray silty clay lens at 15- 15.5 feet and 19.5 to 20 feet) from 11 to 21 feet; then two foot layers of fine sand with some silt, alternating with one to two foot layers of silty clay. The four wells all terminated in sand at depths ranging from 26.1 to 30.3 feet below the surface. Copies of the monitoring well logs have been included in Appendix B.

After reviewing the monitoring well data for the surface impoundment and sprayfield wells, several deficiencies were noted. The following are general comments on information that should be submitted for review:

1. What method was used to drill the surface impoundment wells? Was any type of drilling fluid used in any of the wells?

2. What are the elevations of all the wells relative to MSL (mean sea level)?

3. Why was PVC casing chosen over teflon-coated or stainless steel considering that organics are of primary concern at this facility?

4. What are the dimensions of the sand pack? Were any sieve analyses run on the sand pack? Could an inadequate sand pack explain the high turbidity? (If the facility cannot demonstrate that the filter pack was designed for the formation, then the wells yielding turbid samples are not suitable for monitoring purposes).

5. Is the annular space adequately sealed? (Wells in which drill cuttings were backfilled and used as the annular seal are not acceptable as RCRA monitoring wells.)

6. How long were the wells developed? Were the wells developed until pH, temperature and specific conductance stabilized?

7. Are any of the wells capped at the bottom?

8. There is a possibility of contamination by placing cuttings from the well on top of the sand pack. What measures were taken to prevent this?

There is not enough information to determine if the monitoring wells are adequately located at the surface impoundment and the sprayfield. It is evident that upgradient well R-5 appears to be affected by the facility and a new well should be required. Also, an unsaturated zone monitoring system is required at the sprayfield. Regulation 40 CFR 265.278 - Unsaturated Zone Monitoring requires owners/operators to implement an unsaturated zone monitoring system which will detect migration of hazardous wastes under the active portion of a land treatment facility, and provide background information on untreated soils. This type of monitoring will show the adequacy of the land treatment process and provide an early detection of contaminant migration.

Little site-specific hydrogeologic work is available. Additional stratigraphic and hydrogeologic information is needed to assess whether the screened intervals are appropriate. Hydraulic gradients and possible hydraulic interconnection between the saturated zones underlying the site are also needed to properly assess the present well design. Also, the possibility of mounding at the surface impoundment indicates that additional wells should be placed on the north side of the impoundment.

Ground Water Sampling - Detection/Assessment

Surface Impoundment

The facility began their quarterly RCRA ground water monitoring program in March 1982 for wells R-1, R-2, R-3 and R-4. Quarterly analyses were taken in March, June, September and December 1982. The only parameters sampled for during this time were pH, TOC, COD (total), phenols, PCP, specific conductivity, arsenic, chromium (total and hexavalent) and copper. Semi-annual sampling and the student's t-test were performed June 1983. No statistically significant differences were noted.

In January 1984, Koppers forwarded the October 1983 semi-annual sample analyses to MSDNR for review. The report contained a revised version of the June 1983 data to include some additional parameters. The list now included chloride, iron, manganese, sodium, phenol, sulfate, pH, specific conductance, TOC, TOH and PCP. No student's t-test results were included.

In March 1984, EPA Region IV Atlanta sent MSDNR a copy of EPA's comments on the Koppers Part B application. Several deficiencies were noted pertaining to ground water monitoring:

- incomplete summary of ground water monitoring data.
- student's t-test results were invalid because incorrect water quality data was used.
- hydrogeologic characteristics of the uppermost aquifer were not included for review.
- incomplete topographic map.
- inadequate description of any contaminant plume.
- inadequate report describing the 264 Subpart F ground water monitoring system.
- downgradient wells too far from the point-of-compliance.

June 1984, Koppers submitted a revised student's t-test of the previously collected sampling data. There was a statistically significant change for well R-2 in pH and conductivity. No other changes were noted.

It was determined by the Mississippi Bureau of Pollution Control (MBPC-MSDNR) that the interim status monitoring program being conducted by Koppers was inadequate to meet regulatory requirements. Commission Order No. 705-84 was issued to Koppers to correct the deficiencies (May 1984). A written complaint was served on Koppers for failing to notify the proper authorities in a timely manner of its findings indicating ground water contamination (July 1984).

In July 1984, the MBPC and Koppers agreed to an assessment program that would be implemented on an accelerated schedule. The purposes of the assessment program were to meet some of the deficiencies of the original interim status program and to perform a more comprehensive assessment of the ground water closer to the surface impoundment.

Five new monitoring wells (R-5 through R-9) were installed in July 1984, and a program of bi-monthly sampling and analysis was started. Law Engineering Testing Company was retained to act as hydrologic consultants for the Koppers facility. Their job was to assess the hydrogeologic conditions at the site, prepare a revised Part B, and revise the Part A to include a new waste storage building.

The last of the bi-monthly sampling and analysis episodes was to be completed in February 1985. Sampling for wells R-1 through R-4 included indicator parameters, ground water quality parameters, drinking water standards and priority pollutants. In August 1984, Wells R-6 through R-9 were sampled for the indicator parameters, primary drinking water standards, ground water quality parameters, select organics, pesticides and herbicides. The new upgradient well, R-5, was not sampled due to mechanical interference of the bailer.

In October 1984, wells R-6 through R-9 were sampled for all parameters mentioned above except select organics, pesticides and herbicides. Acid extractable organics and base neutral extractable organics were added. Again, R-5 was not sampled due to mechanical interference of the bailer.

In December 1984 and February 1985, wells R-1 through R-9 were sampled, thus completing the accelerated bi-monthly program. The samples were analyzed for the indicator parameters, primary drinking water standards, ground water quality parameters, PAH's and chlorophenols. The statistical analysis performed indicated significant changes in R-8. No other changes were noted.

The significant change triggered "compliance" monitoring - a term used by the facility. Wells R-5 through R-9 were the "compliance" monitoring system and were to be sampled once each quarter using the same procedures used for interim status and the assessment program. Parameters to be sampled for were pH, conductivity, TOC, TOX, PCP, napthalene, acenaphthene, chloride, sodium, sulfate and phenol.

In April 1985 samples were collected from wells R-5 through R-9 for Appendix VIII analyses. Results were submitted to MSDNR for review July 1985.

In September 1985, Law Engineering prepared for Koppers the submittal "Report on Ground Water Assessment" which was submitted to MSDNR and outlined the procedures used during the assessment and presented the results. The report was basically Section E of the Part B submitted in February 1985 with some field permeability test results added.

In December 1985, Law Engineering prepared for Koppers an "Exposure Information Report" to address potential exposure to humans resulting from the operation of the surface impoundment. The report concluded that a potential ground water pathway could exist for shallow private wells that might be located north-northeast of the facility and between Batupan Bogue and the facility. There was no evidence that private wells in the area had been contaminated.

The report also concluded that a ground water pathway for public, industrial and institutional wells did not likely exist because those wells draw from deep water-bearing units that are hydrogeologically isolated from the uppermost aquifer immediately below the surface impoundment.

It was stated that normal operating procedures would reduce the risk of exposure through surface water and soil pathways and that security, inspection and training programs existed to correct potential releases. The report concluded that current data did not suggest a plume of contamination.

At the time of the Task Force inspection, no further information pertaining to the surface impoundment was available for review. It is the conclusion of the Task Force that a contaminant plume does exist at the surface impoundment and that Koppers has not defined the extent of the plume nor the rate of travel as required by 265.93 (d)(4), nor does the Part B contain the information required by 270.14 (c).

A ground water monitoring system of four wells was installed around the sprayfield in August. Two rounds of samples were taken in September and three rounds in October. The results were evaluated using the student's t-test and statistically significant differences were noted for pH in wells SF-2, SF-3, and SF-4; conductivity in SF-2; and TOX in SF-2 and SF-3. This was compiled into a "1985 Annual RCRA Ground Water Monitoring Summary, Grenada Sprayfield" in February 1986.

At the time of the Task Force inspection, no further information pertaining to ground water quality at the sprayfield was available for review. Historical water quality indicates the hazardous constituents (trichlorophenols) are contaminating the ground water and that an assessment program is needed for this unit. The Task Force also recommends that the following additional work should be completed as part of the assessment at the surface impoundment and the sprayfield:

1. A series of closely spaced borings should be placed around the surface impoundment. The cores should be analyzed for free oil and dissolved constituents. There is the possibility that a dense immiscible creosote phase is present and work should be done to determine if this phase exists.

2. Additional wells are needed downgradient of the surface impoundment and the sprayfield to define the lateral extent of the plume. In addition, some wells should be screened in the uppermost aquifer so that the vertical extent of the plume can be determined.

Koppers Sampling Collection and Handling Procedures

During the inspection, samples were collected from eight wells for analysis by the EPA contractor laboratory. After the Task Force sampling, the facility took samples for their second quarter sampling event. Steve Hall of the Task Force observed the sample collection and handling procedures. Koppers personnel closely followed the protocol established in the "Procedures for Ground Water Sampling", submitted as Appendix B of the Part B, January 1985, revised January 1986. A copy is included as Appendix C in this report.

The following is a summary of the sampling protocol followed by Koppers personnel:

a. determine when sampling is to be performed and what analyses are required,
b. bottle preparation - use new, pre-cleaned bottles for samples,
c. bailers to be used are dedicated for each well; bailer is stainless steel with an open top and a new disposable cork for the bottom; new cotton string is used as lowering cord,
d. after use, bailers are thoroughly cleaned and stored for next sampling program,
e. before sampling, take water levels from all wells; mark last few feet of measuring tape with water - soluble ink; lower tape into well; read tape to nearest hundredth; calculate water level.
f. determine purge volumns for three well-casing volumes - purge water can be disposed of on the ground, but contaminated water is disposed of in the plant wastewater system.
g. sample the well - place plastic around the wells to prevent sampling equipment from coming into contact with the ground; tie cotton cord to bailer and place cork securely in end of bailer; put on disposable gloves; lower bailer into well; remove three well volumes; fill containers; if VOA's are taken, aerate the sample as little as possible; check for air bubbles.
h. take samples to field laboratory where pH and specific conductance measurements are made - instruments are to be calibrated before use each day and at periodic intervals throughout the day.

i. samples are to be capped, placed on ice, put into cooler that is then sealed with evidence tape.
j. at the end of each day of sampling, coolers are shipped via overnight air express to the Koppers Environmental Analysis Laboratory, 440 College Park Drive, Monroeville, PA 15146, or to be appropriate contract laboratory.
k. a field blank will be collected during sampling for QA/QC purposes.

An example of the field data sheets, chain-of-custody, etc. is also included in Appendix C of this report.

Some comments on the sampling protocol used by Koppers are:

1. Using a water soluble ink pen to mark the water level measuring tape may introduce some organics into the well.

2. Cleaning the bailers with acetone and hexane may introduce some organics into the wells if the bailers are not totally allowed to dry.

Except for the use of open top bailers (closed top bailers should be used), procedures utilized by Koppers for RCRA ground water monitoring appear adequate for sampling purposes. However, the RCRA ground water sampling and analysis plan (SAP) is incomplete.

The SAP, as written and compiled, does not fully meet the requirements of a sampling and analysis plan as described at 40 CFR Part 265.92(a). These requirements state that the SAP must contain procedures and techniques for:

1. sample collection
2. sample preservation and shipment
3. analytical procedures; and
4. chain-of-custody control

The SAP covers items 1,2 and 4 adequately but does not include a reference to a specific analytical procedure for each parameter or constituent which is analyzed or measured.

In addition, there are no specific procedures referenced for the 40 CFR Part 265.92 (b)(1)(2) and (3) parameters. These procedures must be included in the SAP.

Alternate Concentration Limits (ACL's)

Alternate concentration limit evaluations are presently being conducted to determine the concentrations that could exist at the point of compliance and still preclude substantial present or potential hazards to human health and the environment at the point of exposure (point of use). Koppers has begun their ACL evaluation based on procedures outlined in the US-EPA memorandum by John H. Skinner pertaining to ACL Guidance.

The point-of-compliance has been designated the exterior toe of the slope of the surface impoundment. The point of exposure is the Koppers property line, about 300 feet downgradient from the impoundment. Existing wells R-2, R-3 and R-4 are to provide preliminary downgradient monitoring.

The ACL demonstration is to be based on attenuation mechanism analyses. Other analyses will also consider decay, retardation, advection and dispersion. The key constituents may include napthalene, fluoranthene, benz(a) anthracene, benz(c) fluoranthene, benz(a) pyrene and dibenze (a, h) anthracene.

The thickness of the contaminated zone at the point-of-compliance is taken as the 20 feet immediately beneath the surface impoundment.

Much work needs to be done to show the merits of ACL's for this site. The Task Force recommends that at a minimum future work should determine:

- continuity of the silt/clay layer underlying the site
- thickness of the underlying primary sand unit
- potentiometric surface of the primary sand unit - should include seasonal variations
- discharge area of the primary sand unit
- hydraulic characteristics of the underlying geologic units - should include silts, clays, sands, etc.
- effects of retardation factors, degradation half-lifes, decay and advection of the key constituents
- effects of transverse and longitudinal dispersion
- exposure assessment regarding human health, and the environment - should include possible exposure pathways
- additional wells at the point-of-compliance and downgradient of the surface impoundment

At the time of the inspection, the Task Force was informed that the ACL demonstration was underway and a summary of the findings would be available at the end of summer (August - September 1986). It should be noted that information contained in the Part B was not adequate to support the ACL.

TASK FORCE SAMPLE COLLECTION AND HANDLING PROCEDURES

This section describes the well evacuation and ground water sampling procedures followed by Task Force personnel during the May 1986 site inspection. Samples were collected by an EPA contractor (GCA) to determine if the ground water contains hazardous waste constituents or other indicators of contamination. Koppers declined to split samples with the Task Force, but did take samples for their 2nd quarter sampling period. The Task Force observed their procedures for sampling.

Water samples were collected from wells R-1, R-4, R-5, R-7 and R-9 at the surface impoundment; and from wells SF-1, SF-2 and SF-4 at the sprayfield (See Table 5). The selection of these eight wells for sampling was based on well locations to provide areal coverage both up and downgradient at the surface impoundment and the sprayfield.

EPA Region IV requested and received split samples for the wells R-5, R-9, SF-1 and SF-2. MSDNR and Koppers declined to split samples for independent analysis. A field blank was poured the first two days of sampling by the EPA contractor at locations specified by the Task Force. Water used to pour the blanks was HPLC water. One duplicate was taken from R-5 for quality assessment/quality control (QA/QC) purposes. A trip blank was poured prior to the trip and an equipment blank was poured after all samples were taken on the last day for QA/QC purposes.

