CONSTRUCTION STATUS REPORT
CLOSURE/RETROFIT OF
SURFACE IMPOUNDMENT SYSTEM
CEDAR CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI

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EXECUTIVE SUMMARY

In 1988, Cedar Chemical Corporation (Cedar) elected to upgrade the surface water impoundment system at their Vicksburg, Mississippi plant by removing the sediments within the impoundments, placing the sediments in a Solidified Waste Containment Area (SWCA) and retrofitting the existing impoundments with a double synthetic liner system.

Below is a summary of construction activities from the beginning of the closure/retrofit.

Sediment Solidification

Impoundment A sediment solidification began in February 1989. The sediments were solidified with lime kiln dust in order to absorb the excess water and to improve the consistency of the mixture for placement and compaction in the SWCA. Impoundments B and C solidification took place between October 2, 1990 and October 30, 1990.

SWCA Foundation

The SWCA was constructed using the southern end of Impoundment A. Subsequent to the solidification of the Impoundment A sediments, the solidified sediments were removed from the south portion and stockpiled in the north portion of Impoundment A during construction of the SWCA bottom liner system. The SWCA foundation soils (below the sediment) were found to be unsatisfactorily soft due to high in place moisture contents. The foundation soils were mixed with lime kiln dust and compacted to provide a stable foundation for the bottom liner system.

SWCA Bottom and Side Liner System

The SWCA was constructed for containment of the sediments removed from the impoundments with a four component synthetic bottom and side liner system. It consists of a leachate collection system, 60-mil primary synthetic liner, leakage detection system, and 60-mil secondary synthetic liner. The SWCA bottom and side liner system was constructed during the period August 16, 1989 through September 5, 1989. A cross section of the SWCA can be seen on Figure 2.

SWCA Sumps

The SWCA was constructed with two sumps; one for collection of the free liquids which leach from the sediments, and the other for the leak detection system.

Removal and Placement of Sediments

Upon completion of the SWCA bottom and side liner system, the solidified sediments were removed from the northern portion of Impoundment A, and placed and recompacted in the SWCA. During excavation of the solidified sediments, soils which visually appeared to be contaminated were found to extend deeper than expected. Cedar elected to over excavate, solidify, and place these soils in the SWCA. The volume of sediments removed from Impoundments B and C were also more than originally estimated. The lack of consistent survey data supplied by the contractor, and the time from the original survey to the solidification allowed eroded soils to collect in the impoundments. The increased sediment volume ultimately resulted in an expansion of the SWCA.

Impoundment Sump

The impoundment sump was constructed at the juncture of the impoundment dikes (see Figure 1) and is connected to the leak detection/removal systems of Impoundments B and C. A 4-inch pipe is connected to the leak detection/removal system trench of the impoundments to allow water to flow by gravity to the impoundment sump (see Detail 4 of Figure 5 for construction of the sump). The Impoundment A leak detection removal system piping was placed on the slope between the liners. Any collected water is removed by a diaphragm pump (see Detail 11 of Figure 7 for details of construction).

Foundations and Dikes

The Impoundment A, B, and C bottom soils were mixed with lime kiln dust and recompacted in order to provide support for the synthetic liner system. The dikes for Impoundments B and C were constructed with stabilized bottom soils. The SWCA dikes and impoundment A dikes were constructed using soils from an on site borrow pit. The locations and cross sections of the impoundment dikes can be seen in Figures 1 and 2, respectively.

Slope Drainage System

During construction of the Impoundment A dikes, groundwater seepage problems were encountered along the north slope. A slope drainage system was constructed to intercept and facilitate removal of the water. This system consisted of a 1-foot thick blanket of gravel which allows intercepted water to flow into a sump at the toe of the dike. By pumping water from the sump, construction on the north slope could continue. See Figure 8 for construction of the slope drain system.

Impoundment Liner Systems

The impoundments are retrofitted with a four component synthetic liner system, consisting of a 60-mil HDPE synthetic primary liner, leak detection/removal system, 60 mil HDPE synthetic secondary liner, and gas relief system. The Impoundment A liner system was installed during the period March 20, 1990 through April 5, 1990. The Impoundments B and C liners were installed from July 2, 1991 through July 27, 1991.

Pump Stations

Two pump stations were constructed to facilitate removal and rerouting of water within the impoundment system. Pump Station No. 1 is located at the northwest corner of Impoundment A, and Pump Station No. 2 is located at the northeast corner of Impoundment C. See Figures 1 and 4 for the location and construction of the pump stations. The impoundments are interconnected with HDPE piping through the dikes that allow for gravity transfer of water. See Detail 1 of Figure 3 for construction of the equalization piping.

SWCA Final Cover System

The SWCA final cover system was constructed as a five component composite, soil and synthetic liner system. The cover system consists of a minimum 18 inches of topsoil, synthetic drainage layer, 60-mil HDPE synthetic liner, a 1 foot thick compacted clay layer, and a synthetic gas venting system. The SWCA cap system was constructed from September 18, 1991 through November 25, 1991. A drainage ditch is on the west side of the SWCA to divert runon from the closure area and remove runoff from the SWCA cap. A cross section of the SWCA cap can be seen on Detail 7 of Figure 6.

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CEDAR CHEMICAL CORPORATION
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1.0 Introduction

Cedar Chemical Corp. (Cedar) owns and operates a chemical plant in Vicksburg, Mississippi. The plant site is divided physically and functionally into a "north plant" and a "south plant". Both plants are approximately thirty years old. Each was constructed under separate corporate ownership. Vicksburg Chemical Company acquired both plants in approximately 1974 and merged them into one operating facility. In 1986, Cedar Chemical Corporation acquired this facility.

A surface impoundment system was originally constructed in the early 1950s as part of the south plant operation to collect, by gravity flow, the rainwater runoff from that plant. In addition to its original function, the impoundment system now serves also as a standby retention basin to receive water diverted from the north plant when that water does not meet regulatory pH guidelines for discharge to the Mississippi River. Throughout its history, the impoundment was from time to time the receptor of pretreated wastewater from various specialty agricultural chemical operations.

In 1988, Cedar elected to upgrade the impoundment system by solidifying and removing the sediments from the impoundments, then retrofitting the excavated impoundments with a synthetic liner system. Construction engineering design of the retrofit was begun in early 1988; however, because the original engineering consultant was unable to meet Cedar's schedule, IT Corporation (IT) was selected to complete the design and construction specifications package in accordance with the original conceptual design.

Following construction contractor selection in late 1988, IT was requested to provide limited construction quality assurance (CQA) oversight. This level of oversight was provided by IT from the beginning of construction in February 1989 to August 1990. From August 1990 to the present, Cedar requested IT to provide full time construction oversight. IT prepared a Construction Quality Assurance Program (CQAP) to assist Cedar in determining that the completed closure and impoundment retrofit met the intent of the project design criteria outlined in the plans and specifications. To implement the CQAP, it was intended that Cedar would call IT on an as needed basis to be on site to observe milestones in the construction.

The CQAP contained methods and specifications necessary to confirm compliance with or to detect deviations from the construction specifications. The CQAP also contained procedures for corrective action, if construction deviation, or modification to the design were needed.

The CQA plan outlined closure activities as follows:

- Construction of the bottom and side liner system for the Solidified Waste Containment Area (SWCA)
- Solidification and removal of contaminated sediments which were observed in Impoundments A, B, and C
- Placement of the solidified sediments in the SWCA
- Construction of a final cover system over the SWCA
- Reconstruction and retrofitting of Impoundments A, B, and C
- Construction of the pump stations.

During construction, many problems and delays were encountered because of unexpected soil conditions (requiring additional design), weather, and other construction contractor delays. As a result, Cedar requested in August 1990 that IT increase its construction oversight and have on site personnel present during all remaining construction activities.

During the closure/retrofit of the impoundments, Cedar began negotiations on a consent agreement with the United States Environmental Protection Agency (EPA) to investigate the presence and extent of chemical constituents in the plant environment from past plant operations. This report of the status of the closure/retrofit activity will detail the implementation of these construction activities and provide post construction information including pertinent design specifications. Upon the satisfactory completion of construction activities, this report will provide the basis for IT to provide a certification of construction activities. Provisions have been made to include the certification in Appendix A.

2.0 CQA and Contractor Personnel

To assist in the implementation of the CQAP, and to provide verification of the work, Cedar contracted IT to serve as the Quality Assurance/Quality Control Engineer. During the early phases of construction, IT's role was limited to performing CQA on an as-call basis. After August 1990, IT began full time construction oversight. IT personnel provided the inspection and testing required to assure conformance with the CQAP and to provide documentation that the intent of the construction specifications and drawings had been met. In addition, IT would provide to Cedar documentation of any deviations from the construction specifications and drawings.

General contracting and earthwork construction was provided by Lewis Miller Construction Company (Miller), a general contractor to Cedar. Geosynthetic liner installation was performed by Gundle Lining Systems, Inc. (Gundle) as a subcontractor to Miller. The various organizations associated with construction and CQA of this project and key personnel from those organizations, are listed below:

- Cedar Chemical Corporation - Owner
  - Fred Ahlers - Plant manager (Beginning of project to August 1991
  - John Miles - Plant Manager (August 1991 to present)
  - Dave Madson - Technical Manager
  - Steve Boswell - Director of Environmental Affairs
- IT Corporation - Design Engineers and Construction Quality Assurance
  - Mike Richardson - Design Engineer - (August 1988 - June 1991)
  - Hewitt Beauvais - Project Engineer - (November 1989 - January 1991)
  - Stan Campbell - Project Manager - (January 1991 - April 1991)
  - Blaine Johnson - Project Manager - (April 1991 - November 1991)
  - Glen Landry - Project Manager - (November 1991 - Present)
  - Mike Doran - Field Technician (Part-time: March 1989 - July 1990)
  - Billy Frey - Field Technician (Full-time: August 1990 - Present)
  - Mike Hebert - Field Technician
  - Roy Keel - Field Technician
  - Mike Oubre - Field Technician

- On-site IT Technicians - the IT field technicians present during the construction, and the dates they were present, are listed below:

  - M. Doran
    3/8 - 10/89
    4/17/89 - 6/21/89
    7/20 - 25/89
    8/14/89 - 11/30/89
    12/15/89
    1/30/90 - 2/1/90

  - R. Keel
    2/27/90 - 3/2/90

  - M. Hebert
    5/7/90
    8/16/90
    1/28 - 29/91

  - B. Frey
    3/8/89 - 4/18/89
    6/27 - 28/89
    8/2/90 - 9/5/90
    10/2/90- 12/21/90
    1/4/91 - 4/11/91
    5/13/91 - 11/27/91
    1/6/92 - 1/17/92
    2/20/92 - 3/5/92
    3/10/92 - 3/14/92

  - M. Oubre
    8/12 - 14/91

- Lewis Miller Construction Company - General Contractor, Earthwork Contractor

  - Tim Temple - Project Manager (February 1989 - May 1990)
  - Joe Strawbridge - Project Manager (May 1990 - Present)

- Gundle Lining Systems, Inc. - Lining Installer

  - Garth Hewitt, Kevin Simms - Project Managers

- DIMCO, Inc. - Land Surveyors

  - Kimball Slayton - Land Surveyor

- Gee and Strickland - Soils Testing Laboratory

  - Phil Gee - Laboratory Manager

- Louis J. Capozzoli and Associates, Inc. - Soils Testing Laboratory

  - Mike Kohn - Laboratory Manager

- Encor - Geosynthetic Testing Laboratory

  - Sammie Fuller - Laboratory Manager

3.0 Construction Information

This section presents information on the construction of the major components of the SWCA and the impoundments. These components consist of the SWCA liner system, the SWCA final cover system, and the impoundment retrofit systems. Information concerning sediment solidification, foundation and dike earthwork, and pump station construction is presented also.

