CHAPTER FIVE

DOCUMENTED AND POTENTIAL DAMAGES FROM MANAGEMENT OF CKD

5.0 INTRODUCTION AND METHODOLOGY

Section 8002(o)(4) of RCRA requires that EPA's study of CKD waste examine "documented cases in which danger to human health or the environment has been proved." In order to address this requirement, EPA defined danger to human health or the environment in the following manner. First, danger to human health includes both acute and chronic effects (e.g., directly observed health effects such as elevated blood lead levels or loss of life) associated with management of CKD waste. Second, danger to the environment includes the following types of impacts:

(1) Significant impairment of natural resources (e.g., contamination of any current or potential source of drinking water, with contaminant concentrations exceeding drinking water and/or aquatic ecologic standards);

(2) Ecological effects resulting in degradation of the structure or function of natural ecosystems and habitats; and

(3) Effects on wildlife resulting in damage to terrestrial or aquatic fauna (e.g., reduction in species' diversity or density, or interference with reproduction).

This approach parallels that used in the previous RCRA §8002 studies prepared by the Agency.[1]

This section describes the approach the Agency has employed to address the §8002(o)(4) requirement, including the "tests of proof" and the methods used to identify potential cases, information on actual damage cases, and verification of the accuracy and completeness of the resulting case studies. In addition, this section provides a discussion of the limitations associated with interpreting the results obtained. Throughout the discussion, cases where damage to the environment has been proved are referred to as damage cases.

"Tests of Proof"

The statutory requirement is that EPA examine proven cases of danger to human health or the environment. Accordingly, EPA developed "tests of proof" to determine if documentation available on a case provides evidence that danger/damage has occurred. (These are the same criteria used in the Report to Congress on Special Wastes from Mineral Processing.) These "tests of proof" consist of three separate tests; a case that satisfies one or more of these tests is considered "prove." The tests are as follows:

- Scientific investigation. Damages are found to exist as part of the findings of a scientific study. Such studies should include both formal investigations supporting litigation or a state enforcement action, and the results of technical tests (such as monitoring of wells). Scientific studies must demonstrate that damages are significant in terms of impacts on human health or the environment. For example, information on contamination of a drinking water aquifer must indicate that contamination levels exceed drinking water standards.[2]

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[1] See, for example, U.S. EPA, 1990. Report to Congress on Special Wastes from Mineral Processing. Office of Solid Waste. July.

[2] We recognize that comparison of drinking water standards and constituent levels in groundwater is not routine. But because of the lack of benchmark standards for constituents in

- Administrative ruling. Damages are found to exist through a formal administrative ruling, such as the conclusions of a site report by a field inspector, or through existence of an enforcement action that cited specific health or environmental damages.

- Court decision. Damages are found to exist through the ruling of a court or through an out-of-court settlement.

Identification of Prospective Damage Cases

EPA identified damage case sites by compiling a list of (1) currently operating cement manufacturing facilities and currently inactive or closed facilities that were active during the last 10 to 20 years based on industry and government sources (e.g., the Portland Cement Association and the U.S. Bureau of Mines); and (2) cement manufacturing facilities investigated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and listed in EPA's CERCLIS data base. Additional facilities were identified during the information collection process described below when state or federal contacts indicated that these facilities should be considered. The initial search resulted in the identification of 127 active and inactive sites as a basis for searching records for documented damages. Some cases, though they did not meet the "tests of proof" were identified as "potential" damage cases because they showed evidence of on-site contamination, but lacked any information regarding whether or not contaminated media migrated off site.

Information Collection

In addition to gathering information from its regional offices, EPA contacted state, other federal, and local agencies to collect information. Telephone contacts were made with agencies in all states in which cement is currently produced. These agencies included state environmental regulatory agencies; state, regional, or local departments of health; and other agencies potentially knowledgeable about damages related to the management of CKD waste. EPA also contacted professional and trade associations, and public interest and citizens groups, seeking additional information and perspective on prospective damage cases.

The Agency then visited four states identified in the initial telephone screening to collect information about specific sites from state and local agency files. These four states (California, Missouri, South Carolina, and New York) account for 23 of the 127 sites investigated for potential documented damages. EPA selected the states to be visited based on (1) the type and extent of site-specific information available in the files (based on contacts with state and local personnel); and (2) the ability of the Agency to combine data collection activities with scheduled CKD sampling visits. Where feasible, information also was collected by mail from state and local agency personnel. EPA did not conduct file searches in all states in which CKD sampling visits occurred because, based on contacts with state and local government personnel, EPA determined that no relevant information was available in the files of some agencies.

During visits to the regulatory agencies in the four states described above EPA reviewed documentation on sites on the list of potential damage cases, and collected documentation on those cases that appeared to meet one or more of the "tests of proof." Follow-up contacts were also made with relevant agencies, groups, and individuals based upon initial information review.