All samples bottles and preservatices were provided by an EPA contractor (I-Chem). Samples were collected by the EPA sampling contractor using the following protocol:

a) Depth to ground water determined by using an electric water - level recorder. Total well depth also measured.

b) Height and volume of the water column then calculated.

c) Calculated three water column volumes.

d) Purged the well three well volumes using a pre-cleaned teflon bailer.

e) Prior to sampling, the EPA sampling contractor monitored the open well for chemical vapors using an HNU meter, and monitored for radiation using a Geiger counter.

f) Collected a sample aliquot and made field measurements (water temperature, specific conductance and pH) a minimum of three times.

g) EPA contractor filled VOA vials, then filled the remaining sample containers in the order shown on Table 6.

h) EPA contractor placed samples on ice in an insulated container immediately after filling the bottles.

The first step in the ground water well sampling procedure is to measure the depth from a reference point at the wellhead. At Koppers, that reference is a known elevation at a mark near the top of the well casing. The EPA sampling contractor used an electric water-level recorder to measure the depth to water. The recorder was rinsed with isopropanol alcohol and wiped dry with a Kim® wipe. The recorder used for this exercise was clean and kept protected from potential outside contamination. Water-level measurements were made to within 0.01 foot.

The volume of water to be purged was then calculated. The column volume of a well is the volume of standing water in the well and is calculated using the depth-to-water measurement, total well depth (determined in the field with well sounder) and casing radius. All calculations were done correctly by the EPA contractor.

For purposes of the Task Force, the column volume is multiplied by three to compute the purge volume. The volume is measured into a graduated bucket as it is taken from the well. In all cases, standard field measurements (temperature, pH, specific conductance) were taken to determine when sampling should begin.

The wells were purged by the EPA sampling contractor using a pre-cleaned, double check-valve Teflon bailer which was lowered into the well with teflon-covered stainless steel cable.

After purging, the EPA contractor began the sampling procedure. HNU readings ranged from 0.1 to 0.5 ppm at the surface impoundment wells and 0.1 to 0.2 ppm at the sprayfield wells. Geiger counter readings ranged from 0.01 to 0.02 millirems/hr at the surface impoundment wells and at the sprayfield wells. Parameter by parameter, the EPA contractor filled the sample containers in the order listed in Table 6.

After sampling was completed, the EPA contractor took the samples to a staging area where a turbidity measurement was taken. Samples for metals, TOC, phenols, cyanide, nitrate and ammonia were preserved.

At the end of the day, samples were packaged and shipped to the EPA Contract Laboratory. The EPA Region IV samples were released to EPA Region IV Environmental Services Division personnel for transport. A "Receipt for Samples" was given to Koppers for the samples taken off-site by the Task Force. All samples were shipped according to applicable Department of Transportation regulations (40 CFR Part 171-177). All water samples from monitoring wells were considered "environmental" for shipping purposes.

LABORATORY EVALUATION

To be completed at a later date - will be issued as an addendum.

MONITORING DATA ANALYSIS

Acceptability and Validity of Data

The samples collected during this evaluation were analyzed by Compu Chem Laboratories, Research Triangle Park, North Carolina, and Centec Laboratories, Salem, Virginia. Compu Chem performed the organic analyses and Centec performed the inorganic analyses. The results were compiled and tabulated by Life Systems, Inc. and forwarded to the Task Force for evaluation. The OSWER functional guidelines for evaluating contract laboratory program data, as well as the Region IV EPA protocols were used to assess the validity of the data. All data was considered valid except for the results of analyses for antimony and most of the arsenic. Some data was qualified, as indicated in the data summary tables, as estimated in concentrations or as presumptive evidence of material. Pesticide, herbicide and dioxin data was considered to be unreliable.

There was generally a good agreement between the contract labs and the Region IV lab, except for the arsenic analyses and one aluminum analysis, on the four samples split with Region IV. For station number R-9, the contractor result was 25,000 ug/l for aluminum, while the Region IV lab reported 14,000 ug/l. This may appear to be a significant difference, but might be expected if the sample contained substantial amounts of particulate matter. The aluminum results for the remaining split samples were comparable. For station number R-5, the average arsenic result reported by the contract lab was 23 ug/l, while Region IV reported 90 ug/l. Arsenic results for the remaining three stations agreed well. All other organic and inorganic indicator parameters were in close agreement for the split samples.

Discussion of Results

A review of the data indicates ground water degradation has occurred at upgradient well R-5. The degradation in this area was metals, extractable and purgeable organics. Table 7 summarizes the contractor data from the samples collected from the RCRA monitoring wells at the surface impoundment and the sprayfield. Table 8 is a summary of analyses performed by the Region IV ESD laboratory. The contractor data is discussed in the following sections.

Surface Impoundment

Inorganic Elements/Compounds

Twenty inorganic elements and compounds were detected in samples collected from monitoring wells in this area. Upgradient well R-5 had the highest concentrations for seventeen of the twenty elements/compounds. The National Interim Primary Drinking Water Standard (NIPDWS) of 50 ug/l for chromium was exceeded in R-7 (160 ug/l), R-4 (190 ug/l), R-5 (530 ug/l), R-5 duplicate (580 ug/l) and R-1 (63 ug/l). The NIPDWS of 50 ug/l for lead was exceeded in R-4 (estimated 80 ug/l), R-5 and R-5 duplicate (estimated 70 ug/l). The NIPDWS of 10 ug/l for selenium was exceeded in R-5 (estimated 15 ug/l), R-5 duplicate (estimated 13 ug/l) and R-1 (estimated 18 ug/l). The secondary drinking water standard of 50 ug/l for manganese was exceeded in R-7 (estimated 620 ug/l), R-4 (estimated 360 ug/l), R-5 (estimated 2,700 ug/l), R-5 duplicate (estimated 2,600 ug/l), R-1 (estimated 130 ug/l) and R-9 (estimated 280 ug/l). The secondary drinking water standard of 0.3 mg/l for iron was exceeded in R-7 (80 mg/l), R-4 (137 mg/l), R-5 (134 mg/l), R-5 duplicate (146 mg/l), R-1 (29 mg/l) and R-9 (21 mg/l). Aluminum concentrations ranged from 25,000 ug/l in R-9 to 84,000 ug/l in R-5 duplicate.

Extractable Organic Compounds

Ten extractable organic compounds were detected in samples collected from upgradient wells R-5 and R-1. Napthalene was detected in R-5 and R-5 duplicate at 2,200 and 870 ug/l, respectively. Estimated concentrations of acenaphthene for R-5 were, (120 ug/l), R-5 duplicate (63 ug/l) and R-1 (3.2 ug/l). Estimated concentrations were also given for fluorene, phenanthrene, 2-methylnapthalene and dibenzofuran in R-5 and the R-5 duplicate. 12 ug/l of 1,4 naphthoquinone was estimated for the R-5 duplicate. Presumptive evidence was found for C3 alkylbenzene, benzothiophene, and ethylideneindene in R-5 and the R-5 duplicate. No other extractable organic compounds were detected in any of the surface impoundment wells.

Purgeable Organic Compounds

Purgeable organic compounds were detected only in R-5 and the R-5 duplicate. Benzene was measured at 5.4 ug/l and estimated at 4.1 ug/l; toluene 6.1 ug/l and estimated 4.7 ug/l; ethyl benzene 9.0 and 6.8 ug/l; and total xylenes 16 and 6.5 ug/l, respectively. However, according to the QA/QC check, there was a possibility of false negatives for the semi-volatiles in well R-5.

Conventional/Indicator Parameters

Consistent with the previously discussed organic data, there is a clear indication of ground water degradation at R-5. Chloride, ammonia, sulfate, TOC and TOH were detected at concentrations exceeding those in the other surface impoundment wells. Phenols were undetected in all wells except R-5 and the R-5 duplicate, which had concentrations of 220 and 210 ug/l, respectively.

Sprayfield

Inorganic elements/compounds

Sixteen inorganic elements and compounds were detected in samples collected from monitoring wells around the sprayfield. Of these sixteen, thirteen were found in noticeably higher concentrations in downgradient well SF-2. The NIPDWS limit of 50 ug/l for chromium was exceeded in SF-2 (70 ug/l). The secondary drinking water limit of 50 ug/l for manganese was exceeded in SF-2 (estimated 250 ug/l) and SF-1 (estimated 150 ug/l). The secondary drinking water standard of 0.03 mg/l for iron was exceeded in SF-2 (44 mg/l), SF-4 (6.9 mg/l) and SF-1 (16 mg/l). Aluminum concentrations ranged from 7,200 ug/l in SF-4 to 15,000 ug/l in SF-2.

Extractable Organic Compounds

Four unidentified compounds were detected in upgradient well SF-1 with an estimated concentration of 200 ug/l. No other extractable compounds were detected in any of the sprayfield wells.

Purgeable Organic Compounds

No purgeable organic compounds were detected in any of the sprayfield wells.

Conventional/Indicator Parameters

Nitrate-nitrite nitrogen, sulfate and TOH were detected in all of the sprayfield wells, but concentrations were highest in upgradient well SF-1. Chloride and TOC concentrations were highest in downgradient well SF-4. No phenols were detected in any of the sprayfield wells.

REFERENCES

1. "Revised Draft Protocol for Ground Water Inspections at Hazardous Waste Treatment, Storage and Disposal Facilities", by the EPA Hazardous Waste Ground Water Task Force April 1986.

2. 1985 Annual RCRA Ground Water Monitoring Summary, Grenada Sprayfield. Grenada. MS: prepared by Koppers Co. Inc.. February. 1986.

3. Report of Ground Water Assessment, Grenada, MS: prepared for Koppers Co. Inc.. by Law Engineering, September. 1985.

4. Proposed RCRA Compliance Ground Water Monitoring Spray Irrigation Field, Koppers Co. Inc., Grenada, MS: prepared by Koppers Co. Inc., August, 1985.

5. Application for RCRA Part B Permit, Volume II prepared for Koppers Co. Inc.. by Law Engineering, February, 1985.

6. RCRA Part B Application for the Koppers Co. Inc., Hazardous Waste Management Facility, Grenada, MS: submitted by Koppers Co. Inc., January, 1985.

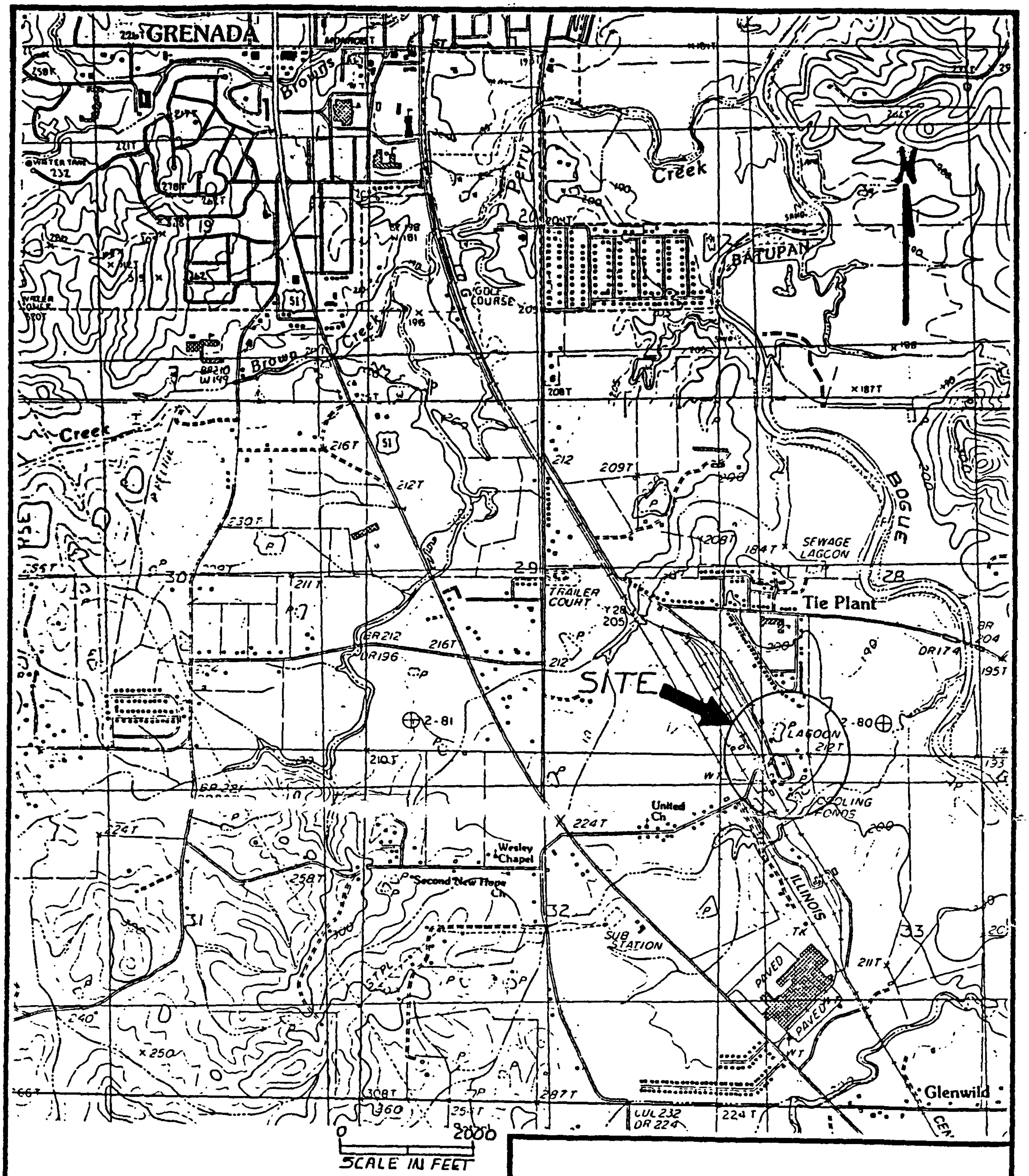
7. Fetter, C. W. Jr.; Applied Hydrogeology. Bell and Howell Company. 1980.

8. Wasson, B.E., Potentiometric Map of the Meridian - Upper Wilcox Aquifer in Mississippi, Fall, 1979. USGS WRI Report 80-590. 1980.

9. Spiers, C. A., The Winona-Tallahatta Aquifer in Mississippi, USGS WRI 77-125, 1977.

10. Newcome, R. Jr. and J. M. Bettandorff, Water for Industrial Development in Calhoun, Chickasaw, Choctaw, Grenada, Montgomery, Webster and Yalobusha Counties, Mississippi, U.S.G.S. and Mississippi Research and Development Center, 1973.