3.1 Sediment Solidification

The sediments within each of the impoundments were mixed with lime kiln dust to reduce moisture and improve the consistency of the mixture prior to placement and compaction in the SWCA. The lime kiln dust was hydrated by the free liquids and its pozzolanic properties formed a binder for the sediment particles therefore "solidifying" the sediments. The solidified sediments were then removed, placed in the SWCA, and compacted to greater than 95 percent of their Standard Proctor density. This density requirement was selected to provide adequate support for the final cover system. See Photo no. 1 in Appendix J for typical solidification activities.

3.2 SWCA Bottom and Side Liner System

The SWCA bottom and side liner system liner system includes the construction of the SWCA expansion. The SWCA is constructed with a bottom and side synthetic liner system consisting of the four components listed below in the order of construction:

- Secondary synthetic liner
- Leachate detection system (LDS)
- Primary synthetic liner
- Leachate collection system (LCS).

The SWCA bottom and side liner system also included construction of the SWCA sumps.

3.2.1 Secondary Synthetic Liner

The secondary liner consists of 60-mil HDPE which underlies the leachate detection system and provides back-up for the primary synthetic liner. This liner was installed by Gundle after removal of sediments and solidification of the remaining bottom soils. See Figures 14 and 17 for the SWCA bottom and expansion liner placement as-built drawings.

3.2.2 Leachate Detection System

The leachate detection system consists of a HDPE geonet placed between the primary and secondary liners. The geonet allows liquids to flow into a trench and sump, and is designed to detect the presence of liquids between the primary and secondary synthetic liners. See Detail 4 of Figure 5 and Detail 9 of Figure 6 for post-construction details of the sump and trench.

3.2.3 Primary Synthetic Liner

The 60-mil HDPE primary synthetic liner provides protection against leachate migration from the SWCA. The primary synthetic liner overlies the leachate detection system and is below the leachate collection system. See Figures 14 and 17 for the bottom and expansion liner placement as-built drawings.

3.2.4 Leachate Collection System

The leachate collection system consists of an 8-ounce/square yard geofabric placed over a HDPE geonet which allows flow to a removal trench. This system is designed to allow leachate generated in the SWCA to flow into the leachate collection sump for removal. The leachate collection system overlies the primary liner providing the initial protection against leachate migration by collection. Solidified sediments are placed and compacted directly on the top of the leachate collection system. See Detail 9 of Figure 6 for post-construction details of the trench and piping.

3.2.5 SWCA Sumps

The SWCA utilizes two sumps as part of the leachate collection system and leachate detection system. The sumps consist of 60-inch internal diameter reinforced concrete pipe (RCP) with an 18-inch primary detection riser pipe inside the RCP. The sumps provide access for inspection and testing of the collection and detection system. See Detail 4 of Figure 5 for post-construction details of the sump.

3.3 SWCA Final Cover System

The SWCA final cover system is a six component composite soil and synthetic liner cover system intended to minimize the infiltration and migration of liquids into and through the cap. The SWCA cover system consists of the following components in the order of construction:

- Gas collection/venting system
- Clay cap
- Synthetic liner
- Synthetic drainage layer
- Topsoil layer
- Runon/runoff control.

3.3.1 Gas Collection/Venting System

The gas collection venting system consists of a synthetic drainage net (geonet) between two layers of 8-ounce geotextile filter fabric and placed directly on top of the solidified sediment to facilitate removal of potential gases generated by the solidified sediments. See Detail 8 of Figure 6 for post-construction details of the trench. Figure 1 shows the location of the trench.

3.3.2 Clay Cap

This cap liner is a minimum of twelve inches of compacted clay which will act as secondary protection against infiltration of liquids into the SWCA wastes. The clay was placed and compacted so as to obtain a coefficient of hydraulic conductivity of less than 1.0×10^{-7} centimeters per second. The clay liner overlies the gas venting system. Cross section A-A of figure 2 details post-construction of the clay cap.

3.3.3 Synthetic Liner

The 60-mil synthetic liner, installed on top of the clay liner, provides primary protection against rainfall infiltration into the SWCA. The synthetic liner is designed to maintain its integrity during possible settling of the solidified sediment in the SWCA. See Figure 15 for the liner placement as-built drawings.

3.3.4 Synthetic Drainage Layer

A synthetic drainage layer overlies the synthetic liner and underlies the topsoil. It consists of geonet fabric covered by an 8-ounce geotextile fabric and is designed to inhibit accumulation of liquids in the cap so as to minimize the effect of hydraulic head on the synthetic liner.

3.3.5 Topsoil

The topsoil consists of a minimum of 18-inches of topsoil placed on the SWCA cap to provide protection for the underlying liners, and to serve, in addition, as a growth medium for the final vegetative cover. Erosion protection material placed on the SWCA slopes will reduce erosion and allow for growth of the vegetative cover. Cross section A-A of Figure 2 presents post-construction details of the topsoil cover.

3.3.6 Runon/Runoff Control

A perimeter ditch, constructed west of the SWCA is designed to prevent runon from the adjacent hillside from entering the SWCA area. The ditch is designed with a capacity to divert stormwater drainage from the areas west of the SWCA and carry runoff from portions of the SWCA cover in which rainfall runs off to the west. See Figure 1 for location of the drainage ditch.

3.4 Foundations and Dikes

After the sediments were removed from the impoundments, the remaining soils were found to have a high moisture content. These soils were solidified with lime kiln dust to provide a stable foundation for the synthetic liners. These stabilized underlying soils were also used during reconstruction of the dikes for Impoundments B and C. The SWCA dikes and Impoundment A dikes were constructed using soils from an onsite borrow pit. Equalization piping was installed in the impoundment dikes to allow for circulation of water within the impoundment systems. Flow through the pipes is controlled by valves. See Figure 2 for cross section of the post-constructed dikes. See Detail 1 of Figure 3 for post-construction details of the equalization pipes.

3.5 Slope Drainage System

During construction of the Impoundment A dikes, groundwater seepage problems were encountered at the north slope of the impoundment. A leak in a nearby city water line and the existing effluent pipe, along with the existing groundwater levels were suspected to be contributing to the supply of seepage water. A 1-foot thick layer of wash gravel was placed along the slope with a collection trench at the toe of the slope to intercept the seepage water. Details of the post-constructed slope drain system can be seen in Figure 8.

3.6 Impoundment Retrofit Systems

The purpose of the retrofit of the impoundments is to enable continued collection and treatment of stormwater. The retrofit consisted of removing contaminated sludges and then installing a synthetic liner system in each impoundment.

The impoundment liner systems consist of four components listed in the order of construction:

- Gas relief system
- Secondary synthetic liner
- Leak detection/removal system
- Primary synthetic liner.

The impoundment retrofit also included construction of the impoundment sump.

3.6.1 Gas Relief System

The gas relief system consists of a synthetic drainage net (geonet) and an 8-ounce geotextile fabric placed directly on the foundation, below the secondary liner. The gas relief system is designed to prevent bulges in the liner system which might result from the buildup of gas pressures beneath the liner. The gas relief system can also function as a relief of groundwater pressure. The drainage net is connected to riser pipes to vent any generated gas to the atmosphere. The geonet is also tied into a groundwater sump which when pumped, will relieve groundwater pressure in the geonet. See Detail 2 of Figure 3 for post-construction details of the gas relief system and vent.

3.6.2 Secondary Synthetic Liner

The secondary liner, constructed from 60-mil HDPE, overlies the gas relief system and underlies the leachate detection system. This material conforms with EPA guidelines for liner systems and provides for secondary prevention of leachate migration. See Figures 16 and 17 for liner panel as-built drawings of Impoundment A and Impoundments B and C, respectively.

3.6.3 Leakage Detection/Removal System

This system consists of an HDPE geonet placed between the primary and secondary liners. It provides for drainage into a removal trench and is designed to detect any migration of liquids through the primary synthetic liner. The leakage detection/removal system allows any liquids which enter the zone between the liners to gravity flow into the impoundment sump for removal. The Impoundments B and C piping are connected to one common impoundment sump. See Detail 6 of Figure 5 for post-construction details of the trench. Figure 1 shows the location of the trenches and piping.

The 4-inch and 6-inch pipes from the Impoundment A leakage detection/removal system had to be abandoned during construction because of improper placement. The external 6-inch pipe was abandoned by excavating into the slope, cutting the pipe and backfilling the excavation. The 4-inch pipe was removed from the interior of the larger 6-inch pipe. A diaphragm pump is used to remove any leakage from the leakage detection/removal system. See Detail 10 of Figure 7 for post-construction details of Impoundment A leakage detection/removal system piping.

3.6.4 Primary Synthetic Liner

The primary synthetic liner consists of 60-mil HDPE and provides the initial protection against leakage of water from the impoundments. The primary synthetic liner overlies the leachate detection/removal system. See Figures 16 and 17 for liner panel as-built drawings of Impoundment A and Impoundments B and C, respectively.

3.6.5 Impoundment Sump

Impoundment B and Impoundment C utilize a common sump for collection of liquids from the leachate detection/removal systems. The sump is constructed of a 60-inch internal diameter reinforced concrete pipe and an 18-inch HDPE primary detection pipe. The sump is located at the juncture of the three impoundments and has access for inspection and testing of the detection systems.

3.7 Pump Stations

Two pump stations were constructed to facilitate rerouting and removal of water from the impoundments to the Calgon Water Treatment Units, prior to discharge into the Mississippi River. Pump Station No. 1, located at the northwest corner of Impoundment A uses three 300 gpm pumps for water removal from Impoundment A. Pump Station No. 2, located at the northeast corner of Impoundment C, uses one 600 gpm pump for water removal from Impoundment C. See Figure 1 for the location of the post-constructed pump stations and Figure 4 for construction of Pump Station No. 1.