Damage Case Preparation and Review

Following completion of the data collection efforts, EPA prepared detailed damage case study notes of the information obtained for documented damage case sites. These notes provide the basis for the discussions of damage case findings for CKD waste management that are covered in this report. The detailed damage case notes are available in the RCRA docket.

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leachate, we believe it is a useful comparison.

Limitations of the Damage Cases

The damage case findings that resulted from the process described above must be interpreted with care, for several reasons. First, CKD waste disposal sites are often co-located with limestone mining operations (e.g., active and exhausted quarries) that may also be used for storage of other cement manufacturing feedstocks (e.g., petroleum coke). Similarly, and more importantly, CKD waste is or has been co-managed with other wastes such as refractory brick at many sites. In such cases, it is often difficult to determine if the documented damages were caused by management of CKD waste, or if the stored raw material or co-managed waste may have caused or contributed to the observed damage. The sites included in this report are those for which available data indicate that the documented damages are attributable, in whole or in large part, to the management of CKD waste.

Second, the extent to which the findings can be used to draw conclusions concerning the relative performance of waste management practices among states is limited by variations in requirements and recordkeeping. For example, recordkeeping varies significantly among states. Some states have up-to-date central enforcement or monitoring records on cement manufacturing facilities within the state. Where states have such records, information on damages may be readily available.

More often, enforcement and monitoring records are incomplete and/or distributed throughout regional offices within the state. Data collection efforts generally were focused on the central office of the appropriate state agencies. In some instances, information may have been available at a state regional office that was not available in the central office.

The third reason for caution is that, because CKD waste is not regulated under Subtitle C of RCRA, many states do not specifically regulate the management of CKD at cement manufacturing facilities. As a result, monitoring and, thus, detection of problems at cement manufacturing facilities has occurred on a very limited basis, if at all, in some states. Therefore, while damages may have occurred in states that do not have an environmental monitoring or regulatory program specifically for CKD wastes, these damages could not be identified in this study.

Finally, because environmental contamination resulting from waste disposal practices often takes years to become evident, documented examples of danger that have resulted from particular waste disposal practices may reflect conditions that no longer exist. Specifically, processing operations, waste characteristics, and/or waste management practices may have changed. As a result, damage cases associated with CKD waste do not necessarily demonstrate that current CKD waste management practices or regulations affecting CKD waste generation and management are in need of change. Conversely, failure of a site to exhibit documented damages at present does not necessarily suggest that past or current waste management practices have not or will not cause damage. The Agency believes, however, that information on dangers posed by past waste management practices is useful in understanding the potential for environmental and human health impacts when releases to the environment occur.

5.1 OVERVIEW OF FINDINGS, TRENDS, AND CONCLUSIONS

5.1.1 Findings

Using the methodology described above, EPA collected information regarding damages to human health and the environment at 115 cement plants that were active in the United States in 1990. EPA also investigated the possibility of damages at 12 additional sites, including abandoned (inactive) cement plants and inactive, off-site disposal areas, at which CKD has been disposed within the past 20 years.

Based on its investigation, the Agency compiled the following information concerning the recorded documentation alleging human health and/or environmental damages at these 127 sites:

Exhibit 5-1

Summary of Cases of Documented and Potential Damage to Human Health and/or Environmental

Number of Sites	Documented and Potential Damages
90	No allegations of damages.
15	Alleged damages: documentation insufficient to support a test of proof.
19	Information available to support at least one test of proof for damages. These are cases of documented damage to surface water and/or groundwater and/or air.
3	Information available to indicate that on-site surface water has been impacted, but there is no data to indicate that damaged media has impacted ground water or has migrated off site. These are cases of potential damage.

From its investigation of compliance with environmental regulations and CKD management and disposal practices at these sites, EPA was able to document damages to human health and/or the environment at 19 cement plants in the United States using the tests of proof described above. Three additional sites are classified as cases of potential damage, because there is no substantial evidence the damaged media has migrated off site. Exhibit 5-2 presents a summary of EPA's findings at seven of the sites where there has been documented damage to surface water and/or ground water, including waste management practices at the time the damage occurred, the environmental media impaired, and the chemical constituents of concern in the affected media. They are among the 19 cases of documented damage identified above in Exhibit 5-1. Exhibit 5-3 presents the same information for the two cases of potential damage. The eight documented damages are described in more detail under Documented Ground and Surface Water Damage Case Summaries in Section 5.2 of this chapter. The two documented cases of potential damage are described after description of the eight cases of documented water damage in Section 5.3. Documented damages to air were found at 12 sites and are listed in Exhibit 5-17. Air damages are summarized in this chapter in Section 5.4.

5.1.2 Overall Trends and Conclusions

Damages the Agency has documented are in the form of exceedances of established constituent limits; no direct impacts on human health have been demonstrated during the conduct of this analysis. In cases where damages to surface and ground water from the management of CKD have been documented, there are exceedances of a Federal or State minimum concentration limits (MCLs) for constituents of drinking water, and/or exceedances of aquatic/ecologic MCLs for constituents of surface water. In the air damage cases, damages are exceedances of opacity limits adopted by States in compliance with the Clean Air Act.[3] In all damage cases the available data included no evaluation of or information on potential for actual human exposure to waste constituents. Waste management practices included disposal in unlined units: waste piles, abandoned quarries, or landfills; two of the 19 damage case facilities disposed of CKD in off-site units. These waste management practices are common at many sites across the country.