11. Soil Survey, Grenada County, Mississippi. USDA, SCS, April 1967.



REF: U.S. GEOLOGICAL SURVEY TOPOGRAPHIC MAP OF GRENADA, MISSISSIPPI; DATED 1983 AND U.S. GEOLOGICAL SURVEY TOPOGRAPHIC MAP OF TIE PLANT, MISSISSIPPI; DATED 1983

after Law Engineering

Figure 1
Facility Location Map
Koppers Tie Plant
Grenada, Mississippi

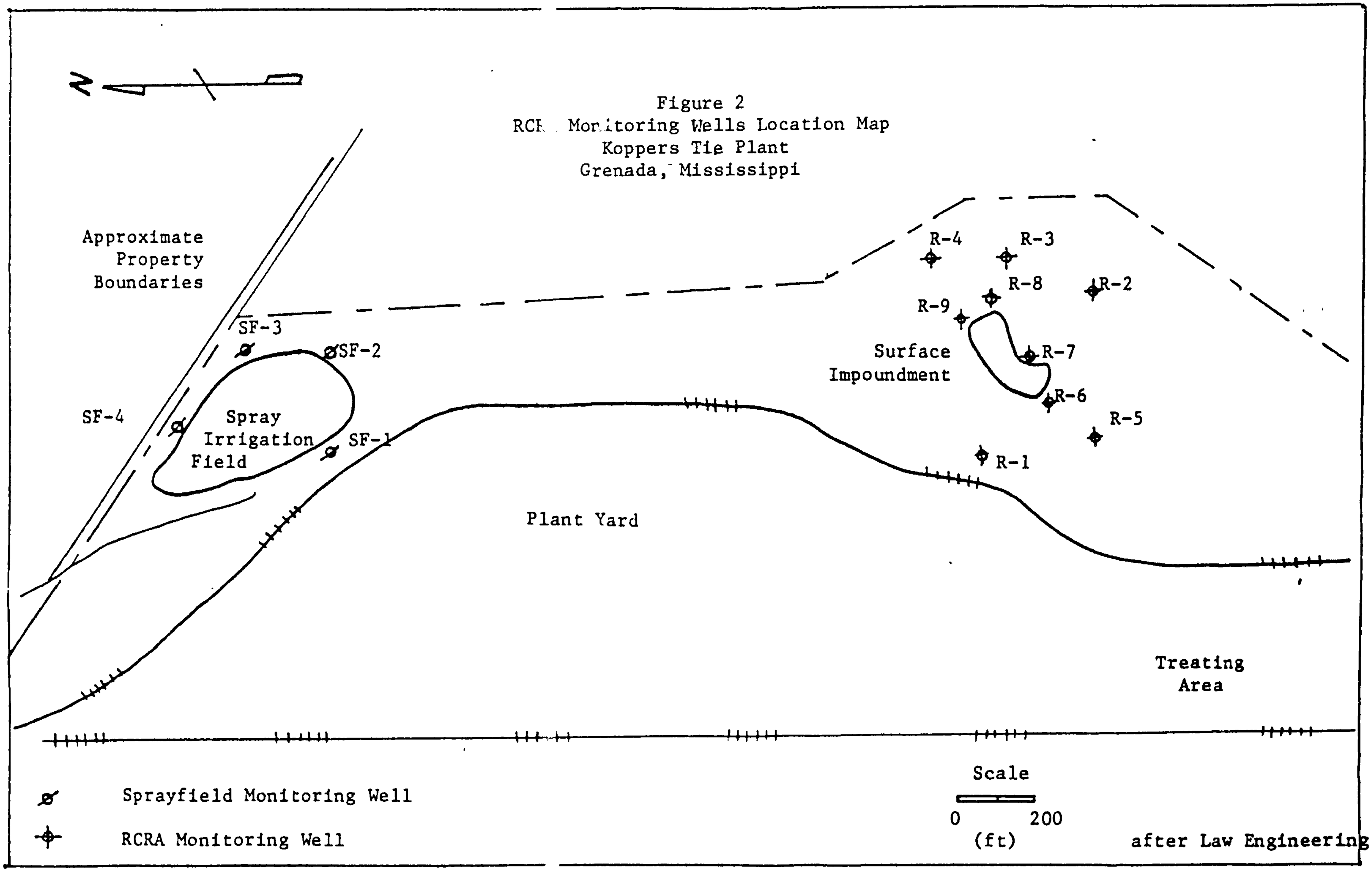


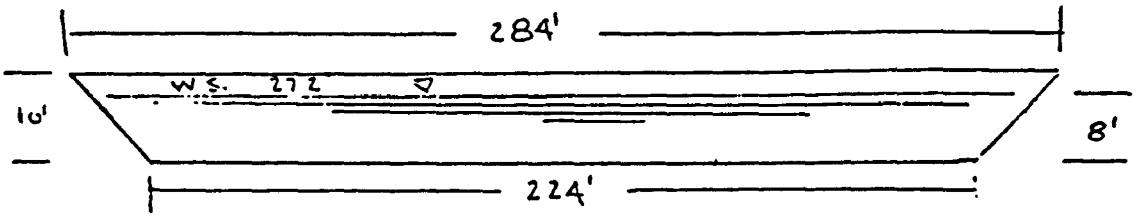
Figure 2
RCRA Monitoring Wells Location Map
Koppers Tie Plant
Grenada, Mississippi

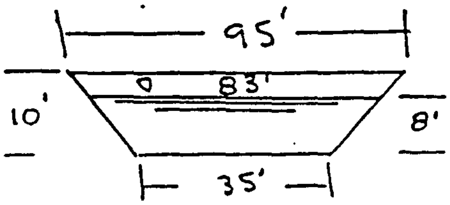
after Law Engineering

Figure 3
Surface Impoundment Diagram
Koppers Tie Plant
Grenada, Mississippi

- SURFACE IMPOUNDMENT CALCULATIONS

General Shape of Impoundment





Net cross section area equals 8' x (83 + 35/2) = 472 sq. ft.

Gross volume = 272' x 472 sq. ft. = 128,384 cu. ft.

Less end wedge of 12,384 cu. ft.

Net volume = 116,000 cu. ft.

= 867,680 cu. ft.

Sludge Generation

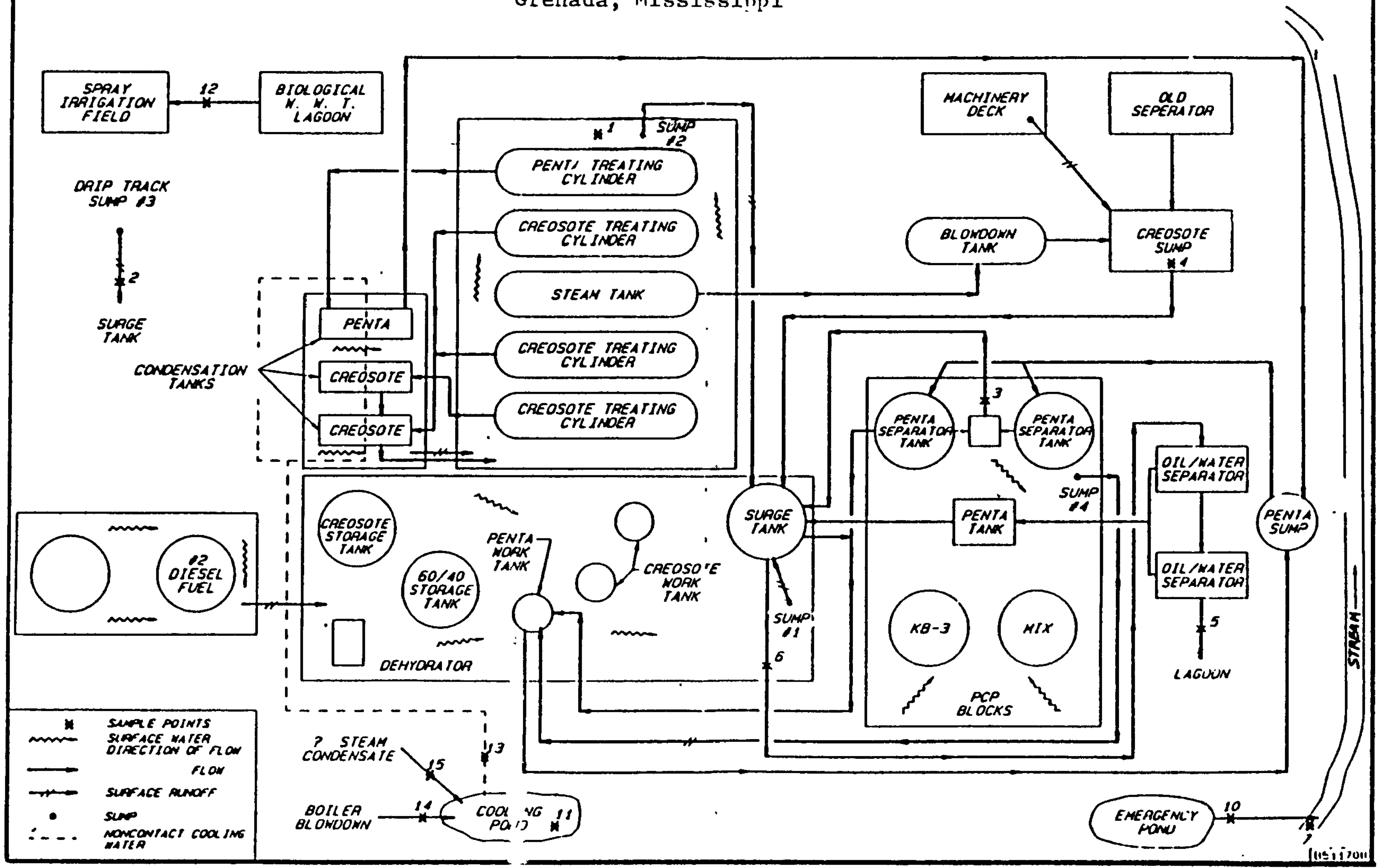
2,500 pounds = 312 gallons at 8 lbs/gallon
42 cu. ft.

Bottom Area = 35' x 224' = 7,840 sq. ft.

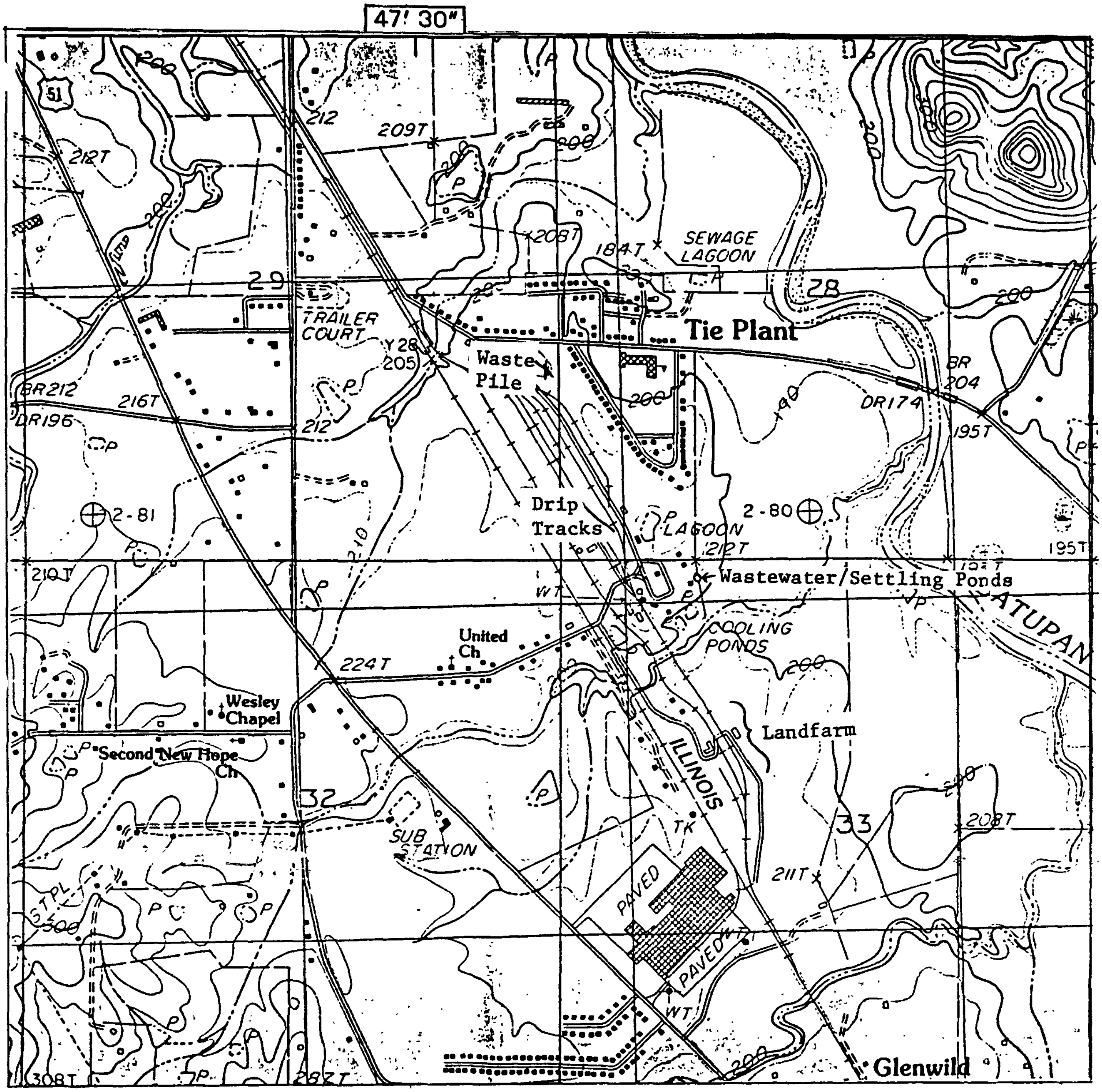
Bottom Storage = 42 cu. ft./yr./7,840 sq. ft. = 0.063"/yr.

after Law Engineering

Figure 4
Flow Diagram of the Water Treatment System
Koppers Tie Plant
Grenada, Mississippi



after Koppers



Reference: 1983 USGS Tie Plant Quadrangle Topographic Map

scale

Figure 5

Map showing the location of the
Solid Waste Management Units
Koppers Tie Plant
Grenada, Mississippi

Table 1
Stratigraphic Units and their Water-Bearing Characteristics

Era	System	Series	Group	Stratigraphic unit	Thickness (ft)		Water-bearing character
Cenozoic	Quaternary	Holocene		Flood-plain deposits	0-50		Small supplies available from shallow wells.
		Pleistocene		Loess	0-60		Not an aquifer.
				Terrace deposits and lower part of Mississippi River alluvium	0-170		Water hard and high in iron. Probably large supplies available from alluvium.
	Tertiary	Eocene	Claiborne	Sparta Sand	0-150		Too limited in extent and too shallow to be a major aquifer in project area. May have local importance.
				Zilpha Clay	0-40		Not an aquifer.
				Winona Sand	0-30		Not a major aquifer in project area.
				Tallahatta Formation	250-300		Not an aquifer.
				Meridian Sand Member			50-225 feet thick. The principal source of water supply in western part of project area. Large yields available. Water levels shallow. Water contains iron, but good otherwise.
			Wilcox	upper minor aquifers	400-850		Minor aquifers in Wilcox are locally important sources of water in Choctaw and Grenada Counties and potentially major sources in Yalobusha County.
				lower			100-250 feet thick. Principal aquifer in southeastern part of project area. Iron a problem.
		Paleocene	Midway	Naheola Formation	450-900		Not aquifers.
				Porters Creek Clay			
				Clayton Formation			
Mesozoi	Cretaceou	Upper Cretaceous	Selma	Prairie Bluff Chalk	300-900		Ripley supplies many wells in Chickasaw County but few major ones. Limited potential for industrial supplies. Chalk units are not aquifers.
				Ripley Formation			
				Demopolis Chalk			
				Mooreville Chalk		Not exposed in seven-county study area	
				Eutaw Formation	300-350		Principal aquifer in Chickasaw County, important in Calhoun County. Some iron problems. Fluoride excessive.
				McShan Formation			
			Tuscaloosa	Gordo Formation	200-500		A principal aquifer in Calhoun and Webster Counties. Dissolved solids exceed 400 mg/l. Iron is a problem locally.
				Coker Formation	0-400		Tapped by few wells. Potential source of water supplies in northeastern part of project area. Quality similar to Gordo.
		Lower Cretaceous		Undifferentiated	0-1100		No wells. Water probably is slightly saline.
Paleozoic				Undifferentiated			Not known to contain aquifers in project area.