4.0 Construction Quality Assurance

The construction quality assurance activities described herein were performed by CQA personnel to supplement the test data provided by the contractor, and to provide independent documentation that the construction met the requirements of the construction specifications and drawings. The results of CQA testing are summarized in Tables 1 to 3. Post construction drawings documenting the completed construction are presented as Figures 1 to 17. Documentation of test results, contractor certificates, sample collection logs, design modifications, and construction photographs are presented in Appendices A to J.

This section describes the CQA activities for each of the components of the closure/retrofit.

4.1 Site Preparation

4.1.1 Clearing and Grubbing

CQA personnel monitored the removal of all debris from construction areas, placing special emphasis on the removal of stumps, roots, and foreign objects. CQA personnel monitored fill operations in these areas.

Clearing of the borrow pits were monitored to assure the removal of roots and organic matter from soils used for construction of the clay cap, topsoil, dike and foundation. The results of geotechnical testing of borrow pit soils are presented in Appendix B.

No stockpiling of borrow soils occurred during construction.

4.1.2 Site Drainage

CQA personnel monitored the construction and effectiveness of drainage swales, dikes and other measures taken to control run-on into the impoundments closure area. CQA personnel also observed the placement of the rip-rap in the SWCA drainage ditch.

4.1.3 Impoundment Operation Relocation

CQA personnel documented the placement of a temporary dike at the south end of the existing dike for Impoundment A/Impoundment B (April 18, 1989). The temporary dike was constructed in order to separate the impoundments prior to solidification. It was constructed of lime kiln dust stabilized sediment. This construction represented a change from the original plan to construct a sheet pile wall between the impoundments. The temporary dike was later removed when a new permanent dike was constructed as part of the SWCA dike construction activities.

CQA personnel monitored the installation of the impoundment *equalization piping*. This 18-inch HDPE piping, and associated valves, was installed on the Impoundment A side of the common impoundment dike during the Impoundment A dike and foundation construction phase (November 3, 1989 to November 20, 1989). Polyethylene valves were used in place of the 18-inch diameter cast iron valves which had been specified. The 18-inch valves were certified by the manufacturer to be able to withstand a pressure greater than 10 feet of head as required by the specifications. This certification is shown in Appendix E. CQA personnel monitored the subsequent backfill operations and verified proper compaction of backfill soils.

Valve boxes constructed of cinder block were provided to allow access to each of the 18-inch valves (see Detail 1, Figure 3 for details of construction). The location of the equalization piping between Impoundments A and C deviated from the plan because of an obstruction of the existing Impoundment C pump station. The actual placement is indicated on the post-construction drawing, Figure 1. Invert elevations of the Impoundments A/C and Impoundments B/C equalization pipes were also changed. The changes were made to match the new grades of Impoundment C which were required to provide flow to the new locations of the equalization pipes. The invert elevations of the piping are shown in Table 1 of Figure 3. Photo no. 9 in Appendix J shows the typical construction of equalization piping.

It was necessary to relocate the pump station in Impoundment A to the west-northwest corner because its original proposed location encroached on the Mid-South system railroad-right-of-way. CQA personnel monitored the construction of the foundation for the pump station and the suction pipe support stands. The Impoundment A pump station (designated as Pump Station No. 1) was constructed between August 31, 1989 through September 21, 1989 (see post-construction drawings, Figures 1 and 4).

Cedar elected to construct a second pump station, (designated as Pump Station No. 2), at the northeast corner of Impoundment C. It was designed similar to Pump Station No. 1, using suction pipe stands to support piping on the slope. The design modification report documenting the construction is included in Appendix H. The location of Pump Station No. 2 can be seen in Figure 1. The contractor submitted records of the concrete mix design. CQA personnel collected concrete mix designs and also monitored the foundation, reinforcement and form work before placement of the concrete. Due to the quality of construction and the minimal stresses applied to the structure, concrete cylinders were made but strength data was not obtained. The mix design is included in Appendix E.

All of the effluent piping was constructed by Cedar and is beyond the scope of this CQA.

4.1.4 Impoundment System Dewatering
CQA personnel monitored the impoundment dewatering and rerouting of water in the impoundment system, and verified that all free water was removed prior to beginning solidification activities. All water was rerouted within the impoundments or discharged to the on-site waste water treatment units for processing.

4.1.5 Removal of Impoundment Structures
Prior to beginning work on the impoundments, CQA personnel oversaw the demolition and removal of the existing Pond C pump station. The pump station debris was placed in a central location of the SWCA. A solidified waste covering at least 3 feet thick was placed above and below the debris so that the debris would be separated from the SWCA cap system and bottom liner system by at least 3 feet. The removed portion of the impoundment influent line was also demolished and placed in the SWCA. The pump station was demolished and buried on October 31, 1990.

4.2 Solidification Activities
CQA personnel monitored the solidification of sediments in Impoundment A, Impoundment B and Impoundment C. Lime kiln dust was used to adsorb excess water and to improve the consistency of the mixture for placement and compaction. The lime kiln dust was hydrated by the free liquids and its pozzolanic properties formed a binder for the sediment particles, therefore "solidifying" the sediments. Paint filter tests were performed to verify the removal of all free water. The contractor adjusted solidification percentages from the original design of 25 percent as required for good stabilization of the sediments. The average percentage of lime kiln dust was approximately 17 percent (based on wet weight.) Test cylinders, taken by

CQA personnel during the solidification process, and vane shear tests of the in-place SWCA solidified sediments verified that the lime kiln dust ratios were adequate to achieve the shear strength specified in the CQA plan. In situ vane shear tests were used instead of pocket penetrometer readings for verification of the strength of the solidified sediments. Photo no. 1 in Appendix J shows typical solidification activities during the Impoundment A solidification.

Test cylinders of solidified Impoundment B and Impoundment C sediments were taken to verify the 7-day shear strength of the solidified sediments. Seven sets of test cylinders were taken from Impoundment B. One set, designating one area of Impoundment B, failed the required shear strength tests. The area of Impoundment B, corresponding to this set, was resolidified. Upon resampling, the new test cylinders showed the required shear strength was obtained. Two sets of test cylinders were taken from Impoundment C. Both sets of cylinders failed to achieve the required shear strength. The low strengths are believed to be the result of non-reactive lime kiln dust. The Impoundment C sediments were resolidified with additional lime kiln dust and upon resampling, passed the required strength tests.

A summary of verification test results for solidification is presented below:

Solidification Testing

	Test Methods	Number of Passing Tests	Average Reading of Passing Tests	Standard Deviation
Impoundment A	Vane shear	12	1.20 tsf	0.2 tsf
Impoundment B	Penetrometer	7	4.5+ tsf	0.0 tsf
Impoundment C	Penetrometer	2	4.5+ tsf	0.0 tsf

The solidification process was accomplished using trackhoes for mixing. CQA personnel monitored the approximate depths of solidification using construction cross section plans. After solidification had been carried out, test pits were excavated in areas of the solidified material until natural impoundment bottoms were reached. Field pocket penetrometer tests were performed on the sides of test pits to verify strength and consistency of the solidified sediments. Photo No. 6 in Appendix J shows a test pit. The results of this testing are included in Appendix D. A summary of the results of each test pit is presented below:

Test Pit Results

Location	No. of Test Pits	Average Depth to Soil/Sediment Interface (Feet)	Average Penetrometer Reading	Standard Deviation of Readings
Impoundment A	7	6	2.83 tsf	0.62 tsf
Impoundment B	4	3.6	3.72 tsf	0.30 tsf
Impoundment C	2	3	3.85 tsf	0.35 tsf

Impoundment A sediment solidification was carried out during the period March 8, 1989 to April 12, 1989. Impoundments B and C solidification took place between October 2, 1990 and October 30, 1990. Delays were experienced during both phases as a result of adverse weather.

4.3 Relocation of Solidified Material

While the SWCA was being constructed the solidified sediments from the southern portion of Impoundment A were transferred to a stockpile in the northern area of Impoundment A. CQA personnel observed this transfer. They also periodically verified that soils with sediment-like consistency were removed down to the natural sediment/soil interface. Photo no. 3 in Appendix J shows stockpiling of the sediments in the SWCA.

A cross section survey by the contractor verified that the sediments had been removed from the SWCA area of Impoundment A to the elevations shown on the construction drawings. Relocation of sediments was accomplished from April 13, 1989 through April 24, 1989.

4.4 SWCA Foundation Preparation

The SWCA foundation preparation included:

- Construction of SWCA dikes
- Preparation of SWCA bottom.

4.4.1 SWCA Dikes

CQA personnel periodically observed the construction of the interior west slope of the SWCA excavation and the SWCA dikes which consisted of the new SWCA/Impoundment A dike, and the SWCA/Impoundment B dike. The SWCA/Impoundment B dike was stripped of vegetation and built up to the elevations and grades of the construction drawings. Loess soils were used as structural fill for the SWCA dikes. The loess was obtained from an onsite borrow pit and was classified, in accordance with the Unified Soil Classification System, as an ML soil.

4.4.2 SWCA Bottom

During excavation of the sediments from the SWCA portion of Impoundment A, the underlying soils were found to be high moisture content soils. They were thus unsuitable as a structural base for the synthetic liner system. These soils were mixed with lime kiln dust in order to achieve the necessary shear strengths. CQA personnel monitored solidification of the existing underlying soils in which the final mixture contained approximately 17 percent lime kiln dust based on wet soil weight. The underlying soils were solidified to depths of 3 feet and compacted with a sheepsfoot roller. CQA personnel visually observed and verified that the foundation surface was properly compacted, and that it was smooth, uniform, and consistent with design grades. Initial solidification work occurred between May 26, 1989 and June 1, 1989; a second stage of work was performed from August 4 through August 7, 1989.

An inactive septic tank leach field was discovered to be draining water into the excavated SWCA area. Plugging the leach field pipes eliminated the drainage problem. A survey of the SWCA bottom and side foundation was not performed by a certified licensed land surveyor or registered civil engineer as stated in the specifications. While CQA personnel were not present on site, construction personnel proceeded construction without the specified survey.

4.5 SWCA Bottom and Side Liner System

Construction of the bottom and side liner system involved CQA activities in the following areas:

- Leachate detection/collection system sumps
- Leachate detection/collection system trench and piping

- Leachate detection/collection system clean out pipes
- Synthetic liner systems.

4.5.1 Leachate Detection/Collection System Sumps

CQA personnel monitored the installation of two drainage sumps which were located north of the SWCA. Due to economy of construction, Cedar elected to use 60-inch internal diameter reinforced concrete pipe (RCP) sumps, in place of the planned 48-inch HDPE sumps.

During excavation for the sumps, the existing foundation soils were found to be soft. Excavation stability problems were encountered when portions of the excavation caved in. Sheet piling was driven to brace the excavations and prevent further cave-in. The sump foundations were redesigned and constructed to support the sumps on the soft foundation soils.

CQA personnel monitored the proper placement of the reinforcement steel and concrete for the foundation and placement of the 18-inch riser pipes into the foundation concrete (see Detail 4 of Figure 5). This phase of work was carried out between June 2, 1989 and June 23, 1989. CQA personnel monitored the placement of the 4-inch and 6-inch piping between the SWCA leachate detection/collection system and the sumps. Monitoring included a check of proper alignment with the line and a grade survey to assure proper flow into the SWCA sump. The connection of the 6-inch HDPE pipe into the 60-inch RCP sump was made with non-shrink grout. See Detail 4 of Figure 5 for details.

4.5.2 Leachate Detection/Collection System Trench and Piping

CQA personnel collected and reviewed the manufacturer's data for the synthetic drainage layers and the piping to verify compliance with the specifications. The trench excavation was monitored to ensure proper grade for flow toward the sumps and to verify removal of all potentially damaging materials prior to placement of the geomembranes.

CQA personnel monitored the installation of the perforated piping for the leachate detection/collection system. The monitoring included verification of proper connections and careful placement of the washed gravel to prevent damage to the liner system. A detail of the constructed trench is presented as Detail 9 of Figure 6. The installation of the leachate detection/collection system was carried out from August 8, 1989 through August 25, 1989.

Mill certificates for the synthetic drainage layer materials, piping, and perforated pipes are included in Appendix E.

4.5.3 Leachate Detection/Collection System Clean Out Pipes

CQA personnel inspected the piping for size, strength and material of construction. Manufacturer certifications were obtained confirming that the materials conformed to the specifications were collected. CQA personnel monitored trenching and pipe placement to verify that the operations conformed to the construction drawings. Welds and liner sleeves were visually inspected. Photo no. 17 of the (LD/CS) cleanout pipe is shown in Appendix J.

CQA personnel monitored and documented the placement of the manhole cover over the cleanout pipes. The cover system was modified by using a steel manhole cover and a ring which was set in concrete. Concrete tests were not performed. The leachate detection/collection system clean out pipes were installed between August 16, 1989 and August 25, 1989 (see Detail 7 of Figure 6 for details). The manufacturer's certificate for the piping is included in Appendix E.

4.5.4 Synthetic Liner Systems

The synthetic liner systems, consisting of the secondary liner, the leachate detection system, the primary liner, and the leachate collection system were installed in a manner to provide drainage to the collection trenches and piping. CQA personnel collected and reviewed the manufacturer's data for synthetic liner materials to check compliance with material specifications. The materials consisted of 60-mil HDPE sheeting, HDPE geonet and 8 ounce/square yard geotextile fabric. The subgrade was visually inspected prior to placement of the synthetic liner materials, as required by the specifications. Materials which could potentially damage the liner were removed from the area by the contractor prior to placement of the liner.

CQA personnel monitored the placement, welding and anchoring of the liner systems. An accumulation of liner material was placed as required at the toe of interior slopes to accommodate thermal contractions and differential settling. CQA personnel monitored the connection of the synthetic liner systems to the leachate collection/detection systems piping to assure that the pipe boots were connected in accordance with design specifications.

CQA personnel observed the backfill and compaction operations for the bottom liner system anchor trench. The anchor trench was monitored to ensure proper dimensions and proper backfill. Loess (ML) soils from the onsite borrow pit were used for fill instead of the USCS classified clay (CH) or silty clay (CL) soils as stated in the specifications.

CQA personnel monitored the removal of samples of liner seams for destructive testing. They verified that all seams which failed the tests were repaired in accordance with the CQA plan and Gundle's quality assurance specifications. Table 3 presents a summary of all destructive geosynthetic seam test results. Non-destructive vacuum and air lance testing of synthetic liner seams was observed subsequent to installation of each liner system. The entire surface of the liner was visually inspected for tears, punctures, and cuts. The SWCA bottom and side synthetic liner systems were installed from August 16, 1989 through September 5, 1989.

Certification from the contractor that the SWCA bottom and expansion liners were installed in accordance with manufacturer's recommendations are included in Appendix E. Manufacturer's certificates for the synthetic liner are included in Appendix E. Results of destructive testing are included in Appendix F. A copy of the contractor's panel placement drawings of the SWCA secondary and primary liners is presented as Figure 14.

4.6 Placement of Solidified Material into the SWCA

After installation of the liner systems, a minimum of 1 foot of clean solidified sediment was placed as a protective cover over the bottom liner. The protective cover was used to maintain the integrity of the SWCA liner system during placement of the remaining solidified material.

The first stage of placement of sediment into the SWCA consisted of placing all sediment removed from Impoundment A. During this stage, CQA personnel periodically monitored lift thickness and compaction by visual verification. This work was performed from September 7, 1989 through October 10, 1989. During subsequent placement of the solidified sediments from Impoundments B and C, CQA personnel monitored material placement and also checked compaction and soil moisture content with a nuclear density device. Geotechnical laboratory tests for inplace density and moisture were also performed to supplement and verify the field moisture/density results. Compaction was monitored to verify densities of at least 95 percent of the maximum as determined by a Standard Proctor compaction test. The geotechnical test results and the nuclear density test results are presented in Appendices B and C, respectively. The results of the nuclear density tests and geotechnical testing results are summarized in Table 1 and 2, respectively.

During the removal of solidified sediments from the north portion of Impoundment A, it was discovered that contaminated soils extended deeper than originally estimated. Sampling and testing performed by Cedar Chemical Company verified that these soils contained significant amounts of constituents found in the impoundment sediments. Cedar elected to over excavate, solidify, remove, and place these contaminated soils in the SWCA. The volume of sediments removed from Impoundments B and C were also more than originally estimated. The lack of consistent survey data supplied by the contractor, and the time from the original survey to the solidifications allowing eroded soils to collect in the impoundments added to the volume. As a result of this additional material the final volume of sediments exceeded the original design of the SWCA. A design modification in which the SWCA was expanded to the west was required to accommodate the increased volume. The expansion area is shown on the cross section of Figure 2 and in Figure 17. The variance report is included in Appendix H. Sediments were temporarily stockpiled in the SWCA while the expansion of the SWCA footprint to the west was being implemented. This stockpiled sediment was later placed and compacted in the expanded SWCA. CQA personnel visually monitored and documented the removal of solidified sediments down to the natural sediment/soil interface in the impoundments. Photo No. 3 in Appendix J shows stockpiling of the sediments.

After removal of sediments from Impoundments A, B, and C, Cedar performed verification sampling at the bottoms of the impoundments as agreed with the Mississippi Department of Pollution Control (MDPC). The sampling data was transmitted to MDPC at the time that the test results became available. A copy of the data is presented in Appendix I. The results indicate that constituents in the soils below the sediments indicated levels of arsenic, atrazine, cyanizine, dinitrobutylphenol, toxaphene, and methyl parathion were found to be below the hazardous levels set by the EPA. CQA personnel monitored the removal of sediment from Impoundment A from September 6, 1989 through October 9, 1989. The removal of the remaining sediments from Impoundments B and C and their placement in the SWCA took place from November 1, 1990 through August 2, 1991.

4.7 SWCA Final Cover System

Construction of the SWCA Final Cover System included CQA activities for the following which are shown in the order of construction:

- Grading
- Gas collection/venting system
- Clay cap
- Synthetic cap
- Synthetic drainage layer
- Top soil
- Erosion protection.

4.7.1 Grading

CQA personnel monitored the grading of the solidified sediments to verify proper design configurations. The SWCA north and east slopes were graded to slopes of 4 horizontal (H) to 1 vertical (V). A design modification from the design drawings authorized a grade change of the SWCA top to allow run-off to flow west (instead of east) in order to minimize the erosion potential on the north and east slopes. The west slope was constructed on an approximately 2 H to 1 V slope. A survey was performed by DIMCO, Inc. (DIMCO) a licensed Mississippi land surveyor to establish the grades of the SWCA material prior to placement of the clay cap. A map of the survey showing the elevations referenced to the National Geodetic Vertical Datum (NGVD) is included as Figure 9. Cross section A-A of the SWCA can be seen on Figure 2.

4.7.2 Gas Collection Venting System

CQA personnel visually inspected and verified the foundation to be uniform and compacted before placement of the geotextile fabric and geonet which comprise the gas collection venting system. CQA personnel collected and reviewed the manufacturer's data for the geofabric and geonet materials to verify compliance with the specifications. They also monitored and documented installation and proper tying of the geonet, and liestering of the geofabric. Pea gravel and 4-inch diameter schedule 20 PVC perforated pipe were used in place of select sand and 3-inch schedule 40 PVC perforated pipe in the gas venting trench.

CQA personnel monitored and documented the installation of the vent pipes and verified the proper placement of clay and topsoil around the pipes. The gas venting system was placed from September 18, 1991 through September 27, 1991.

Mill certificates for the geonet and geofabric are included in Appendix E. Pea gravel gradation results have not been supplied by the contractor.

4.7.3 Clay Cap

4.7.3.1 Inspection and Documentation

CQA personnel monitored the removal of clay from the on-site borrow pit and its placement on the SWCA. The top 2 feet of clay, topsoil and organic materials were stripped from the borrow area and excluded from construction of the clay cap.

CQA personnel monitored proper placement of clay cap material, lift thickness, and uniformity of areal coverage with the compaction equipment. During placement of the SWCA clay cap, CQA personnel monitored placement of the clay and checked compaction and moisture content with a nuclear density device. Geotechnical laboratory tests for in-place density and moisture were also performed to supplement and verify the field moisture/density results. Compaction was monitored to assure greater than 90 percent of the Standard Proctor density and an in place moisture content greater than the optimum moisture content. Appendices B and C present geotechnical test results and nuclear density test results obtained during placement of the clay cover. The results of the nuclear density tests are summarized in Table 1.