Reference:

Newcome, R. Jr., and J.M. Bettandorff, Water For Industrial Development in Calhoun, Chickasaw, Choctaw, Grenada, Montgomery, Webster, and Yalobusha Counties, Mississippi, U.S. Geological Survey and the Mississippi Research and Development Center 1973

TABLE 2
RCRA GROUND WATER MONITORING PARAMETERS

*Category 1	**Category 2	***Category 3
Arsenic	Chloride	pH
Barium	Iron	Specific Conductance
Cadmium	Manganese	Total Organic Carbon
Chromium	Phenols	Total Organic Halogen
Fluoride	Sodium	
Lead	Sulfate	
Mercury		
Nitrate (as N)		
Selenium		
Silver		
Endrin		
Lindane		
Methoxychlor		
Toxaphene		
2, 4-D		
2,4,5-TP Silvex		
Radium		
Gross Alpha		
Gross Beta		
Turbidity		
Coliform Bacteria		

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*EPA Interim Primary Drinking Water Standards
**Ground Water Quality Parameters
***Ground Water Contamination Indicator Parameters

TABLE 3
MONITORING WELL CONSTRUCTION DATA

Well	GSE (ft, MSL)	Total Depth (ft)	Casing/ Screen Material	Screened Interval (ft)	Date Completed
R-1	98.59	32.77	2" #40 PVC	21-31	3-24-82
R-2	97.16	30.54	2" #40 PVC	19-29	3-25-82
R-3	94.47	29.80	2" #40 PVC	18-28	3-26-82
R-4	93.65	30.55	2" #40 PVC	19-29	3-27-82
R-5	-	31.0	2" #40 PVC	21-31	7-17-84
R-6	-	31.0	2" #40 PVC	21-31	7-17-84
R-7	-	31.0	2" #40 PVC	21-31	7-17-84
R-8	-	31.0	2" #40 PVC	21-31	7-17-84
R-9	-	31.0	2" #40 PVC	21-31	7-17-84
SF-1	99.67	27.5	2" #40 PVC	17-27	8-21-85
SF-2	98.02	30.0	2" #40 PVC	20-30	8-22-85
SF-3	98.23	26.0	2" #40 PVC	16-26	8-22-85
Sf-4	99.23	30.0	2" #40 PVC	20-30	8-23-85

Table 4

Wells Designated for Ground Water Monitoring During Interim Status at the Koppers Tie Plant Facility

Well	Date of Active Monitoring	Monitoring Designation
Old System Surface Impoundment		
R-1	March 1982 to	upgradient
R-2	February 1985	downgradient
R-3		downgradient
R-4		downgradient
New System Surface Impoundment		
R-5	July 1984	upgradient
R-6	to	downgradient
R-7	?	downgradient
R-8		downgradient
R-9		
Spray Field		
SF-1	August 1985	upgradient
SF-2	to	downgradient
SF-3	?	downgradient
SF-4		downgradient

TABLE 5
SAMPLE COLLECTION DATA

Sample Point	Sampling Date	Time	Remarks
SF-1	5-19-86	1120	light yellow, cloudy, clayey
SF-2	5-19-86	1230	orange, cloudy-turbid
SF-4	5-19-86	1450	light yellow, clear, gritty with mica flakes
R-1	5-20-86	0925	yellow, cloudy
R-9	5-20-86	0910	light orange, cloudy-turbid
R-4	5-20-86	1120	orange, opaque, turbid
R-7	5-20-86	1425	orange, opaque
R-5	5-21-86	0930	dark gray, opaque
R-5 (dup)	5-21-86	0930	dark gray, opaque

TABLE 6
ORDER OF SAMPLE COLLECTION
BOTTLE TYPE AND PRESERVATIVE LIST

Parameter	Bottle	Preservative
Volatile Organic Analysis (VOA)		
Purge and trap	2 60-ml VOA vials	
Direct inject	2 60-ml VOA vials	
Purgeable Organic Carbon (POC)	1 60-ml VOA vial	
Purgeable Organic Halogens (POX)	1 60-ml VOA vial	
Extractable Organics	4 1-qt. amber glasses	
Pesticide/Herbicide	2 qt. amber glass	
Dioxins	2 qt. amber glass	
Total Metals	1 qt. plastic	HNO_3
Total Organic Carbon (TOC)	4 oz. glass	H_2SO_4
Total Organic Halogens (TOX)	1 qt. amber glass	
Phenols	1 qt. amber glass	H_2SO_4
Cyanide	1 qt. plastic	NaOH
Nitrate/ammonia	1 qt. plastic	H_2SO_4
Sulfate/chloride	1 qt. plastic	

TABLE 7
KOPPERS TIE PLANT
GRENADA, MISSISSIPPI
HWGWTF
ANALYTICAL DATA SUMMARY

	R-7	SF-2	SF-4	R-4	R-5	R-5(dup)	SF-1	R-1	R-9
	S.I.	S.F.	S.F.	S.I.	S.I.	S.I.	S.F.	S.I.	S.I.
	DN GRAD	DN GRAD	DN GRAD	DN GRAD	UP GRAD	UP GRAD	UP GRAD	UP GRAD	DN GRAD
	05/20/86	05/19/86	05/19/86	05/20/86	05/21/86	05/21/86	05/19/86	05/20/86	05/20/86
<u>RCRA WASTE CHARACTERISTICS</u>	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
PURGEABLE ORGANIC HALOGEN	--	8	--	--	--	--	--	--	--
<u>INORGANIC ELEMENT/COMPOUND</u>	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ARSENIC	--	--	--	13J	19J	27J	--	--	15J
BARIUM	280	320	130	330	330	320	110	160	140
BERYLLIUM	--	7JN	--	11JN	31JN	33JN	--	--	--
CADMIUM	1	--	1	1	4J	4J	--	1	1
COBALT	--	--	--	--	410J	400J	--	--	--
CHROMIUM	160	70	11	190	530	580	26	63	43
COPPER	30	30	--	47	88	83	--	--	--
NICKEL	40	46	--	54	270	260	--	--	--
LEAD	33J	--	--	80J	70J	70J	--	--	--
SELENIUM	--	--	--	--	15J	13J	--	18J	--
VANADIUM	230	80	--	290	550	610	--	50	45
ZINC	180	120	33	290	2400	2300	39	79	73
MERCURY	0.62JN	--	0.3JN	0.04JN	--	--	--	--	--
ALUMINUM	64000	36000	7200	82000	82000	84000	15000	27000	25000
MANGANESE	620J	250J	--	360J	2700J	2600J	150J	130J	280J
	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CALCIUM	21	87	55	22	35	34	44	16	12
MAGNESIUM	14	21	23	16	17	16	19	11	6.9
IRON	80	44	6.9	137	134	146	16	29	21
SODIUM	25	145	69	21	140	138	150	20	22
POTASSIUM	7.6	6.1	5.8	8.0	11	11	--	--	--
<u>EXTRACTABLE ORGANIC COMPOUNDS</u>	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
NAPHTHALENE	--	--	--	--	2200	870	--	--	--
[illegible]	--	--	--	--	120J	63J		[illegible]	
FLUORENE	--	--	--	--	52J	24J	--	--	--
PHENANTHRENE	--	--	--	--	24J	12J	--	--	--
C3 ALKYLBENZENE	--	--	--	--	200JN	130JN	--	--	--
BENZOTHIOPHENE	--	--	--	--	300JN	140JN	--	--	--
ETHYLIDENEINDENE	--	--	--	--	200JN	90JN	--	--	--
4 UNIDENTIFIED COMPOUNDS	--	--	--	--	--	--	200J	--	--
2-METHYLNAPHTHALENE	--	--	--	--	70J	30J	--	--	--
DIBENZOFURAN	--	--	--	--	64J	40J	--	--	--
1,4-NAPHTHOQUINONE	--	--	--	--	--	12J	--	--	--

TABLE 7 (cont.)
KOPPERS TIE PLANT
GRENADA, MISSISSIPPI
HWGWTF
ANALYTICAL DATA SUMMARY

	R-7 S.I. DN GRAD 05/20/86	SF-2 S.F. DN GRAD 05/19/86	SF-4 S.F. DN GRAD 05/19/86	R-4 S.I. DN GRAD 05/20/86	R-5 S.I. UP GRAD 05/21/86	R-5(dup) S.I. UP GRAD 05/21/86	SF-1 S.F. UP GRAD 05/19/86	R-1 S.I. UP GRAD 05/20/86	R-9 S.I. DN GRAD 05/20/86
PURGEABLE ORGANIC COMPOUNDS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
BENZENE	--	--	--	--	5.4	4.1J	--	--	--
TOLUENE	--	--	--	--	6.1	4.7J	--	--	--
ETHYL BENZENE	--	--	--	--	9.0	6.8	--	--	--
TOTAL XYLENES	--	--	--	--	16	6.5	--	--	--
CONVENTIONAL PARAMETERS	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
AMMONIA	--	--	--	--	0.35	0.35	--	--	--
CHLORIDE	24	108	120	48	72	71	76	11	9.8
NITRATE-NITRITE NITROGEN	0.46	0.60	0.67	0.72	--	--	2.2	1.5	1.3
SULFATE	40	140	98	30	190	220	200	66	63
	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
PHENOL (4AAP)	--	--	--	--	220	210	--	--	--
	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
TOTAL ORGANIC CARBON	1.1	1.8	1.9	1.9	12	14	1.0	1.8	--
	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
TOTAL ORGANIC HALOGEN	13	34	16	19	56	53	18	14	5

****

FOOTNOTES
J - ESTIMATED VALUE
N - PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIA
-- - MATERIAL WAS ANALYZED FOR BUT NOT DETECTED

(CONTINUED)

TABLE 8
KOPPERS TIE PLANT
GRENADA, MISSISSIPPI
HWGWMTF
ESD - ATHENS DATA SUMMARY

	SF-1	SF-2	R-5	R-9
	UP	DOWN	UP	DOWN
	05/19/86	05/19/86	05/21/86	05/20/86
	1120	1230	0930	0910
	UG/L	UG/L	UG/L	UG/L
1-METHYLNAPHTHALENE	--	--	100JN	--
C5 ALKYLBENZENE (4 ISOMERS)	--	--	80JN	--
C6 ALKYLBENZENE (2 ISOMERS)	--	--	30JN	--
BIPHENYL	--	--	30JN	--
C2 ALKYLNAPHTHALENE (4 ISOMERS)	--	--	80JN	--
NAPHTHALENECARBONITRILE	--	--	20JN	--
NAPHTHALENOL	--	--	30JN	--
METHYLFLUORENE	--	--	20JN	--
METHYLNAPHTHALENOL	--	--	30JN	--
METHYLDIBENZOFURAN	--	--	30JN	--
DIBENZOTHIOPHENE	--	--	30JN	--
BIPHENYLOL	--	--	30JN	--
NAPHTHALENECARBOXYLIC ACID	--	--	30JN	--
DIBENZOFURANOL	--	--	30JN	--
NITROSOCARBAZOLE	--	--	100JN	--
ACRIDINONE	--	--	10JN	--
4 UNIDENTIFIED COMPOUNDS	--	--	400J	--
2-METHYLPHENOL	--	--	21	--
4-METHYLPHENOL	--	--	7.6J	--
DIBENZOFURAN	--	--	45	--
2-METHYLNAPHTHALENE	--	--	38	--
PURGEABLE ORGANIC COMPOUNDS				
BENZENE	--	--	5J	--
ETHYL BENZENE	--	--	8.3	--
TOTAL XYLENES	--	--	12	--
CONVENTIONAL PARAMETERS	MG/L	MG/L	MG/L	MG/L
AMMONIA	--	--	0.25	--
CHLORIDE	82A	110	74	10
NITRATE-NITRITE NITROGEN	2.0	0.87	0.12	1.1
SULFATE	170A	110	120	50
	UG/L	UG/L	UG/L	UG/L
PHENOL (4AAP)	--	--	200	--
	MG/L	MG/L	MG/L	MG/L
TOTAL ORGANIC CARBON	3.8	3.5A	22	3.1

****

FOOTNOTES

*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES
*J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN
* -- MATERIAL WAS ANALYZED FOR BUT NOT DETECTED.

TABLE 8
KOPPERS TIE PLANT
GRENADA, MISSISSIPPI
HWGWMTF
ESD - ATHENS DATA SUMMARY

	SF-1	SF-2	R-5	R-9
	UP	DOWN	UP	DOWN
	05/19/86	05/19/86	05/21/86	05/20/86
	1120	1230	0930	0910
INORGANIC ELEMENT/COMPOUND	UG/L	UG/L	UG/L	UG/L
ARSENIC	--	--	90	--
BARIUM	93	310	350	110
BERYLLIUM	--	--	31	--
COBALT	--	--	380	--
CHROMIUM	19	60	490	30
COPPER	--	13	79	--
NICKEL	--	23	280	--
LEAD	--	--	65J	--
STRONTIUM	420	1200	310	190
TITANIUM	200	470	810	170
VANADIUM	23	89	540	44
YTTRIUM	--	24	180	--
ZINC	27	83	2600	51
ALUMINUM	11000	31000	91000	14000
MANGANESE	150	270	3400	260
	MG/L	MG/L	MG/L	MG/L
CALCIUM	43	85	40	12
MAGNESIUM	17	19	18	5.7
IRON	13	43	120	16
SODIUM	150	140	150	21
EXTRACTABLE ORGANIC COMPOUNDS	UG/L	UG/L	UG/L	UG/L
NAPHTHALENE	--	--	560	--
ACENAPHTHENE	--	--	85	--
FLUORENE	--	--	38	
PHENANTHRENE	--	--	32	--
ANTHRACENE	--	--	2.8J	--
FLUORANTHENE	--	--	1.6J	--
BIS(2-ETHYLHEXYL) PHTHALATE	--	22	--	--
PHENOL	--	--	2.4J	--
2,4-DIMETHYLPHENOL	--	--	34	--
2-METHYL-4,6-DINITROPHENOL	--	--	--	6.6J
PENTACHLOROPHENOL	--	--	5.0J	--
BENZOFURAN	--	--	30JN	--
METHYLSTYRENE	--	--	100JN	--
INDENE	--	--	30JN	--
METHYLBENZONITRILE	--	--	30JN	--
C4 ALKYLBENZENE	--	--	30JN	--
C3 ALKYLBICYCLOHEPTANONE	--	--	30JN	--
METHYLBENZOFURAN	--	--	40JN	--
C2 ALKYLPHENOL (NOT 2,4-DIMETHYL)(3 ISOM	--	--	100JN	--
C2 ALKYLSTYRENE (2 ISOMERS)	--	--	40JN	--
CHLOROANILINE (NOT 4-)	--	--	30JN	--
BENZOTHIOPHENE	--	--	100JN	--
C3 ALKYLPHENOL (7 ISOMERS)	--	--	200JN	--
C4 ALKYLPHENOL (3 ISOMERS)	--	--	80JN	--
C2 ALKYLBENZOFURAN	--	--	20JN	--

APPENDIX A

TASK FORCE ANALYTICAL RESULTS

Due to size, the raw data is not included in this report. A copy of the data can be requested from:

EPA, Region IV
Residuals Management Branch
345 Courtland Street, N.E.
Atlanta, Georgia 30365

APPENDIX B

EPA REGION IV ESD ANALYTICAL RESULTS

Due to size, the raw data is not included in this report. A copy of the data can be requested from:

EPA Region IV
Residuals Management Branch
345 Courtland Street, N.E.
Atlanta, Georgia 30365

MONITORING WELL LOG

PROJECT Grenada, MS (RCRA)

WELL NO. R-1

DRILLING METHOD H.S.A.

GEOLOGIST

DRILLER DISC (Developers International Service

DATE 3/24/82

GROUND ELEVATION 98.59

TOP OF WELL 100.36

DEPTH OF WELL (ft) 32.77

GROUND WATER DEPTH (ft):

AT COMPLETION 22.8

AFTER 12 HOURS 22.6

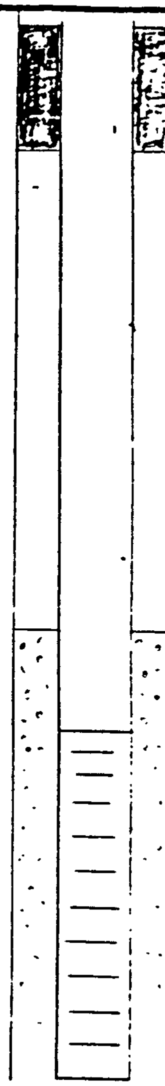
GRAVEL PACK ▨
BENTONITE ▨
BACK FILL ▨
CONCRETE ▨
SCREEN ▨

CASING MATERIAL 2" PVC

SCREEN 10 ft of 0.010" screen

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION
		Brown FILL and CLAY & SILT, lt broken rock fragments
	2.0	
		Gray/tan CLAY & SILT, tr f brown sand
5	5.0	
		Brown CLAY & SILT, lt f sand
	7.0	
		Tan F-SAND, tr brown clay & silt
	9.0	
10		
		Tan F-SAND
15		
20		
	21.0	
		Lt tan F-M SAND, tr c sand
25		
	27.0	
		Lt red/tan F-SAND, tr silt
30		
	31.0	

CONSTRUCTION



MONITORING WELL LOG

PROJECT Grenada, MS (RCRA)

WELL NO. R-

DRILLING METHOD H.S.A.

GEOLOGIST

DRILLER Developers International Service Corp.

DATE 3/25/82

GROUND ELEVATION 97.16

TOP OF WELL 98.70

DEPTH OF WELL (ft) 30.54

GROUND WATER DEPTH (ft):

AT COMPLETION 21.54

AFTER 12 HOURS 21.5

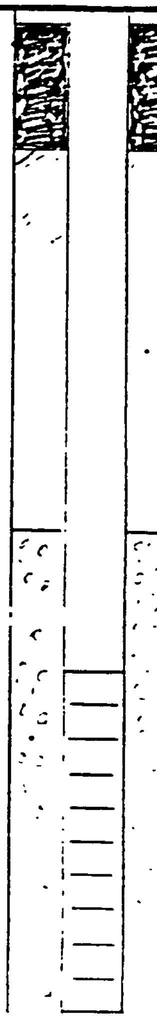
GRAVEL PACK
BENTONITE
BACK FILL
CONCRETE
SCREEN

CASING MATERIAL 2" PVC

SCREEN 10 ft of 0.010" screen

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION
	2.0	Gray CLAY & SILT, tr brown/black organic particles (roots)
5	6.0	Tan CLAYEY SILT, tr f sand
10	10.0	Tan/gray CLAYEY SILT, some f sand
	12.0	Lt tan/gray CLAYEY SILT and F-SAND
15	18.0	Lt gray/tan F to V-F SAND, tr silt
20		
25	25.0	Lt tan/brown FMC SAND, tr silt
	29.0	Gray F SAND, tr silt
30		

CONSTRUCTI



MONITORING WELL LOG

PROJECT Grenada, MS (RCRA) WELL NO. R-

DRILLING METHOD H.S.A. GEOLOGIST

DRILLER Developers International Service Corp. DATE 3/25/82

GROUND ELEVATION 94.47

TOP OF WELL 96.27

DEPTH OF WELL (ft) 29.8

GROUND WATER DEPTH (ft):

AT COMPLETION 21.8

AFTER 12 HOURS 22.0

GRAVEL PACK

BENTONITE

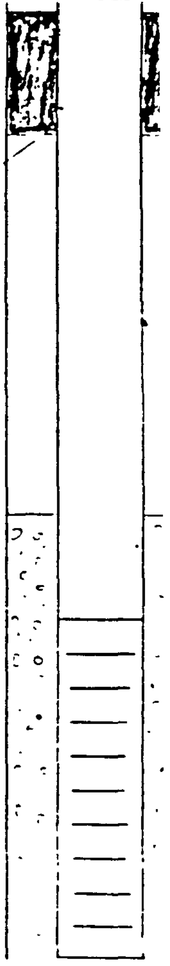
BACK FILL

CONCRETE

SCREEN

CASING MATERIAL 2" PVC SCREEN 10 ft of 0.010" screen

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION	CONSTRUCT
		Brown/gray SILTY CLAY, tr f sand	
	2.0		
5			
		Brown/gray CLAYEY SILT, lt f sand	
10			
	12.0		
15			
20		Lt tan M-F SAND, tr silt	
25			
	28.0		
30			



MONITORING WELL LOG

PROJECT Grenada, MS (RCRA) WELL NO. S-4

DRILLING METHOD H.S.A. GEOLOGIST

DRILLER Developers International Service Corp. DATE 3/27/82

GROUND ELEVATION 93.65

TOP OF WELL 95.22

DEPTH OF WELL (ft) 30.55

GROUND WATER DEPTH (ft):

AT COMPLETION 21.55

AFTER 12 HOURS 21.0

GRAVEL PACK ⁘

BENTONITE ▨

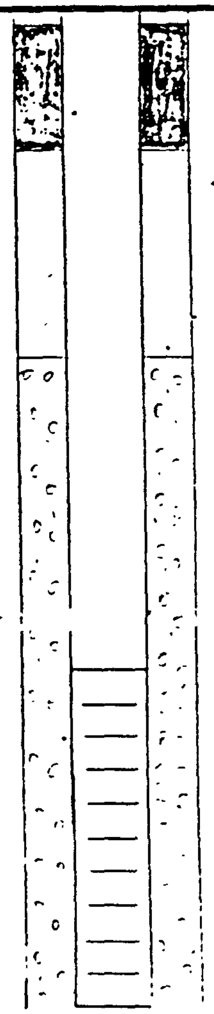
BACK FILL

CONCRETE ▧

SCREEN ☰

CASING MATERIAL 2" PVC SCREEN 10 ft of 0.010" screen

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION	CONSTRUCTION
		Brown CLAY & SILT, tr f sand	
5	4.0	Lt tan CLAYEY SILT, and F SAND	
10	6.0	Lt gray/tan F SAND, tr silt	
15 20 25	12.0	[illegible] gray M-F SAND, tr silt	
30	27.0		



MONITORING WELL LOG

PROJECT Grenada, MS

WELL NO. R-5

DRILLING METHOD H.S.A.

GEOLOGIST J. B. Gillespie

DRILLER P.S.I. Inc.-Engineering

DATE 7/17/84

GROUND ELEVATION

TOP OF WELL

DEPTH OF WELL (ft) 31.0

GROUND WATER DEPTH (ft):

AT COMPLETION

AFTER HOURS

GRAVEL PACK ▨

BENTONITE ▨

BACK FILL ▨

CONCRETE ▨

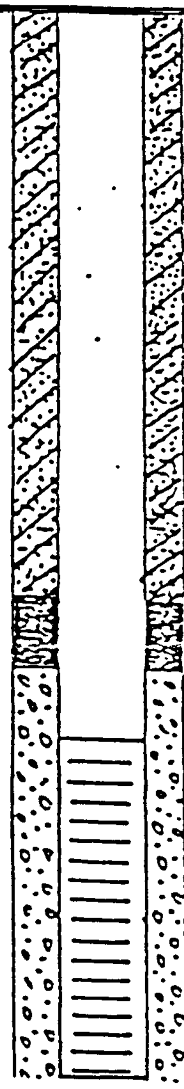
SCREEN ▤

CASING MATERIAL 2" PVD

SCREEN 10' 0.010 Slot

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION
	☒	Dk brown TOPSOIL, tr organic (roots)
	☒	Tan/brown/gray SILT, tr organics (roots)
5.0	☒	Brown/tan SILT, some clay & silt, tr stone fragments
	☒	Brown SILT and SILT & CLAY
10.0	☒	Brown/gray SILT & CLAY and f SAND
	☒	Tan SILT & CLAY and F SAND
15.0 20.0	☒ ☒	Tan f SAND, tr. silt
25.0 30.0	☒ ☒	Gray fm SAND, sl anaerobic odor

CONSTRUCTIO



SHEET 1 OF 1

MONITORING WELL LOG

PROJECT Grenada, MS

WELL NO. R-6

DRILLING METHOD H.S.A.

GEOLOGIST J. B. Gillespie

DRILLER P.S.I. Inc.-Engineering

DATE 7/17/84

GROUND ELEVATION

TOP OF WELL

DEPTH OF WELL (ft) 31.0

GROUND WATER DEPTH (ft):

AT COMPLETION

AFTER ____ HOURS

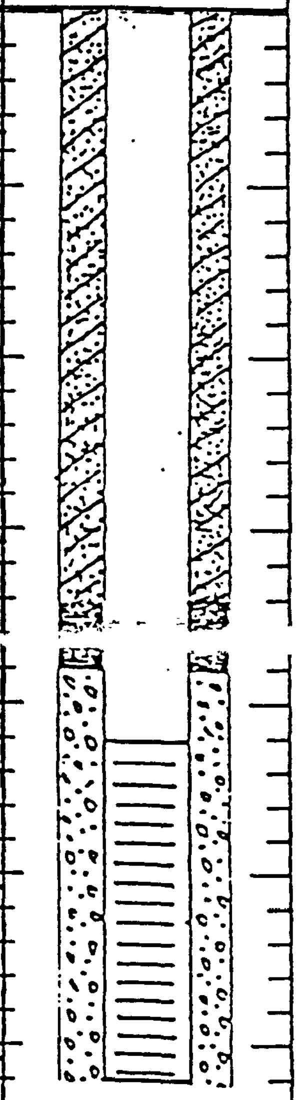
GRAVEL PACK	▨
BENTONITE	▨
BACK FILL	▨
CONCRETE	▨
SCREEN	▤

CASING MATERIAL 2" PVC

SCREEN 10' 0.010 Slot

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION
	☒	Brown SILT, and SILT & CLAY, tr stone fragments
	☒	Tan/gray SILT
5.0	☒ ☒	Gray/brown SILT & CLAY
10.0 15.0	☒ ☒ ☒	Tan/white f SAND, tr silt
20.0	☒	Rust/gray fm SAND and CLAY & SILT
25.0	☒	Gray CLAY & SILT, tr f SAND
30.0	☒	Gray fmc SAND, tr silt

CONSTRUCTION



MONITORING WELL LOG

PROJECT Grenada, MS

WELL NO. R-7

DRILLING METHOD H.S.A.

GEOLOGIST J. B. Gillespie

DRILLER P.S.I. Inc.-Engineering

DATE 7/17/84

GROUND ELEVATION

TOP OF WELL

DEPTH OF WELL (ft) 31.0

GROUND WATER DEPTH (ft):

AT COMPLETION

AFTER ____ HOURS

GRAVEL PACK ▨

BENTONITE ▨

BACK FILL ▨

CONCRETE ▨

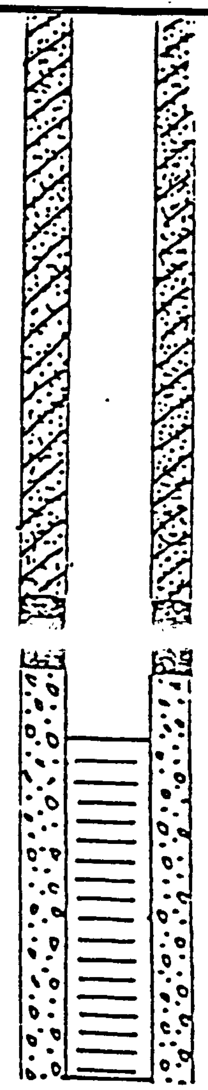
SCREEN ▤

CASING MATERIAL 2" PVC

SCREEN 10' 0.010 Slot

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION
	☒	Tan/brown/gray SILT, tr roots
5.0	☒	
	☒	Tan/brown SILT and SILT & CLAY
	☒	Brown SILT & CLAY and f SAND, SILT
10.0		
	☒	White vf SAND, some brown silt & clay, tr silt
		White vf SAND, tr brown silt & clay, tr silt
15.0	☒	
20.0	☒	
		Tan f SAND, tr silt
25.0	☒	
		Gray/tan mf SAND, tr clay & silt
30.0	☒	

CONSTRUCTION



SHEET 1 OF 1

MONITORING WELL LOG

PROJECT Grenada, MS

WELL NO. R-8

DRILLING METHOD H.S.A.