Initially, some problems were encountered with the contractor's soil placement methods which allowed the cover soils to dry out and crack. After changes in construction methods, laboratory test results of samples indicated permeability was less than the required 1×10^{-7} cm/sec. An elevation survey was performed by DIMCO to document the clay cap elevations. Comparison of surveys made before and after placement of the clay liner allowed the thickness of the clay liner to be calculated. The survey results showing the clay cap elevations (in NGVD) and the calculated thickness of the clay cap are included in Figures 10 and 11, respectively. Those areas which showed a cap thickness of less than 1 foot were located and checked with a blunt 3/4-inch diameter probe. In those areas where the cap thickness was inadequate, the areas were reworked by placing and compacting additional clay soils to bring these areas to grade. CQA personnel verified the clay cap as having a minimum of 1.0 foot thickness of clay on these areas prior to placement of the lateral drainage layer. A resurvey of the reworked areas was not performed. The SWCA clay liner was placed from September 28, 1991 through October 18, 1991. Cross section A-A of the SWCA can be seen on Figure 2. Photo no. 21 in Appendix J shows the clay cap during the synthetic liner placement.

4.7.3.2 Testing

An off-site borrow pit was tested, prior to the use of any material, to ensure that the material met the specifications for the clay cap construction. The clay borrow pit located on Mississippi Highway 61 north of Vicksburg, Mississippi and is owned by Louis Miller Construction Company.

Tests were performed to determine soil conformance with the following specifications:

- CH or CL classification (Unified Soil Classification System ASTM D2487)
- Liquid limit between 40 and 90 (ASTM D4318)
- Plasticity index greater than 15 (ASTM D4318)
- Moisture content (ASTM D2216)
- Unconfined compression strength tests (ASTM D2166)
- Standard Proctor density and optimum moisture content (ASTM D698)
- Hydraulic conductivity; the soil must be able to be compacted to a permeability equal to or less than 1×10^{-7} cm/sec (EPA Method 9100).

Geotechnical test results included in Appendix B verify that the clay conformed to the requirements of the specifications.

A summary of the geotechnical test for the clay borrow soils is presented below:

Geotechnical Conformance Tests

Parameter	Number of Tests	Average Value	Standard Deviation
USCS Classification	15	CH (all)	
Liquid Limit (%)	15	62.0	7.6
Plasticity Index (%)	15	36.0	5.6
Undrained Shear Strength (tsf)	2	3.73	1.17
Standard Proctor Maximum Density (pcf)	3	97.3	1.02
Standard Proctor Optimum Moisture (%)	3	22.1	1.4
Permeability Test (cm/sec)	3	8.1×10^{-9}	1.4×10^{-9}

Quality assurance testing of the in-place clay liner material was conducted as required. The testing consisted of performing nuclear density/moisture tests described in "Density of Soil and Soil Aggregate In-place by Nuclear Methods (Shallow Depth)", (ASTM D2922-81), on the clay cap material on 50-feet centers. A total of 48 tests verified compaction to a minimum of 90 percent of maximum dry density. The average maximum dry density (from 3 tests) was determined to be 97.3 pcf with an average optimum moisture content of 22.1 percent, as indicated in the above table. Additional nuclear density tests were performed to assist in controlling the earthwork construction.

During construction, those areas where testing indicated that the soil was below the required compaction specifications were reworked until within the specifications. The results of the tests on areas passing the compacting specifications (including the reworked areas) are summarized below.

Five undisturbed in-place samples of the compacted clay were obtained from each of the 6-inch lifts to provide a total of 10 samples for hydraulic conductivity testing, as required by the specifications. Hydraulic conductivity test (EPA method 9100) results, ranging from a maximum conductivity of 1.3×10^{-8} to a minimum of 2.5×10^{-9} centimeters per second, verified that the clay liner met the specifications for hydraulic conductivity of less than 1.0×10^{-7} centimeters per second. The results of these tests are included in Appendix B and summarized in the table below.

Two samples of borrow clay brought to the site were tested for Atterberg Limits (ASTM D4318) to assess material changes. The results of these tests, which are shown in Appendix B and summarized in the table below, verified conformance with the specifications.

Two relatively undisturbed samples of the in-place clay liner were tested for unconfined compressive strength (ASTM D2850), as required by the specifications, to assess the stability of the SWCA clay liner. These test results are included in Appendix B and summarized in the table below.

A summary of all geotechnical test results for the in-place clay cap verification is presented below.

Geotechnical Verification Tests

Parameter	Number of Passing Tests	Average Value	Standard Deviation
% of Average Standard Proctor Density	48	93.8	2.4
Field Dry Density (pcf)	48	91.2	2.3
Field Water Content at Compaction (%)	48	28.3	1.7
Liquid Limit/Plasticity Index (%)	2	64.5/47.5	2.1/2.1
Unconfined Compression (tsf)	4	2.4	0.3
Hydraulic Conductivity (cm/sec)	10	7.0×10^{-9}	3.2×10^{-9}

4.7.4 Synthetic Cap

4.7.4.1 Inspection and Data Documentation

CQA personnel collected and reviewed the manufacturer's data for the synthetic cap materials, to verify compliance with the specifications. The synthetic cap consisted of 60-mil HDPE sheeting. The subgrade was inspected prior to placement of the synthetic cap materials, as required by the specifications, to verify removal of all potentially damaging materials. CQA personnel monitored and documented placement, welding and anchoring of the cap. Each sheet of material was visually inspected after placement. Any damage incurred during installation was repaired and properly documented.

CQA personnel monitored cleaning of the bottom liner system and the top cap system tie-in area. Welding of the top cap systems to the primary liner of the bottom liner system was monitored. CQA personnel verified that excess liner was correctly placed at the areas on the north, east and south tie-ins of the top cap system to the bottom liner system. Changes in daily temperatures during placement of the cap along the west tie-in area caused contraction of the liner in a manner that shifted the material which had been placed at the west tie-in area. CQA personnel monitored connection of the synthetic cap to the leachate detection/leachate collection and gas venting system riser pipes. Certification from the contractor that the SWCA synthetic cap liner was installed in accordance with manufacturer's recommendations has not been received. Mill certificates and test results are included in Appendices E and F, respectively. Table 3 presents a summary of all destructive geosynthetic seam test results. Photo no. 21 in Appendix J shows deployment of the synthetic cap liner.

The synthetic cap was installed from October 19, 1991 through October 24, 1991.

4.7.4.2 Testing

Prior to startup of welding activities each day, CQA personnel observed proper pre-weld qualifications and verified that the welding equipment was operating properly. In addition to the pre-weld tests, seam samples were removed and sent for laboratory destructive testing at ENCOR. Geomembrane seam samples were collected at approximately every 500 feet of weld. CQA personnel documented that seams, which failed the specifications for the destructive testing, were properly repaired and retested in accordance with quality assurance specifications of Gundle Lining Corporation. Appendix F contains all seam strength test results. Table 3 summarizes the destructive test results for all seams. CQA personnel monitored vacuum testing of extrusion welded seams and air lance testing of fusion welded seams. A total of 8 seam samples taken from the geomembrane cap were tested; 6 of the samples were taken from the cap and 2 from the tie-in area. Only one sample (DS-05 from seam 19/20 of the cap) failed destructive testing. Subsequent additional tests on the DS-05 sample showed that the weld on one side of the sample passed the destructive testing, but the weld on the opposite side of the sample did not pass. The side of the seam which failed the testing was repaired, in accordance with Gundle's quality assurance specifications. It then passed a subsequent vacuum test. A copy of the contractors panel placement drawing for the

SWCA cap liner is presented as Figure 15. Photos no. 13 and 14 show fusion welding and air testing of the liners.

4.7.5 Synthetic Drainage Layer

The synthetic drainage layer overlies the SWCA synthetic cap. The synthetic drainage layer consists of a layer of geonet and 8 ounce per square yard geofabric. The drainage layer on the west slope is tied into a drainage system consisting of 3-inch PVC perforated pipes wrapped in geotextile fabric and covered with wash gravel. The 3-inch PVC drainage pipes are connected by a tee into the main drainage pipe on approximately 100 foot centers. These drainage pipes discharge into the SWCA drainage ditch. A post construction drawing showing the location of the drainage pipe is presented in Figure 1. On the other sides of the SWCA, the drainage layer is located at the toe of the SWCA in the rip-rap erosion protection. See Detail 10 of Figure 7 for post construction details. Photo no. 8 and 11 in Appendix J shows placement of piping.

CQA personnel visually inspected the geofabric and geonet components of the synthetic drainage layer for compliance with the specifications. The CQA personnel monitored and documented proper placement and tying of the geonet and geofabrics. The synthetic drainage layer system was installed from October 28, 1991 through November 26, 1991.

Mill certificates are included in Appendix E.

4.7.6 Topsoil

CQA personnel monitored the removal of topsoil from the on-site borrow pit. They observed stripping of the borrow area to verify removal of unwanted grass and roots which could grow into the synthetic drainage layer. The first lift of topsoil was placed in a minimum lift of 12-inches to ensure protection of the geomembrane system. A minimum of 18-inches of clean topsoil was placed over the drainage layers and synthetic liner systems. An elevation survey was performed by DIMCO to document the finished topsoil elevations. Comparison of the surveys before and after placement of the topsoil allowed calculation of the thickness of the topsoil. A calculated minimum of 18-inches of topsoil was placed on the cover system. The results of the survey and the thickness calculations are presented in Figures 12 and 13, respectively. The topsoil was placed from October 30, 1991 through November 25, 1991.

CQA personnel monitored the placement of rip rap at the base of the topsoil cover. The gradation tests for the rip rap are included in Appendix E. Photo no. 24 in Appendix J shows placement of the rip rap.

4.7.7 Erosion Protection Material

CQA personnel documented the proper placement of the erosion protection material on the area south of the SWCA. Excelsior blanket was used in lieu of Enkamat as specified in the construction specifications. Manufacturer's data for the erosion protection material are in Appendix E. Photo No. 23 in Appendix J shows deployment of the erosion protection material.

4.7.8 Perimeter Drainage Ditch

CQA personnel documented construction of the perimeter ditch adjacent to the SWCA and also documented the dimensions and slopes of the perimeter ditch. A variance from the specifications authorized the placement of geotextile fabric (Mirafi 140 NL) prior to rip-rap placement as a measure to minimize erosion of the ditch soils. This change was approved by the project engineer and documented by CQA personnel. The CQA personnel received gradation, test results for the rip-rap from the contractor and verified that the rip-rap conformed to the specifications. The perimeter drainage ditch was constructed from November 25, 1991 through December 15, 1991.

Mill certificates for the fabric and results of rip-rap tests are included in Appendices E and B, respectively.

4.8 Impoundment Retrofit Area

Construction of the impoundment retrofit included CQA of the following which are listed in the order of construction:

- Foundation and dike preparation
- Slope drainage system
- Structural fill
- Gas relief systems
- Groundwater removal systems
- Synthetic liner systems
- Leakage detection/removal systems
- Leakage detection/removal system sump.

4.8.1 Foundation and Dike Preparation

CQA personnel monitored the construction of the foundations and dikes for Impoundments A, B, and C. The underlying soils were of a high moisture content and were thus unsuitable as a structural base for the synthetic liner systems for Impoundments A, B, and C. The foundation soils were mixed to a depth of 3 feet using approximately 17 percent lime kiln dust. During preparation of the impoundment foundations and dikes, CQA personnel monitored placement and checked compaction and moisture content with a nuclear density device. Compaction was monitored to document greater than 90 percent of the standard Proctor density. Appendices B and C present geotechnical test results and nuclear density test results obtained during preparation of the impoundment foundations and dikes. The results of the nuclear density tests are summarized in Table 1. See Figures 1 and 2 for locations and cross sections of the dikes. See construction Photos nos. 3 and 4 in Appendix J for typical construction of the dikes.

A design modification from the drawings authorized relocating the exterior dikes of Impoundments B and C in order to take advantage of the existing exterior vegetation and slopes. The design change is included in Appendix H.

4.8.2 Slope Drainage System

During construction of the Impoundment A dikes, groundwater seepage problems were encountered at the north slope of the impoundment. The dike design was modified to construct a slope drainage system consisting of 1-foot of washed gravel placed on the north slope, with a collection trench at the toe of the slope. The slope drain collection trench extends along the toe of the west slope to intercept any water from the upgradient area located west of Impoundment A. The intercepted water is collected in two 4-inch HDPE slotted pipes placed in the collection trench. Riser pipes and a diaphragm pump with a capacity of up to 8 gallons per minute were installed to remove the groundwater intercepted at Impoundment A. The groundwater is pumped to the Calgon Treatment Units for treatment. The design modification report is included in Appendix H. Figure 8 details construction of the slope drainage system.

4.8.3 Structural Fill

CQA personnel monitored the placement of the solidified bottom soil used for construction of the dikes for Impoundments B and C. About 90 percent of the fill for these dikes was soft unstable soils which existed below the impoundment sediment level. The soils were solidified with about 17 percent lime kiln dust and recompacted. The remaining 10 percent of soils were imported from the onsite borrow pit. Compaction of the dikes to greater than 90 percent of standard Proctor density was verified by field nuclear density testing.

Nuclear density test results are included in Appendix C and summarized in Table 1.

4.8.4 Gas Relief System

CQA personnel collected and reviewed the manufacturer's data for the geofabric and geonet materials to verify compliance with the specifications. The subgrade of each impoundment was visually inspected prior to placement of the geosynthetic gas venting systems. CQA personnel monitored and documented installation and tying of the geonet and geofabrics. They also monitored and documented the proper installation of the gas vent pipes. Protective guard posts were not constructed around the gas vent riser pipes because no fill was placed over the liner in these areas and the vents were not in a traffic area.

Mill certificates for the geofabric and geonet materials are included in Appendix E.

4.8.5 Groundwater Removal Systems

Prior to installation of the secondary liner systems in Impoundments B and C, Cedar elected to install a sump directly under the lowest point of the leak detection/removal system of each impoundment to allow for collection of groundwater. A design modification was prepared to authorize the modification. The sumps were constructed of pea gravel wrapped in geotextile fabric, with a 1-inch PVC suction line and a diaphragm pump capable of removing the up to 30 gallons of groundwater accumulating each day. The groundwater removal system is tied directly into the gas venting system to take advantage of the drainage properties of the latter system. The groundwater removal systems were installed in Impoundment C and Impoundment B on June 11, 1991 and June 12, 1991, respectively. See the post construction drawing on Detail 11 of Figure 7 for details of construction. The same type of system was subsequently installed under Impoundment A on October 1, 1991. Construction Photo No. 12 in Appendix J shows construction at the Impoundment A groundwater removal piping.

4.8.6 Synthetic Liner System

The impoundment synthetic liner systems, consist of a gas collection venting system, a 60-mil secondary liner, a leakage detection/removal system and a 60-mil primary liner. CQA personnel collected and reviewed the manufacturer's data for the synthetic liner materials (60-mil HDPE sheeting), to verify compliance with the specifications. The subgrade was visually inspected prior to installation of the gas relief systems in each impoundment. CQA personnel monitored the placement, welding and anchoring of the liners. Loess soils were used for backfill of the impoundment anchor trenches as discussed in Section 4.5.4 of this report, for the SWCA bottom liner system for this report. CQA personnel monitored the excavation and backfilling of the anchor trenches and verified proper dimensions and proper anchoring of the liner. They also verified proper connection of the synthetic liner to the Impoundment B and C leak detection/removal system piping, impoundment equalization pipes and influent piping. They visually inspected the entire surface of each layer of synthetic liner material and verified that all necessary repairs had been completed prior to placement of subsequent layers of synthetic materials. CQA personnel monitored the collection of liner seam samples for destructive testing and observed the non-destructive vacuum and air lance testing of the seams. The CQA personnel reviewed the results of destructive tests on samples of field fabricated seams and documented that seams with failing destructive tests were properly repaired and retested in accordance with Gundle's quality assurance specifications.

The Impoundment A liner system was installed from March 20, 1990 through April 5, 1990. Impoundments B and C liner systems were installed from July 2, 1991 through July 27, 1991.

Certification from the contractor that the liner was installed in accordance with manufacturer's recommendations is included in Appendix E.

Mill certificates and destructive test results are included in Appendices E and F, respectively. Table 3 summarizes the results of destructive tests on seam samples. Copies of the contractor's post construction drawing showing panel placement of the Impoundment A and Impoundment B and C secondary and primary liners are presented as Figures 16 and 17, respectively. Photo no. 23 in Appendix J shows the installed liners.

4.8.7 Leakage Detection/Removal System

CQA personnel collected and reviewed the manufacturer's data for the synthetic drainage layer and piping to verify compliance with the specifications. The CQA personnel monitored the installation of the geonet and verified that placement and tying of the materials were in compliance with the specifications.

During a repair of the liner system for Impoundment A, it was determined that the drain pipe for the leakage detection/removal system for Impoundment A had been placed higher than the bottom of the impoundment. The 4-inch and 6-inch drain pipes were abandoned and a 4-inch HDPE pipe placed between the primary and secondary liners. The replacement pipe was laid along the side slope from the collection trench of the leachate detection/removal system to the top of the embankment. A 1-inch PVC suction pipe and a diaphragm pump provide for removal of the leakage to the impoundment. See Detail 11 in Figure 7 for details of construction of the Impoundment A leachate detection/removal system.

Mill certificates for the geonet are included in Appendix E.

4.8.8 Leakage Detection/Removal System Sump

CQA personnel monitored the installation of the impoundment sump located at the juncture of the impoundment dikes. A design modification from the drawings and design specifications authorized the use of a 60-inch internal diameter reinforced concrete pipe sump. Installation problems were encountered as a result of soft foundation soils. A redesigned foundation was constructed which would support the sump on the soft soils. The CQA personnel monitored the proper placement of the reinforcement steel and concrete for the foundation and placement of the 18-inch riser pipe into the foundation concrete. See Detail 4 of Figure 5 for post construction details. CQA personnel inspected the piping for proper size, strength and material type. They also collected manufacturer's certifications that the materials used conformed to specifications. The CQA personnel verified proper connection between the sump and the drain pipes from Impoundment B and C. The Impoundments B and C 4-and 6-inch piping are connected to the leak detection/removal system trench of each impoundment by a boot through the secondary liner. The piping from each impoundment are connected and allow water to flow to the common impoundment sump. The impoundment system leakage detection/removal system sump was placed from October 23, 1989 through November 2, 1989.

Mill certificates for the HDPE piping are included in Appendix E.

4.10 Revegetation and Reclamation

CQA personnel documented the placement of topsoil on areas of the closure site to include eroded and on areas disturbed by construction. Areas adjacent to the SWCA and impoundments were graded to control run-on to the site. The CQA personnel verified proper revegetation of the closure area upon completion of construction. Erosion protection material was placed on the area south of the SWCA in order to control erosion on these steeper slopes. See Photo no. 23 in Appendix J for placement of the erosion protection material.

5.0 Current Status of Construction

5.1 SWCA

Construction of the SWCA is substantially complete with all waste placed and the cap constructed. Subsequent to placement of the topsoil, rains have caused erosion of the topsoil cover, with the north slope being the most affected. Plans call for the eroded areas to be filled and revegetated, as weather permits.

The SWCA leachate collection system is collecting leachate from the SWCA waste at a current rate of less than 50 milliliters per minute. The collection rate has been steadily declining since final capping of the SWCA. The leachate collected from the leachate collection system is expected to continue to decline as the SWCA waste is drained of water collected during construction.

The SWCA leakage detection system is currently detecting a leak rate of 250 milliliters per minute. Based on the difference in analysis of water samples collected by Cedar from the leachate collection system and the leakage detection system, it appears that the SWCA primary bottom liner is intact. Therefore, it is believed that the leakage is through the secondary liner and that groundwater is being collected in the leak detection system.

5.2 Impoundments

All impoundments have been in service since their construction. However, leaking has been experienced in all impoundment liner systems.

Impoundment A underwent substantial repairs between February 20, 1992 and March 14, 1992. The repairs consisted of opening and laying back the primary liner, and conducting hydrostatic and electronic leak tests of the bottom of the secondary liner and vacuum box testing of the secondary liner seams along the impoundment side slopes. All detected leaks were repaired by capping the leaks with 60-mil HDPE liner material. Following the reinstallation of the primary liner using the same CQAP as the original construction, additional hydrostatic and electronic leak testing of the bottom of the primary liner was conducted and vacuum box testing was performed on the liner seams along the impoundment slopes. All detected leaks were repaired by capping the leaks with 60-mil HDPE liner material. The volume of water recovered in the leakage detection system decreased from an initial 1000 milliliters per minute (immediately after the repair), to 4 milliliters per minute within a short period. During this time, groundwater was being removed from below the liner system. This may attribute to the decrease in flow from within the leak detection system. Later, as groundwater was allowed to accumulate below the secondary liner, the leak rate increased to 110 milliliters per minute. The leak response to groundwater pumping has been consistent in several tests to determine the leakage source. Based on water sample analyses and the behavior of the leak rate with respect to the groundwater levels, it appears that the leakage is still occurring through the secondary liner.

The leakage detection/removal system for Impoundment B is indicating a leak rate of 150 to 200 milliliters per minute when the groundwater is allowed to accumulate below the secondary liner. As groundwater is removed, the leak rate slows to 0.7 milliliters per minute. Water sample analyses and the behavior of the leak with respect to the groundwater levels appear to indicate that the 150 to 200 milliliter per minute leak is through the secondary liner and that the 0.7 milliliter per minute leak is through the primary liner.