GEOLOGIST J. B. Gillespie

DRILLER P.S.I. Inc.-Engineering

DATE 7/17/84

GROUND ELEVATION

TOP OF WELL

DEPTH OF WELL (ft) 31.0

GROUND WATER DEPTH (ft):

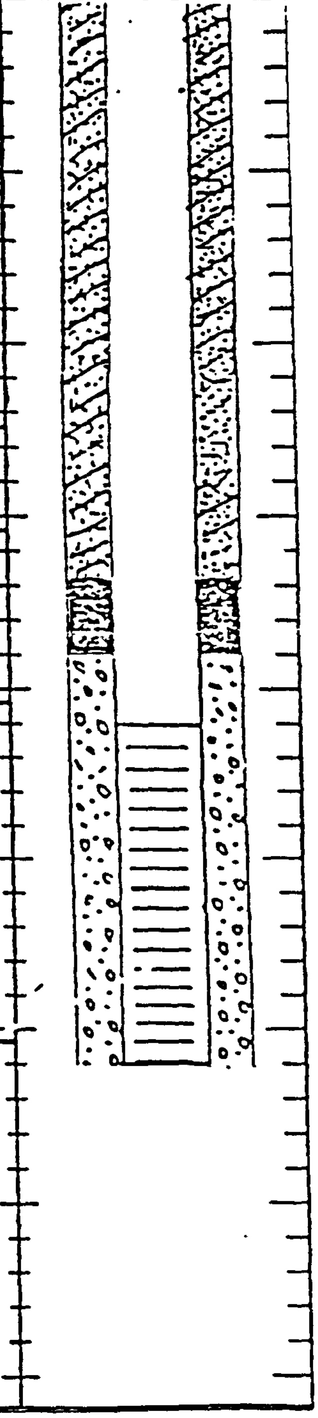
AT COMPLETION

AFTER HOURS

GRAVEL PACK ▨
BENTONITE ▨
BACK FILL ▨
CONCRETE ▨
SCREEN ▤

CASING MATERIAL 2" PVC

SCREEN 10' 0.010 Slot

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION	CONSTRUCTION
	☒	Brown SILT	
	☒	Brown SILT and SILT & CLAY	
5.0 10.0	☒ ☒ ☒ ☒	Brown SILT & CLAY	
15.0	☒	Gray CLAY & SILT, tr vf sand	
20.0	☒	White/tan vf SAND, tr silt	
25.0 30.0	☒ ☒	Gray/tan fmc SAND, TR SILT	

SHEET 1 OF 1

MONITORING WELL LOG

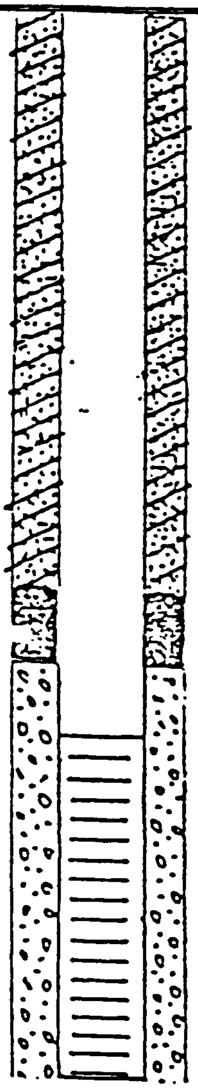
PROJECT Grenada, MS
WELL NO. R-9
DRILLING METHOD H.S.A.
GEOLOGIST J. B. Gillespie
DRILLER P.S.I. Inc.-Engineering
DATE 7/17/84

GROUND ELEVATION
TOP OF WELL
DEPTH OF WELL (ft) 31.0

GROUND WATER DEPTH (ft):
AT COMPLETION
AFTER HOURS

GRAVEL PACK ░
BENTONITE ▤
BACK FILL ▒
CONCRETE ▨
SCREEN ☰

CASING MATERIAL 2" PVC
SCREEN 10' 0.010 Slot

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION	CONSTRUCTION
	☒	Tan SILT, tr roots	
	☒	Brown SILT	
5.0	☒	Gray SILT, little silt & clay	
	☒	Shelby tube	
10.0	☒	Brown SILT & CLAY, tr roots	
	☒	Brown SILT & CLAY, tr f sand	
15.0	☒		
		Tan f SAND, tr silt	
20.0	☒		
25.0	☒	Tan fmc SAND, tr silt	
30.0	☒		

MONITORING WELL LOG

PROJECT Grenada, Miss. Sprayfield

WELL NO. SF-1

DRILLING METHOD HSA

GEOLOGIST C.A. Cramer

DRILLER PSI

DATE 8/21/85

GROUND ELEVATION 99.67

TOP OF WELL 101.92

DEPTH OF WELL (ft)

GROUND WATER DEPTH (ft):

AT COMPLETION

AFTER ____ HOURS

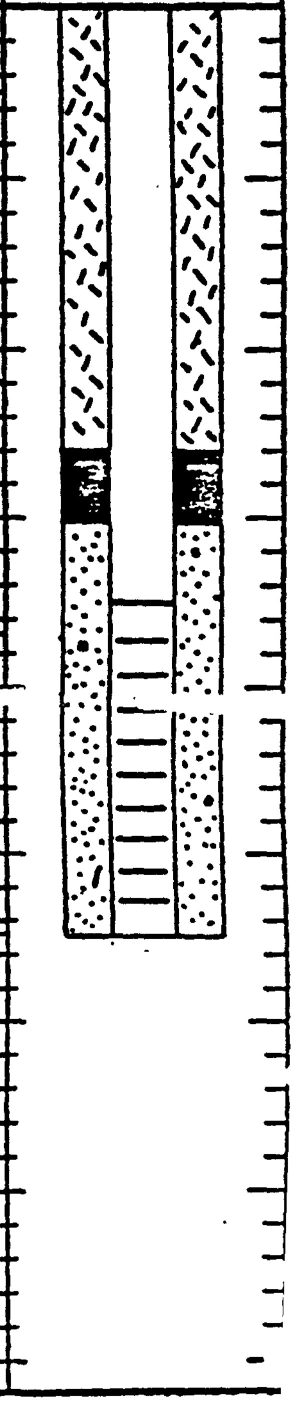
GRAVEL PACK	⁘
BENTONITE	■
BACK FILL	▨
CONCRETE	⁘
SCREEN	☰

CASING MATERIAL 2" PVC

SCREEN 10' 0.010 slotted PVC

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION
		Brown silty CLAY, tr gravel, tr roots, moist
5 10		Light gray and brown mottled silty CLAY, tr silt pockets, tr organics, moist
15		Rust to orange, and light gray mottled silty CLAY, some organic stains, tr concretions (m gravel), moist
20		Gray f SAND and SILT, tr clay, moist to wet
		Gray to Rust f SAND, little silt, tr clay, wet
		Gray silty CLAY, tr sand, wet
25		Gray SILT and f SAND, wet
		Rust to black f SAND, tr silt, wet
30 35		

CONSTRUCTION



SHEET 1 OF 1

MONITORING WELL LOG

PROJECT Grenada, Miss. Sprayfield WELL NO. SF-2

DRILLING METHOD HSA GEOLOGIST C.A. Cramer

DRILLER PSI DATE 8/22/85

GROUND ELEVATION 98.02

TOP OF WELL 100.22

DEPTH OF WELL (ft) ____

GROUND WATER DEPTH (ft):

AT COMPLETION ____

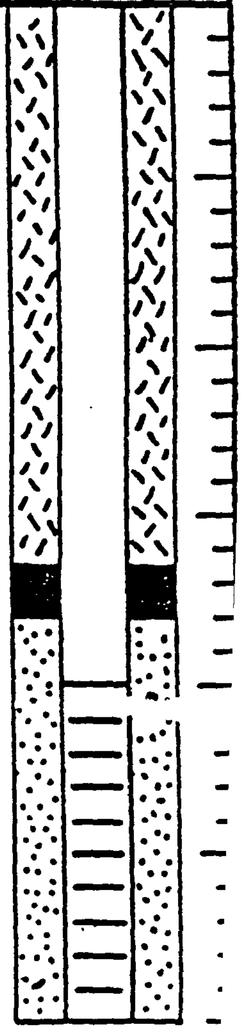
AFTER ____ HOURS ____

GRAVEL PACK	⁘
BENTONITE	■
BACK FILL	▨
CONCRETE	⁂
SCREEN	☰

CASING MATERIAL 2" PVC SCREEN 10' 0.010 slotted PVC

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION
		Light brown silty CLAY, some roots, moist
		Light brown and gray mottled clayey SILT, tr roots, moist
5		Brown and white silty CLAY, fractured, dry
		Tan clayey SILT, tr white silt pockets, moist
10		Light gray and rust CLAY and SILT, moist
15		White, tan, and rust f SAND, tr to some silt, moist
20		Tan mf SAND, little silt, wet
		Blue gray silty CLAY, wet
25		Tan to gray mf SAND, little silt, wet
30		
35		

CONSTRUCTION



SHEET 1 OF 1

MONITORING WELL LOG

PROJECT Grenada, Miss. Sprayfield

WELL NO. SF-3

DRILLING METHOD HSA

GEOLOGIST C.A. Cramer

DRILLER PSI

DATE 8/22/85

GROUND ELEVATION 98.23

TOP OF WELL 100.23'

DEPTH OF WELL (ft)

GROUND WATER DEPTH (ft):

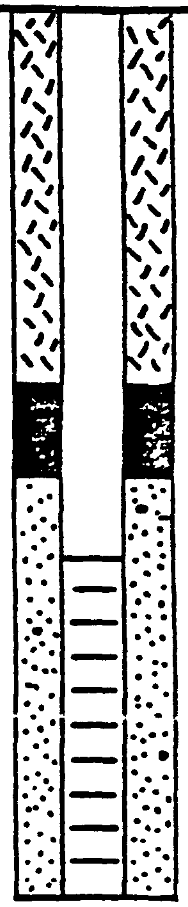
AT COMPLETION

AFTER HOURS

GRAVEL PACK ▨
BENTONITE ■
BACK FILL ▨
CONCRETE ▨
SCREEN ▤

CASING MATERIAL 2" PVC

SCREEN 10' 0.010" slotted PVC

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION	CONSTRUCTION
		Brown to gray clayey SILT, some roots, moist	
5		Tan and gray mottled silty CLAY, tr organic stains, moist	
10		Rust and gray mottled CLAY and SILT, tr f sand, moist	
15		White f SAND and SILT, moist	
20		Rust, tan and white laminated mf SAND, tr silt, gray silty clay lens, 15-15.5, 19.5-20, tr sand, moist	
25		Tan to gray f SAND, little to some silt, wet	
		Tan mf SAND, tr silt, wet	
30 35			

SHEET 1 OF 1

MONITORING WELL LOG

PROJECT Grenada, Miss. Sprayfield WELL NO. SF-4

DRILLING METHOD HSA GEOLOGIST C.A. Cramer

DRILLER PSI DATE 8/23/85

GROUND ELEVATION 99.23'

TOP OF WELL 101.33'

DEPTH OF WELL (ft)

GROUND WATER DEPTH (ft):

AT COMPLETION

AFTER ___ HOURS

CASING MATERIAL SCREEN

GRAVEL PACK ▨

BENTONITE ■

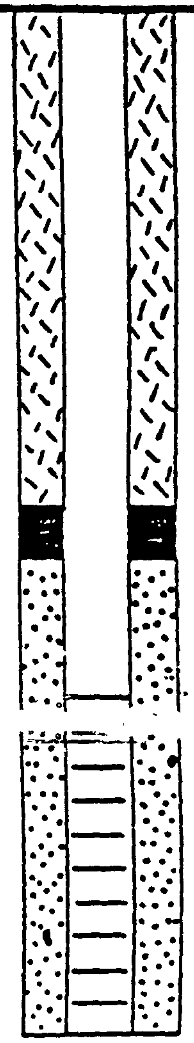
BACK FILL ▨

CONCRETE ▨

SCREEN ▤

STRATA DEPTH	SAMPLE DEPTH	DESCRIPTION
		Brown silty CLAY,some organics, tr sand, moist
5		Brown and tan mottled clayey SILT, tr roots, tr organic stains, moist
10		Light gray and orange mottled, SILT and CLAY, come c sand size black concretions, moist
15		White, tan, and rust laminatedf SAND to mf SAND, tr silt, moist
20		
		Tan to gray silty CLAY, moist to wet
25		
		Gray f SAND and SILT, wet
		Rust and tan f SAND, little silt, tr clay, wet
30		
35		

CONSTRUCTION



SHEET 1 OF 1

Aug. 12, 1985

KOPPERS COMPANY, INC.

PROCEDURES FOR GROUNDWATER SAMPLING,
CHAIN OF CUSTODY,
ANALYTICAL METHODS,
AND ANALYTICAL QA/QC

[illegible] Field [illegible]
were [illegible]
[illegible]

KOPPERS COMPANY, INC.

PROCEDURES FOR GROUNDWATER SAMPLING

GROUNDWATER SAMPLING

A. Preparation for Sampling Trip

1. Determine when sampling is to be performed.

   a. Meet with Project Manager or Environmental Coordinator to determine sampling scheduling requirements, i.e., when was sampling proposed and determine if there is any variability in the sampling dates.

   b. When sampling trip is scheduled, inform Project Manager of dates.

2. Determine what analyses are to be performed.

   a. Review proposal or pertinent environmental regulations with Project Manager to assure that all required samples along with any additional samples are obtained. Also, special sampling requirements such as filtering samples, etc. will have to be indicated by the Project Manager.

3. Bottle Preparation

   a. Conventional Pollutants

      ✓ (1) Sample bottles for holding and shipping samples are all new bottles with screw-type lids.

      (2) Bottles are prelabeled and pre-preserved for the specific analyses. Specific preservatives and containers are listed in an attachment to this document.

      (3) The bottles are securely boxed and labeled and placed in reinforced containers for shipping to the sample site.

      ✓ (4) If bottles are sent air freight, no preservatives are added to the bottles due to airline regulations; therefore, preservatives are purchased locally and added to the bottles at the field laboratory prior to sampling.

   b. Priority Pollutants and Appendix VIII Parameters

      (1) Sample bottles for holding and shipping samples are all new bottles with screw-type lids, then specially cleaned as follows.

         (a) Wash with hot, soapy water.

         (b) Rinse with tap water.

         (c) Rinse with 1:1 nitric acid.

(d) Rinse with distilled water.

(e) Wash with acetone (Pesticide Grade).

(f) Wash with hexane (Pesticide Grade).

(g) Wash with methylene chloride (HPLC Grade).

(h) Dry glassware and equipment with pure nitrogen.

(i) All lids are lined with Teflon.

(j) The bottles are prelabeled and preserved to identify what analyses they are for. Specific preservatives and containers are listed in an attachment to this document.

4. Preparation Of Bailers

a. Description of bailers - bailers are constructed of 1.5-inch diameter stainless steel, and are approximately 18 inches long. A stainless steel ring has been welded to the top of the bailer to tie the lowering cord onto. The bottom of the bailer is fitted at the site with a disposable, natural cork laboratory stopper. New cotton string is used as lowering cord.

b. Cleaning procedure for routine RCRA sampling - After each sampling, the stainless steel bailers are thoroughly cleaned and stored for the next sampling program.

(1) If the bailer is coated with oils, prewash the bailer with acetone.

(2) Rinse with hot, soapy water.

(3) Rinse with tap water.

(4) Rinse with distilled water.

(5) Burn off bailer for one hour at 1200°F.

(6) Wrap each bailer with aluminum foil (shiny side out) and store for next use.

c. Cleaning procedure for bailers for PAH's, priority pollutants, interim primary drinking water standards, and Appendix VIII.

(1) Wash with hot, soapy water.

(2) Rinse with tap water.

(3) Rinse with 1:1 nitric aid.

(4) Rinse with distilled water.

(5) Wash with acetone (Pesticide Grade).

(6) Wash with hexane (Pesticide Grade).

(7) Wash with methylene chloride (HPLC Grade).

(8) Dry with pure nitrogen.

(9) Burn off bailer for one hour at 1200°F.

(10) Wrap bailers with aluminum foil shiny side out.

B. Procedure for Sampling Wells

1. Measuring Water Levels

a. Wetted-Tape Method

(1) Mark first two (2) feet of measuring tape using water-soluble pen.

(2) Lower tape into well to approximate depth (using last well reading as a reference).

(3) Note tape reading at top of well to the nearest hundredth (0.00).

(4) Retrieve tape from well noting that point at which the ink is washed off by the water. Clean tape thoroughly after each time it is used.

EXAMPLE:
25.00 feet - top of well
1.64 feet - length of ink washed off

23.36 feet - depth to water

2. Measuring Well Depth

a. Tie weight to new length of lowering cord.

b. Lower the cord into well until it reaches bottom.

c. Mark the point on the cord equal to the top of the well casing.

d. Remove the cord from the well and stretch out on the ground.

e. Measure the length from the weight to the mark on the cord -- this is depth of well from the top of the casing.

f. Remove weight and wash thoroughly. Dispose of cord.

3. Determining Purging Volumes

a. In order to remove stagnant water and flush the well, three (3) casing volumes of water are removed from each well before sampling. If the well goes dry before three (3) casing volumes are removed, let the well recover, then sample.

> NOTE: Contaminated water will not be disposed of on the ground, but will be put in the plant wastewater system.

$$\# \text{ of bails} = \frac{\overset{\text{(measured)}}{\text{ft of } H_2O \text{ in well}} \times \overset{\text{(listed below are vol for casing)}}{\text{gallons of } H_2O \text{ per linear ft of casing dia}} \times \overset{\text{mls/gal}}{3785}}{\underset{\text{(listed below are vol for bailer size)}}{\text{volume of bailer}}} \times 3$$

Gallons of H_2O/linear foot of casing diameter:

1/2" = 0.1057
2" = 0.1623
4" = 0.6613
6" = 1.5003

Volume of Bailers Used

1-1/8" = 225 mls
1-1/2" = 400 mls ✓
3" = 2000 mls

4. Sampling The Well

a. ✓ Open a plastic garbage can liner and place around bottom of well (if necessary, use stones at corners to secure it). This plastic will prevent sampling equipment from coming into contact with the ground.

b. ✓ Tie cord securely to bailer.

c. ✓ Place cork securely in end of bailer.

d. Put on disposable gloves - cloth or plastic.

e. Lower bailer into the well until you reach water level, allow the bailer to sink to the bottom of the well and cut the cord and tie it securely to the well casing.

f. Proceed to remove the determined number of full bails needed from the well for purging; lower the bailer to the bottom of the well at least once every 10 bails.

g. Mark site number on jar. Start filling sample holding container until full, removing lid and replacing between each bail. Lower the bailer slowly (to prevent degassing of the sample) approximately 2 feet below the water surface..

h. When filling the sample bottle for any Volatile Organics analysis, do not aerate the sample. Allow a meniscus to form at the lip of the bottle, and cap the bottle such that no air is present. Check for air by tilting bottle upside-down. If an air bubble is present, re-open and add sample to form a meniscus, and re-cap.

5. <u>Field Handling of the Samples</u>

a. Immediately after collection, the samples are to be taken to a field laboratory established at the site.

b. At the field laboratory, the pH and specific conductance of the samples will be measured using the appropriate bottle from each well. Instruments will be calibrated before use each day, and at four-hour intervals during the day. Instrument operation will be in accordance with the specific manufacturer's instructions.

c. Sample bottles will be tightly capped and placed on ice in insulated coolers. As each cooler is filled, it will be sealed with shipping tape, and security will be established by placing evidence tape across the lid and body of the cooler. The cooler will then be labeled with appropriate shipping labels.

d. At the end of each day of sampling, the filled coolers will be shipped via overnight air express to the Koppers Environmental Analysis Laboratory, 440 College Park Drive, Monroeville, PA 15146, or to the appropriate contract laboratory.

6. <u>Field Blank</u>

a. A field blank will be collected during the sampling process. This will involve pouring distilled water into a laboratory-cleaned bailer, and then distributing the water between the appropriate sample bottles.

7. Field Data Sheets

a. All pertinent field information will be recorded on the field data sheet (example attached). This will include the date and time of sampling, the sampler, the measured depth to water, the number of bails required to purge the well, and the field pH and conductivity measurements. In addition, the sampling crews are instructed to include significant observations, such as the number of bails removed before a well ran dry, unusual sample conditions (oily, cloudy, colored), unusual sampling conditions (bee's nest in protective pipe, flooded location, etc.), and unusual well conditions (lock broken, protector pipe bit, etc.).

b. Upon return of the sampling crew to Monroeville, the field data sheets are to be given to the sampling coordinator. That person will distribute copies to the appropriate personnel, and retain the original sheets in the plant sampling file.

FIELD DATA SHEET FOR [illegible]UNDWATER SAMPLING

PLANT:	**SAMPLED BY:**
PROJECT:	**WEATHER:**

SAMPLING METHOD:

Site No.	Date	Time	Well Dia. (in.)	Depth of Well (ft) (including stickup)	Depth to H_2O in Well (ft)	Depth of H_2O in Well (ft)	Well Elevation (ft) (top of casing)	H_2O Elevation (ft)	Number of Bails Removed	In-situ Measurements			
										pH (units)	Conductivity (µmhos/cm)		

SITE NO.	OBSERVATIONS

ANALYSES SAMPLED FOR: ______________________________

____

PAGE ____ OF ____

CHAIN-OF-CUSTODY
PROCEDURES

KOPPERS COMPANY, INC.

CHAIN OF CUSTODY

The procedures for chain of custody of samples collected by Koppers personnel, pertaining to those working for the Water Quality Engineering Department and Hydrogeology Department, will follow these specific rules and regulations when sampling a plant or facility, whether it be groundwater, surface water, stormwater, or plant discharge water. These procedures are described in detail and are basically the same as those outlined by the EPA.

SAMPLE IDENTIFICATION

Samples collected will be identified by sample tape placed on each individual bottle for analyses. The tape is waterproof and color coded specific to the type of analyses to be performed. Printing on the tape is waterproof and any additional writing placed on the label will be with waterproof ink. Each sample label will include the following information:

Plant Code - Abbreviation of plant or project.

2. Station Location - identifiable from map layout, usually a number or letter-number.

3. Date - Six digit number, e.g. 6/12/84.

4. Time - four digit number, e.g. 0954 for 9:54 a.m.; 1629 for 4:29 p.m.

5. Sample Analyses

6. Preservatives

7. Samplers - Initials of person collecting sample.

NOTE: Any in-situ measurements made will be recorded directly on field data sheets. Examples of in-situ measurements include pH, temperature, conductivity, flow measurements, color, odor, and any special observations.

SAMPLE CUSTODY

A sample is under custody if:

1. **It is in your possession, or**
2. **It is in your view, after being in your possession, or**
3. **It was in your possession and you locked it up, or**
4. **It is in a designated secure area.**

FIELD CUSTODY PROCEDURES

1. Koppers will collect only the number of samples needed to represent the media being sampled. To the extent possible, Koppers will determine the quantity and types of samples and sample locations prior to the actual field work. Only the technicians will handle samples.

2. The field sampler will be personally responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

3. Sample labels will be completed for each sample, using waterproof ink unless prohibited by weather conditions. For example, a notation would explain that a pencil was used to fill out the sample label because a ballpoint pen would not function in freezing weather.

4. The Project Coordinator will determine whether proper custody procedures were followed during the field work and decides if additional samples are required.

TRANSFER OF CUSTODY AND SHIPMENT

1. Samples are accompanied of a Chain-of-Custody Record (see page 4). When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents sample custody transfer from the sampler, often through another person, to the analyst.

2. Samples will be packaged properly for shipment and dispatched to the appropriate laboratory for analysis, with a separate custody record accompanying each shipment (e.g., one for each field laboratory, one for samples shipped, driven, or otherwise transported. Shipping containers will be taped and sealed for shipment to the laboratory. The method of shipment, courier name(s), and other pertinent information is entered in the "Remarks" section on the custody record.

3. Whenever samples are split with a source or government agency, a separate Receipt for Samples form (see page 5) is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the signature of a representative of the appropriate party acknowledging receipt of the samples. If a representative is unavailable or refuses to sign, this is noted in the "Received by" space. When appropriate, as in the case where the representative is unavailable, the custody record should contain a statement that the samples were delivered to the designated location at the designated time.

CHAIN OF CU[illegible] RECORD

PLANT CODE	PROJECT NAME

SAMPLERS *(Signature)*

STA. NO.	DATE	TIME	COMP.	GRAB	WELL	STATION LOCATION	NUMBER OF CONTAINERS							REMARKS OR OBSERVATIONS

Relinquished by: *(Signature)*	Date	Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date	Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date	Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date	Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date	Time	Received for Laboratory by: *(Signature)*	Date	Time	Remarks:	

DISTRIBUTION: Original accompanies shipment; Copy to Coordinator Field Files.

PAGE ____ OF ____

FIELD DATA SHEET FOR NDWATER SAMPLING

PLANT:	**SAMPLED BY:**
PROJECT:	**WEATHER:**

SAMPLING METHOD:

Site No.	Date	Time	Well Dia. (in.)	Depth of Well (ft) (including stickup)	Depth to H_2O in Well (ft)	Depth of H_2O in Well (ft)	Well Elevation (ft) (top of casing)	H_2O Elevation (ft)	Number of Bails Removed	In-situ Measurements			
										pH (units)	Conductivity (µmhos/cm)		

SITE NO.	OBSERVATIONS

ANALYSES SAMPLED FOR: ____________________

____

PAGE ____ OF ____

4. All shipments will be accompanied by the Chain-of-Custody Record identifying its contents. The original Record will accompany the shipment, and the copy will be retained by the Project Coordinator.

5. If sent by mail, the package will be registered with return receipt requested. Freight bills, post office receipts, and Bills of Lading will be retained as part of the permanent documentation.

PROJECT LOGBOOKS

The Project Coordinator is responsible for the transfer of field data sheets to the individuals who have been designated to perform specific tasks on the survey. Individuals sign their field data sheets upon receipt and use them to record all pertinent information until the project is completed. Observations made into a recording device must be promptly transcribed and retained for the records.

Field data sheets should be dated, legible, and contain accurate and inclusive documentation of an individual's project activities. Because the data sheet forms the basis for the later written reports, it must contain only facts and observations. Language should be objective and factual. If entries are made by more than one individual, then both should sign the field data sheet.

The field data sheet needs to contain information sufficient to recall and describe succinctly each step of the analysis performed because it may be necessary for the analyst to testify in subsequent enforcement proceedings. Moreover, sufficient detail is necessary to enable others to reconstruct the procedures followed should the original analyst be unavailable for testimony. Any irregularities observed during the testing process need to be noted. If, in the technical judgment of the analyst, it is necessary to deviate from a particular analytical method, the deviation shall be justified and properly documented.

FIELD DATA RECORDS

Where appropriate, Field Data Records (in the form of individual sheets) are maintained for each survey sampling station or location and the project code and station number are usually recorded on each page. All in-situ measurements and field observations are recorded in the FDRs with all pertinent information necessary to explain and reconstruct sampling operations. Each page of a Field Data Record is dated and signed by all individuals making entries on that page. The Coordinator and the field team on duty are responsible for ensuring that FDRs are present during all monitoring activities and are stored safely to avoid possible tampering.

CHAIN-OF-CUSTODY RECORDS

Serialized Chain-of-Custody Records are distributed in a manner similar to that used for sample labels. When samples are transferred to mobile laboratory personnel, the analyst, after signing, retains the white (original) custody record and files it in a safe place. The courier returns a copy of the custody record to the Project Coordinator. A similar procedure is followed when dispatching samples via common carrier, mail, etc., so that the original accompanies the shipment and is signed and retained by the receiving laboratory sample custodian while the copy retained for the Coordinator is returned from the dispatch point.

When samples are split with the source or another government agency, this is documented by the Receipt for Samples form. The label numbers from all splits are recorded on the form.

CHAIN OF CUSTODY - LABORATORY

SAMPLE DELIVERY TO THE LABORATORY

The sample will be delivered to the laboratory for analysis by overnight air express from the job site. Samples will have been preserved appropriately prior to shipment; recommended holding times will not be exceeded. The sample must be accompanied by the chain-of-custody record and by a sample analysis request sheet (Figure 1). The sample must be delivered to the Manager, Environmental Analysis Laboratory, or his representative in his absence, hereafter referred to as the "Custodian."

RECEIPT OF SAMPLE

Field samples are delivered to the laboratory either personally or through a public carrier. In the laboratory, a sample custodian will receive the samples. Upon receipt of a sample, the custodian will inspect the condition of the sample and the sample seal, reconcile the information on the sample label and seal against that on the chain of custody record, assign a laboratory number, log in the sample in the laboratory log book, and store the sample in a secured sample storage refrigerator room until assigned to an analyst for analysis.

SAMPLE INSPECTION

The sample custodian will inspect the sample for any leakage from the container. A leaky container containing multiphase sample will not be accepted for analysis. This sample will no longer be a representative sample. If the sample is contained in a plastic bottle and the walls show any bulging or collapsing, the custodian should note that the sample is under pressure or releasing gases, respectively. A sample under pressure will be treated with caution. It can be explosive or release extremely poisonous gases. The custodian will examine whether the sample seal is intact or broken, since a broken seal may mean sample tampering and would make analysis results inadmissible in court as evidence. Discrepancies between the information on the sample label and seal and that on the chain of custody record and the sample analysis request sheet will be resolved before the sample is assigned for analysis. This effort might require communication with the sample collector. Results of the inspection will be noted on the sample analysis request sheet and on the laboratory sample log book.

ASSIGNMENT OF LABORATORY NUMBER

Incoming samples usually carry the inspector's or collector's identification numbers. To further identify these samples, the laboratory will assign its own site identification numbers, which are given consecutively. Each sample will be marked with the assigned laboratory number. This number is correspondingly recorded in a laboratory sample log book along with the information describing the sample. The sample information is copied from the sample analysis request sheet and cross-checked against that on the sample label.