The leak detection/removal system for Impoundment C is indicating a leak rate of 100 milliliters per minute when the groundwater is allowed to accumulate below the secondary liner. As the groundwater is removed, no leakage is detected in the leak detection system. Water sample analyses and the behavior of the leak with respect to the groundwater levels appear to indicate that the leak is through the secondary liner.

TABLES

Table 1

Closure/Retrofit of Surface Impoundment System Summary of Field Nuclear Density Tests Construction Status Report Cedar Chemical Company Vicksburg, Mississippi

Location	Minimum % Proctor Specified	Total No. of Tests Performed	No. of Passing Tests	No. of Failed Tests Reworked	Avg. % Proctor of Passing Tests	Standard Deviation of Passing Tests	Maximum % Proctor	Minimum % Proctor
SWCA Waste Placement	95	108	100	8	99.9	3.08%	108.0	95.0
SWCA Clay Cap	90	68	48	20	93.8	2.42%	99.3	90.0
Impoundment B Dikes	90	57	54	3	94.7	2.05%	98.6	90.1
Impoundment B Foundation	90	12	12	0	92.9	1.83%	95.6	90.1
Impoundment C Dikes	90	22	21	1	94.4	2.57%	101.6	90.8
Impoundment C Foundation	90	2	2	0	91.8	0.55%	92.3	91.2
Imp. A/Imp. C Eq. Pipe	90	3	3	0	93.9	0.58%	94.9	93.1
Imp. B/Imp. C Eq. Pipe	90	6	4	2	95.1	1.27%	96.0	92.9
Imp. A/Imp. B Eq. Pipe	90	5	5	0	96.3	0.78%	97.5	95.1
Imp. C Influent Pipe	90	4	4	0	95.1	0.98%	96.7	94.3

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				Standard Proctor Test[a] ASTM D698 - Method A		Atterberg Limits ASTM D4318			Wet Sieve Analysis ASTM D422	Unconfined Compression Test ASTM D2166		Falling Head Test EPA 9100[c]
Date	Sample No.	Sample Type	Material Description	Max. Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Liquid Limit (LL)	Plasticity Index (PI)	USCS Classification ASTM D2487[b]	%-No. 200	Unconfined Strength (tsf)	Undrained Shear Strength (tsf)	Permeability (cm/sec)
4/27/89	A	Borrow Area Structural Fill	Tan Silty Loess	104.4	17.8	30	7	ML	--	--	--	--
4/27/89	B	Millers Pit Hwy. 80	Brown Clay	100.9	21.9	49	31	CL	99.9	--	--	--
5/31/89	C	E. Side SWCA Bottom	Brown Silty Clay	105.1	14.0	35	11	CL	--	--	--	--
5/31/89	D	W. Side SWCA Bottom	Brown Silty Clay	102.4	17.8	37	14	CL	--	--	--	--
3/7/90	1 and 2	--	Gray Clayey Silt With 15% Lime	--	--	34	29	CL	--	1.89/1.93	0.94/0.97	--
10/29/90	P5273	Solidified Sediment Pond C	--	68.7	47.8	--	--	--	--	--	--	--
10/29/90	P5274	Solidified Sediment Pond B	--	92.2	27.0	--	--	--	--	--	--	--
11/6/90	P5275	Solidified Sediment Pond C	Sludge	81.7	33.6	--	--	--	--	--	--	--
11/20/90	P5278	On Site Material	Brown Silty Clay with Lime	77.4	37.3	56	44	CH	--	--	--	--
1/30/91	P5276	Pond C Bottom	--	--	--	--	--	--	--	--	0.30	--
3/13/91	P5280	Solidified Bottom Soils, Pond B	--	89.3	27.4	--	--	--	--	--	--	--
3/13/91	P5281	Solidified Bottom Soils, Pond C	--	88.3	29.6	--	--	--	--	--	--	--
3/22/91	P5282	Borrow Soils for *Dike Construction*	--	106.5	17.9	--	--	--	99.5	--	--	--
7/12/91	P5293	On Site Material	Brown Silt with Chemicals	82.7	32.3	50	13	MH	--	--	--	--
8/5/91	P5308	40 Material from #60 Limestone	Clay	--	--	22	4	ML	--	--	--	--
9/3/91	P5309	Clay Liner Borrow Material	Clay	97.7	20.5	69	41	CH	--	--	2.28	0.957 X 10-8
9/3/91	P5310	Clay Liner Borrow Material	Clay	98.0	22.9	54	30	CH	--	--	1.45	0.687 X 10-8
9/3/91	P5311	Clay Liner Borrow Material	Clay	96.1	22.9	63	37	CH	--	--	--	0.787 X 10-8
10/30/91	P5312	SWCA Clay Cap 1st 6" Lift	Clay	--	--	--	--	--	--	--	--	0.119 X 10-7

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				Standard Proctor Test[a] ASTM D698 - Method A		Atterberg Limits ASTM D4318			Wet Sieve Analysis ASTM D422	Unconfined Compression Test ASTM D2166		Falling Head Test EPA 9100[c]
Date	Sample No.	Sample Type	Material Description	Max. Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Liquid Limit (LL)	Plasticity Index (PI)	USCS Classification ASTM D2487[b]	%-No. 200	Unconfined Strength (tsf)	Undrained Shear Strength (tsf)	Permeability (cm/sec)
10/30/91	P5313	SWCA Clay Cap 1st 6" Lift	Clay	--	--	--	--	--	--	--	--	0.133 X 10-7
10/30/91	P5314	SWCA Clay Cap 1st 6" Lift	Clay	--	--	--	--	--	--	--	--	0.564 X 10-8
10/30/91	P5317	SWCA Clay Cap 1st 6" Lift	Clay	--	--	--	--	--	--	--	--	0.560 X 10-8
10/30/91	P5318	SWCA Clay Cap 1st 6" Lift	Clay	--	--	--	--	--	--	--	--	0.252 X 10-8
10/30/91	P5319	SWCA Clay Cap 2nd 6" Lift	Clay	--	--	--	--	--	--	--	--	0.446 X 10-8
10/30/91	P5320	SWCA Clay Cap 2nd 6" Lift	Clay	--	--	--	--	--	--	--	--	0.592 X 10-8
10/30/91	P5321	SWCA Clay Cap 2nd 6" Lift	Clay	--	--	--	--	--	--	--	--	0.439 X 10-8
10/30/91	P5322	SWCA Clay Cap 2nd 6" Lift	Clay	--	--	--	--	--	--	--	--	0.857 X 10-8
10/30/91	P5323	SWCA Clay Cap 2nd 6" Lift	Clay	--	--	--	--	--	--	--	--	0.689 X 10-8
10/25/91	P5316	SWCA Clay Cap	Gray Clay	--	--	66	49	CH	--	--	--	--
10/25/91	P5315	SWCA Clay Cap	Gray Clay	--	--	63	46	CH	--	--	--	--
11/5/91	P5329	SWCA Cap 1st Lift	--	--	--	--	--	--	--	2.63	1.32	--
11/5/91	P5330	SWCA Cap 2nd Lift	--	--	--	--	--	--	--	2.01	1.00	--
11/5/91	P5331	SCWA Cap 1st Lift	--	--	--	--	--	--	--	2.60	1.30	--
11/5/91	P5332	SWCA Cap 2nd Lift	--	--	--	--	--	--	--	2.22	1.11	--

[a]American Standards for Testing and Materials
[b]Unified Soil Classification System
[c]Environmental Protection Agency

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Date	Sample No.	Field No.	Weld Type	Seam No.	Location	Pass/Fail	Laboratory	Comments
8/29/89	--	DS-1	Ext.	13/14	SWCA Secondary	Pass	Gundle	
8/29/89	--	DS-2	Ext.	17/18	SWCA Secondary	Pass	Gundle	
8/29/89	--	DS-3	Ext.	8/9	SWCA Secondary	Pass	Gundle	
8/29/89	--	DS-4	Ext.	5/6	SWCA Secondary	Pass	Gundle	
8/29/89	--	DS-5	Ext.	36/37	SWCA Secondary	Pass	Gundle	
9/8/89	--	DS-6	Ext.	2/3	SWCA Secondary	Pass	Gundle	
9/8/89	--	1	Ext.	33/34	SWCA Primary	Pass	Gundle	
9/8/89	--	10	Ext.	20/21	SWCA Primary	Pass	Gundle	
9/8/89	--	11	Ext.	29/20	SWCA Primary	Pass	Gundle	
9/8/89	--	12	Ext.	12/13	SWCA Primary	Pass	Gundle	
9/8/89	--	13	Ext.	10/11	SWCA Primary	Pass	Gundle	
9/8/89	--	8	Ext.	29/30	SWCA Primary	Pass	Gundle	
9/8/89	--	9	Ext.	25/26	SWCA Primary	Pass	Gundle	
3/28/90	--	DS-1	Ext.	10	Impoundment A Secondary	Fail	Gundle	Retested DS-1-W and DS-1-E
3/28/90	--	DS-2	Ext.	2	Impoundment A Secondary	Pass	Gundle	

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Date	Sample No.	Field No.	Weld Type	Seam No.	Location	Pass/Fail	Laboratory	Comments
3/28/90	--	DS-3	Ext.	10	Impoundment A Secondary	Pass	Gundle	
3/28/90	--	DS-4	Ext.	14	Impoundment A Secondary	Pass	Gundle	
4/3/90	--	DS-5	Ext.	28	Impoundment A Secondary	Pass	Gundle	
4/3/90	--	DS-1-W	Ext.	10	Impoundment A Secondary	Pass	Gundle	
4/3/90	--	DS-1-E	Ext.	10	Impoundment A Secondary	Pass	Gundle	
4/6/90	--	1P	Extr.	6	Impoundment A Primary	Pass	Gundle	
4/6/90	--	2P	Extr.	15	Impoundment A Primary	Pass	Gundle	
4/6/90	--	3P	Extr.	15	Impoundment A Primary	Pass	Gundle	
4/6/90	--	4P	Extr.	21	Impoundment A Primary	Pass	Gundle	
4/6/90	--	5P	Extr.	29	Impoundment A Primary	Pass	Gundle	
8/31/90	A4758	DS-R3	Extr.	--	Impoundment A Repair	Pass	ENCOR	
8/31/90	A4759	DS-R1	Extr.	--	Impoundment A Repair	Pass	ENCOR	
8/31/90	A4761	DS-R2	Extr.	--	Impoundment A Repair	Pass	ENCOR	
8/31/90	A4762	DS-R4	Extr.	--	Impoundment A Repair	Pass	ENCOR	
9/5/90	P4184	DS-R5	Extr.	--	Impoundment A Repair	Pass	ENCOR	
6/27/91	P5283	DS-01	Fus.	10/11	SWCA Expansion	Pass	ENCOR	
6/27/91	P5284	DS-02	Fus.	21/22	SWCA Expansion	Pass	ENCOR	