ASSIGNMENT OF SAMPLE FOR ANALYSIS

The manager of the Environmental Analysis Laboratory (or his representative) will assign the sample for analysis. The manager will decide what analyses are to be performed, based on the sample analysis request sheet (Figure 1) and other information at his disposal.

In his own laboratory, the manager may assign the sample analysis to one or more technicians for the requested analyses. The technican assigned to analysis will record in the bound laboratory notebook the identifying laboratory sample number, the date of analysis and subsequent testing data and calculations.

The sample may have to be split with other laboratories in order to obtain all the necessary analytical information. In this case, the same type of chain-of-custody procedures must be employed at the other laboratory and while the sample is being transported to the other laboratory.

Once the sample has been received in the laboratory, the manager or his assignee is responsible for its care and custody. He should be prepared to testify that the sample was in his possession or secured in the laboratory at all times from the moment it was received until the analyses were performed.

TO: Manager, Environmental Analysis Laboratory

FROM: ________________

LOCATION: ________________

LOCATION: MSTC

DATE: ________________

SUBJECT: Analytical Instructions

ACTIVITY NO.: ________________

Please carry out the indicated tests for specified samples from:________________________.

TYPE			EXTRACTS
SOIL	GROUNDWATER	COMPOSITE	TOTAL
RESIDUE	SURFACE WATER	GRAB	EP-TOXICITY
OTHER	PROCESS WATER	BAILER	ASTM
		PUMP	

ANALYSES

1. pH
2. Conductivity
3. Color

Turbidity

5. Acidity
6. Alkalinity
7. Solids-Evaporated T-F-V
8. Solids-Suspended T-F-V
9. Solids-Dissolved T-F-V
10. TOC
11. COD - Total-Soluble
12. BOD - Total-Soluble
13. Phenols
14. Ammonia-N
15. Kjeldahl-N
16. Nitrate-N
17. Nitrite-N
18. Phosphorus - Total
19. Phosphorus - Ortho

Oil & Grease

21. Cyanide-Total-Amenable
22. PCP
23. Thiocyanate
24. Antimony (Sb)
25. Arsenic (As)
26. Barium (Ba)
27. Beryllium (Be)
28. Bicarbonate (HCO_3)
29. Boron (B)
30. Cadmium (Cd)
31. Calcium (Ca)
32. Carbonate (CO_3)
33. Chloride (Cl)
34. Chromium (Cr) Total-Hex
35. Copper (Cu)
36. Fluoride (F)
37. Iron (Fe)
38. Lead (Pb)
39. Magnesium (Mg)
40. Manganese (Mn)
41. Mercury (Hg)
42. Nickel (Ni)
43. Potassium (K)
44. Selenium (Se)
45. Silver (Ag)
46. Sodium (Na)
47. Sulfate (SO_4)
48. Sulfite (SO_3)
49. Sulfide (S)
50. Thallium (Tl)
51. Tin (Sn)
52. Zinc (Zn)
53. Priority Pollutants:
    VOA, BN, AE,
    PEST/HERB.
    METALS
54. PAH
55. OTHER: ________________

[illegible]ECIAL INSTRUCTIONS: ________________________________

LABORATORY QUALITY CONTROL PROCEDURE

KOPPERS COMPANY, INC.

5. Quality Control Procedure

A. Evaluation of Daily Performance

1. At least two standards (a high and a low) should be analyzed routinely along with a blank (if applicable) to determine that comparable operating conditions exist. In addition, it is recommended that with specific ion probe procedures, an additional midrange standard also be run as a check standard.

2. Run duplicate samples every 10th sample or equivalent to 10% of the time.

3. Run duplicate standard after every 10 samples.

4. Run spike every 10th sample or equivalent to 10% of the time.

   a. Guidelines for Spike Selection
      1) Sample selected for spiking should be well within the detectable limits of your test.
      2) For best recovery results the amount (ppm) of spike should fall between 50-100% of the known value for a given sample.
      3) For easiest calculations a 1:1 mixture of sample and spike is recommended.

   b. Calculation of Spike

      1) $$\% \text{ Recovery} = \frac{\text{Value Actually Determined}}{\text{Theoretical Value of Mixed Spike}} \times 100$$

      2) $$\text{Theoretical Value} = \text{Determined Value of Sample} \left(\text{\% of Total Spike Volume}\right) + \text{ppm of Std Determined That Day} \left(\text{\% of Total Spike Volume}\right)$$

3) Example 1: COD Spike PL-1355

50 ml PL-1355 + 50 ml 500 ppm Std

Theoretical = (819 ppm)(.50) + (503 ppm)(.50)

= 409.5 + 251.5

Theoretical = 661 ppm

4) Example 2: Percent Recovery for COD Spike PL-1355

Actual = 671 ppm Theoretical = 661 ppm

$$\% \text{ Recovery} = \frac{671 \text{ ppm}}{661 \text{ ppm}} \times 100 = 101.5\%$$

B. Quality Assurance Tables

1. Record results of duplicate samples, standards and spike on Quality Assurance Table I. (See attached table.)

2. Plot mean ($\overline{X}$) of duplicate standard on 95% confidence $\overline{X}$ chart. (See attached chart A).

3. Plot range ($\overline{R}$) of duplicate standards on 95% confidence chart. (See attached chart B.)

4. Record data on Quality Assurance Table II. (See attached Table II.)

5. Compare data to known tendencies

   a. i.e., TOC, BOD, COD relationships
      Conductivity-solids relationships
      Ammonia nitrogens to TKN, etc.

   b. See references.

      1) EPA, Analytical Quality Control, Chapter 6
      2) Environmental Resource Associates, A Guide to Quality Control Practices for Waste and Potable Water Analysts, p. 17.

Reasons for Rejection of Data

Reason	Course of Action
1. Mean $\overline{X}$ of duplicate standards not within control limits on 95% confidence $\overline{X}$ chart (accuracy chart).	
2. Mean $\overline{R}$ of duplicate standards not within control limits on 95% confidence R chart (precision chart)	
3. % recovery of spike falls less than 90% or greater than 110%	

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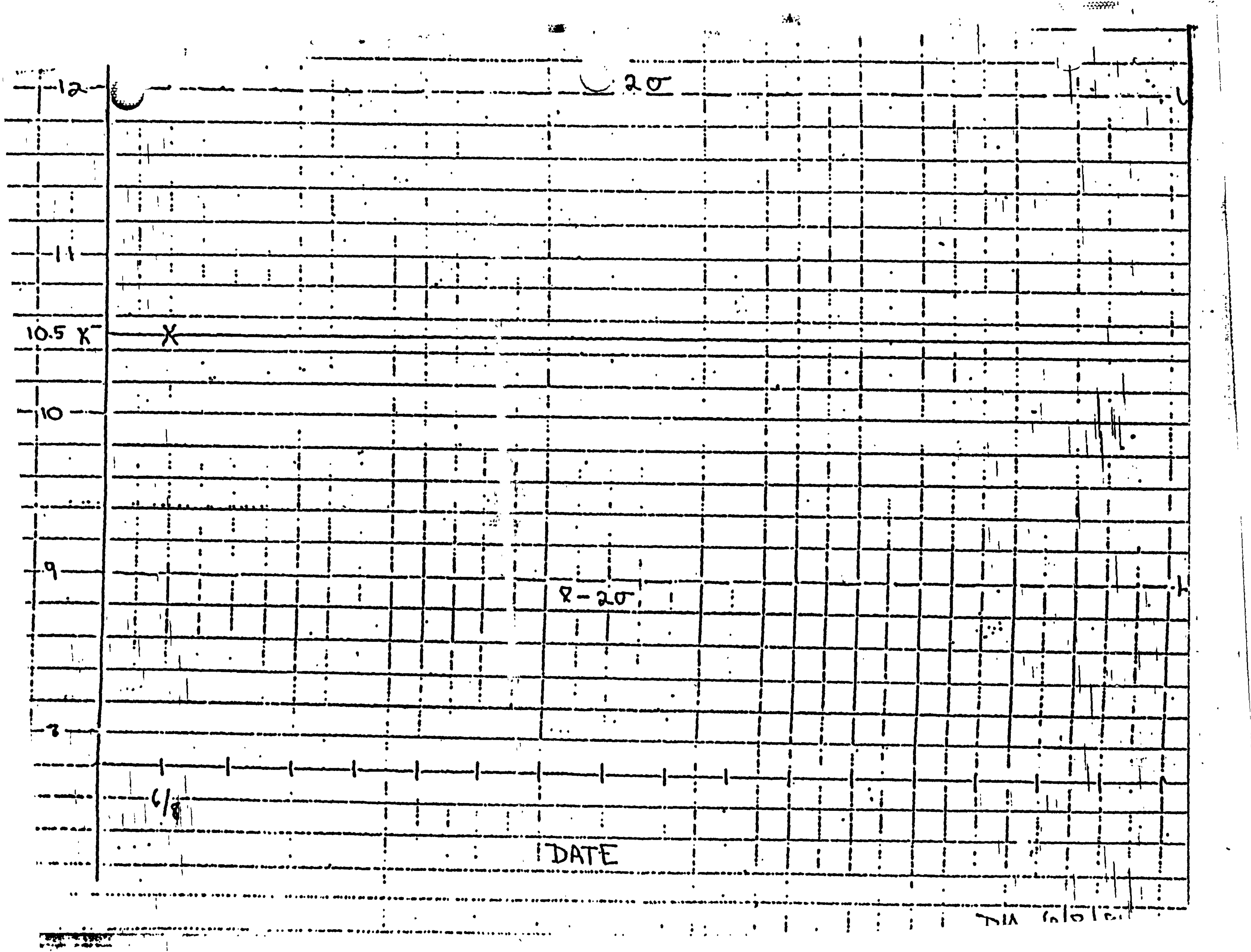
entificatio D d Date	Reference Standards Actual (X̄)	 Actual Found	Range (R)	erage Found	Set-Up By	Analyzed By	Comments
FLB-07435 10/81	TRIAL 1:	1494	6	1497	DM	DM	
	TRIAL 2	1500					
FLB-07435 SPIKE	THEORETICAL	ACTUAL	—	% RECV.	DM	DM	
	499.5	493		98.7			
1000 PPM	N.D.	1022	—	—	DM	DM	
	—	—					
PL-1355	TRIAL 1	814	10	819	DM	DM	
	TRIAL 2	824					
SPIKE PL-1355	THEOR.	ACTUAL.	—	% RECOV.	DM	DM	
	661	671		101.5			
1000 PPM	UD.	1002	4	1004	DM	DM	
		1006					


12
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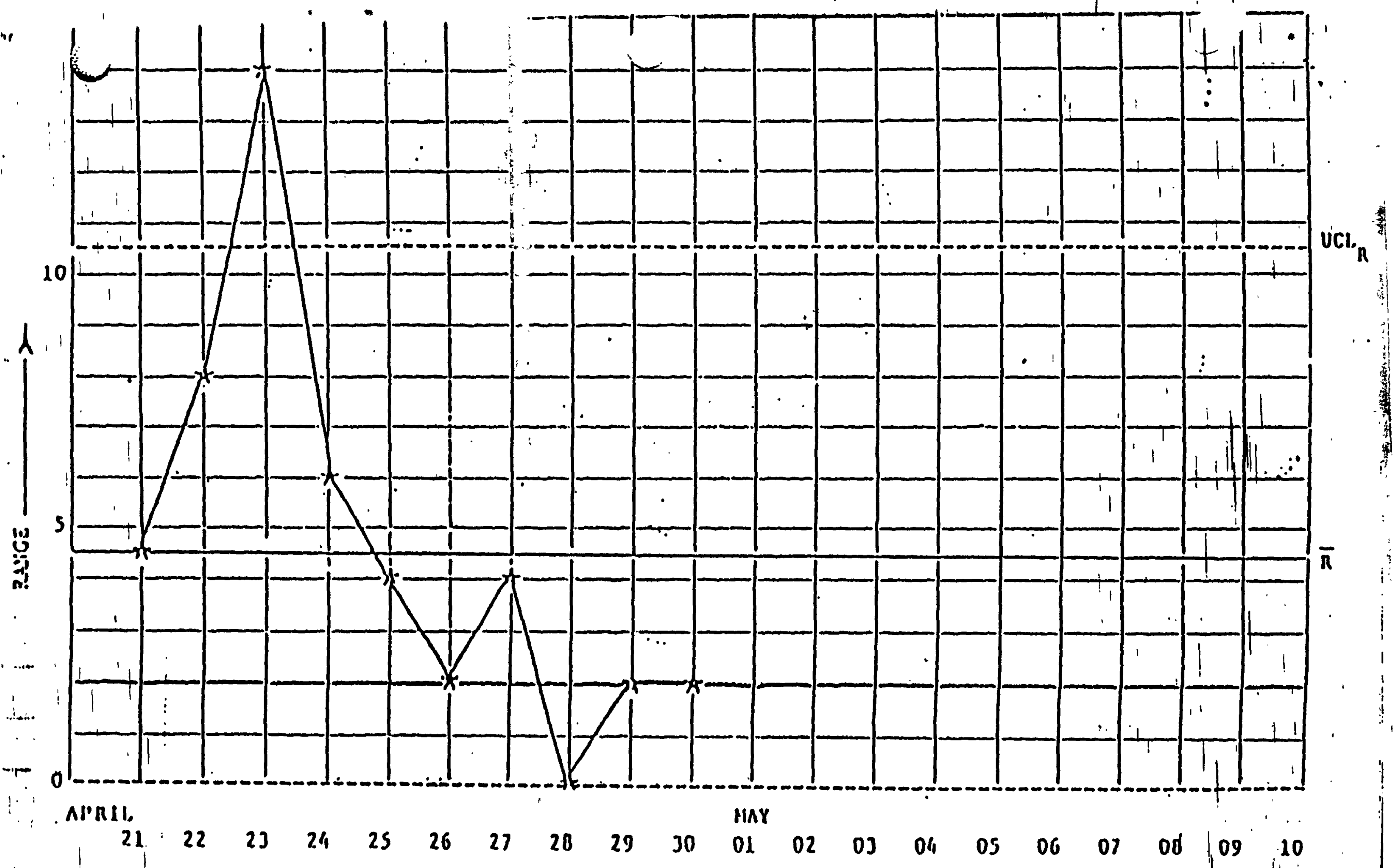

FIGURE 2. R CHART
95% CONFIDENCE

[illegible] Date

Parameter	Actual or true value	Analytical results in duplicate		Analyst	Range (R)	Average ($\bar{X}$)	ACCURACY CHART		PRECISION CHART	
							Upper Control Limits ($UCL_{\bar{X}}$)	Lower Control Limits ($LCL_{\bar{X}}$)	Upper Control Limits (UCL_R)	Lower Control Liml (LCL_R)