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Date	Sample No.	Field No.	Weld Type	Seam No.	Location	Pass/Fail	Laboratory	Comments
6/27/91	P5285	DS-03	Fus.	31/32	SWCA Expansion	Pass	ENCOR	
7/8/91	P5286	DS-03B	Ext.	21/SWCA	SWCA Expansion	Fail	ENCOR	Retested P5302
7/8/91	P5287	DS-04	Fus.	8/9	Impoundment B Secondary	Pass	ENCOR	
7/8/91	P5288	DS-05A	Ext.	16/17	Impoundment B Secondary	Pass	ENCOR	
7/8/91	P5289	DS-05B	Fus.	16/17	Impoundment B Secondary	Pass	ENCOR	
7/8/91	P5290	DS-06	Fus.	26/27	Impoundment B Secondary	Pass	ENCOR	
7/8/91	P5291	DS-07	Fus.	39/40	Impoundment B Secondary	Fail	ENCOR	Retested P5303
7/8/91	P5292	DS-08	Fus.	49/50	Impoundment B Secondary	Pass	ENCOR	
7/8/91	P5293	DS-09	Ext.	17/39	Impoundment B Secondary	Pass	ENCOR	
7/18/91	P5295	DS-10	Fus.	6/7	Impoundment C Secondary	Pass	ENCOR	
7/18/91	P5296	DS-11	Fus.	19/20	Impoundment C Secondary	Fail	ENCOR	Retested P5304 & P5305
7/18/91	P5297	DS-12	Fus.	70/71	Impoundment B Primary	Pass	ENCOR	
7/18/91	P5298	DS-13	Fus.	79/80	Impoundment B Primary	Pass	ENCOR	
7/18/91	P5299	DS-14	Fus.	89/91	Impoundment B Primary	Pass	ENCOR	
7/18/91	P5300	DS-15	Fus.	99/100	Impoundment B Primary	Pass	ENCOR	

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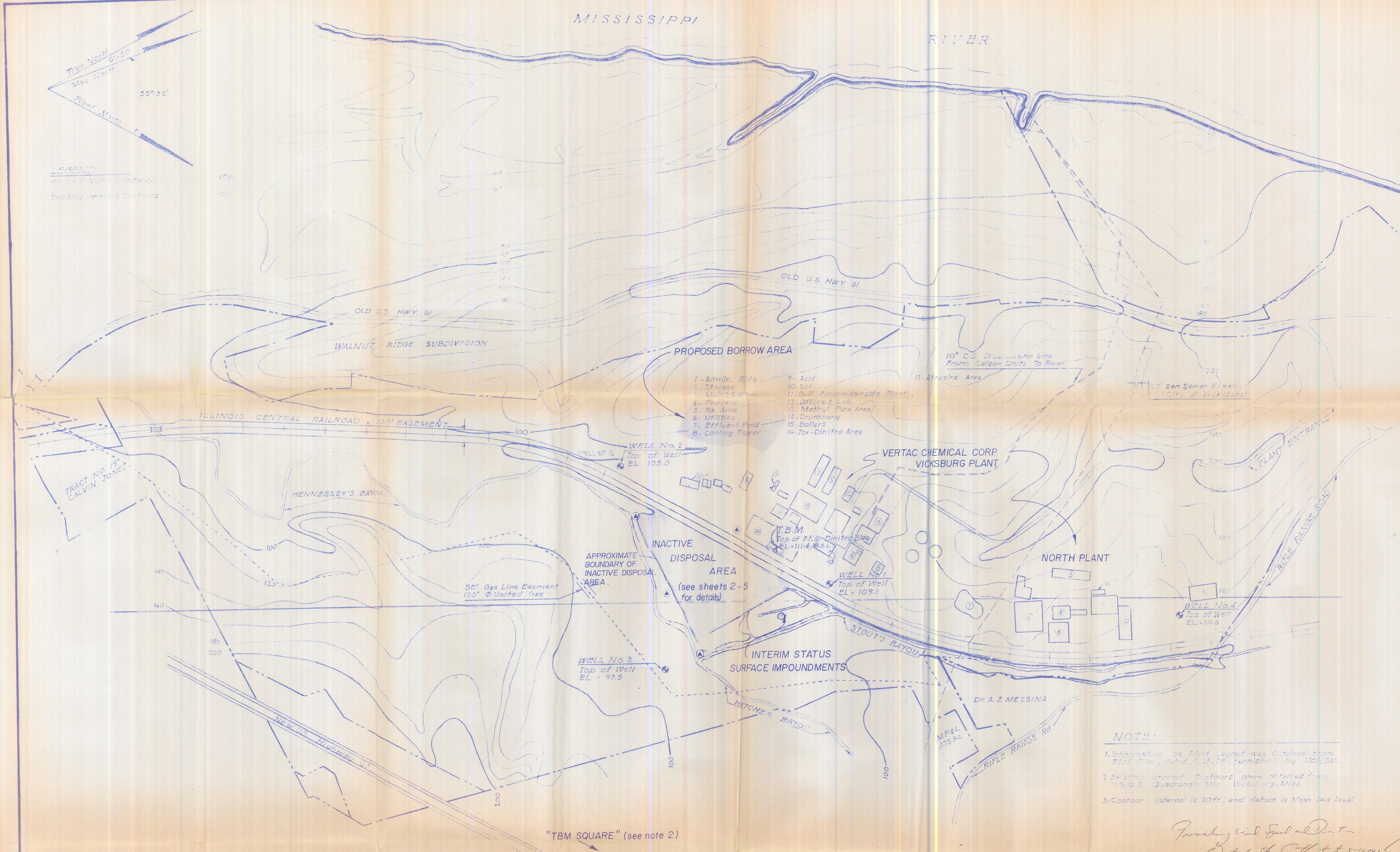
Date	Sample No.	Field No.	Weld Type	Seam No.	Location	Pass/Fail	Laboratory	Comments
7/18/91	P5301	DS-16	Fus.	110/111	Impoundment B Primary	Pass	ENCOR	
7/18/91	P5302	DS-03B Archive	Ext.	21/SWCA	SWCA Expansion	Pass	ENCOR	
7/18/91	P5303	DS-07 Archive	Fus.	38/39	Impoundment B Secondary	Fail	ENCOR	Project Manager OK'd due to Gundle split sample OK.
7/22/91	P5304	DS-11A	Ext.	19/20	Impoundment C Secondary	Pass	ENCOR	
7/22/91	P5305	DS-11B	Ext.	19/20	Impoundment C Secondary	Pass	ENCOR	
7/25/91	P5306	DS-17	Fus.		Impoundment C Primary	Pass	ENCOR	
7/25/91	P5307	DS-18	Fus.		Impoundment C Primary	Pass	ENCOR	
10/22/91	P5324	DS-1	Fus.	4/5	SWCA Cap	Pass	ENCOR	
10/22/91	P5325	DS-2	Fus.	7/8	SWCA Cap	Pass	ENCOR	
10/22/91	P5326	DS-3	Fus.	12/13	SWCA Cap	Pass	ENCOR	
10/22/91	P5327	DS-4	Fus.	16/17	SWCA Cap	Pass	ENCOR	
10/22/91	P5328	DS-5	Fus.	19/20	SWCA Cap	Fail	ENCOR	Retest P5333 & P5334
10/24/91	P5333	DS-5A	Fus.	19/20	SWCA Cap	Fail	ENCOR	Extruded seam to end and vacuum tested.

Table 3 (Page 5 of 5)

Closure/Retrofit of Surface Impoundment System Geosynthetic Testing Destructive Results Construction Status Report Cedar Chemical Company Vicksburg, Mississippi

Date	Sample No.	Field No.	Weld Type	Seam No.	Location	Pass/Fail	Laboratory	Comments
10/24/91	P5334	DS-5B	Fus.	19/20	SWCA Cap	Pass	ENCORe	
10/24/91	P5335	DS-6	Fus.	25/26	SWCA Cap	Pass	ENCOR	
10/24/91	P5336	DS-7	Ext.	Tie-in	SWCA Cap Tie-in	Pass	ENCOR	
10/24/91	P5337	DS-8	Ext.	Tie-in	SWCA Cap Tie-in	Pass	ENCOR	
1/15/91	P5350	DS-1	Ext.	Repair Cap	Impoundment A Repair	Pass	ENCOR	
1/15/91	P5351	DS-2	Ext.	Repair Cap	Impoundment A Repair	Pass	ENCOR	
3/2/92	P5352	DS-1	Fus.	Repair Cap	Impoundment A Repair	Pass	ENCOR	
3/2/92	P5353	DS-2	Fus.	Repair Cap	Impoundment A Repair	Pass	ENCOR	
3/2/92	P5354	DS-3	Fus.	Repair Cap	Impoundment A Repair	Pass	ENCOR	
3/2/92	P5355	DS-4	Fus.	Repair Cap	Impoundment A Repair	Pass	ENCOR	
3/2/92	P5356	DS-5A	Ext.	Repair Cap	Impoundment A Repair	Pass	ENCOR	DS-5 failed field test capped seam to end and vacuum tested.
3/4/92	P5357	DS-6	Ext.	Repair Cap	Impoundment A Repair	Pass	ENCOR	



NOTES:

1.) MAP AND ELEVATIONS PROVIDED BY DISC, MEMPHIS, TN.

2.) CORPS OF ENGINEERS BENCHMARK, LOCATED AT THE INTERSECTION OF NEW U.S. HWY 61 AND HATCHER BAYOU, WAS USED TO ESTABLISH ELEVATIONS FOR TOPOGRAPHIC MAP OF INACTIVE DISPOSAL AREA. SEE SHT. 2 & 3 OF THESE PLANS FOR FURTHER DETAILS.

3.) EXACT LOCATION OF PROPOSED MONITORING WELLS TO BE DETERMINED IN THE FIELD BY REPRESENTATIVES OF VERTAC AND THE MISSISSIPPI BUREAU OF POLLUTION CONTROL.

LEGEND:

PROPOSED MONITORING WELL LOCATIONS ▲

EXISTING MONITORING WELLS

PROPOSED BORROW AREA FOR SOURCE OF SOIL TO BE USED AS COVER MATERIAL

DATE	REVISIONS	BY
	SKETCH (a)(19)(V)	

SITE MAP
VERTAC CHEMICAL CORP.
VICKSBURG, MS.

SCALE: 1" = 300'

PREPARED FOR:
VERTAC CHEMICAL CORPORATION

MCI/CONSULTING ENGINEERS, INC.
NASHVILLE & KNOXVILLE, TENNESSEE

PROJ. 82-529 | DATE 1/24/83 | SHEET ___ OF 4