[3] Opacity is an indirect measurement of the concentration of PM_{10}, the MCL of which is protective of human health. Although a violation of an opacity limit suggests an elevated PM_{10} concentration, it does not necessarily result in an exceedance of the MCL or a human health impact.

At five of the seven sites where documented water damages have occurred, both surface water and ground water have been affected as a direct result of past waste management practices. Typical concerns at these facilities include elevated pH, total dissolved solids, and sulfate above secondary MCLs in ground water and surface water, as well as elevated levels of toxic metals such as arsenic, cadmium, and lead above primary drinking water MCLs.

At the three sites where there are potential water damages, on-site surface waters have been impacted by the disposal of CKD, but there is no significant evidence that these waters have migrated off site. At one of these sites CKD is managed underwater in an inactive quarry.

In addition to the documented damages to both surface water and ground water, EPA identified 21 incidents of air damage at 12 facilities. Notices of Violation (NOVs) were issued for these incidents, with three cases eventually settled through a judicial settlement. Six of these facilities have received more than one NOV. With the exception of two cases associated with the accumulation of fugitive dust, all of the cases were associated with visible emission violations (opacity) related to equipment and process malfunctions associated with the dust management system.

There are several sites with waste management practices similar to those in the documented damage cases that the Agency has investigated under CERCLA. At these sites, the Agency either found no cause for further action under CERCLA, or recommended further action that has not yet occurred. However, further action under CERCLA is based on a ranking system which is weighted towards proximity to human population centers. Therefore, failure to investigate further may overlook the existence of ecologic damage and/or risk to small human populations.

Exhibit 5-2

Summary of Documented Water Damages

Site	Waste Management Practice	Damaged Media	Constituents of Concern (concentrations exceed MCLs)	Other Constituents of Concern (concentrations exceed background levels)
Holnam Incorporated, Mason City, Iowa	CKD formerly disposed in abandoned, unlined quarry partially filled with precipitation and ground water (water table rises into quarry). Currently (1990) recycles 100% of CKD.	Ground Water	elevated pH, TDS, Cl, Mg, SO_4, Cr	elevated Cl, K, Na, phenols
		Surface Water	elevated pH, TDS, Al, Cl, K, SO_4	elevated K, Na
Lehigh Portland Cement, Leeds, Alabama	CKD formerly disposed in unlined waste piles at edge of clay pit/quarry. Currently (1990) recycles 100% of CKD.	Surface Water	elevated pH, TDS	
Lehigh Portland Cement, Mason City, Iowa	CKD currently (1990) disposed in on-site, unlined waste piles at perimeter of abandoned quarry. CKD also formerly disposed in off-site, unlined waste piles at site currently used as Lime Creek Nature Center.	Ground Water	elevated pH, TDS, Al, As, Pb, SO_4	elevated K, Na
		Surface Water	elevated pH, TDS, As	elevated Ca, K, Zn
Portland Cement Company, Salt Lake City, Utah	CKD formerly disposed nearby but in off-site, unlined waste piles with drainage ditch through site and surplus canal adjacent to site. Kiln currently inactive.	Surface Water	elevated pH, As, hexavalent Cr, Pb	elevated Mo
		Ground Water	elevated pH, TDS, As, Cd, F, Pb, SO_4	elevated K, Mo
		Soils		elevated Mo, Pb

Al=aluminum, As=arsenic, Cd=cadmium, Cl=chloride, Cr=chromium, Cu=copper, F=fluoride, Fe=iron, Pb=lead, Mn=manganese, Mo=molybdenum, Ni=nickel, K=potassium, Se=selenium, Na=sodium, SO_4=sulfate, Tl=thallium, TDS=total dissolved solids, Zu=zinc

Exhibit 5-2 (continued)

Summary of Water Damages

Site	Waste Management Practice	Damaged Media	Constituents of Concern (concentrations exceed MCLs)	Other Constituents of Concern (concentrations exceed background levels)
Southdown, Inc., Fairborn, Ohio	CKD formerly disposed in on-site, unlined landfills. CKD currently stored in on-site silos prior to recycling. Excess CKD sold and shipped off site for an unknown purpose.	Surface Water Ground Water	elevated pH, As, Cd, Cr, Fe, Pb, Se elevated pH, As, Cd, Cr, Fe, Ni, Pb, Se	elevated Cu, Zn
National Gypsum Lafarge Corporation Alpena, Michigan	31+ hectares, inactive disposal site. National Gypsum formerly disposed of CKD on the shores of Lake Huron. CKD piled 18 meters above the lake level. On shore there are 9-meter high banks that are actively being undercut by wave action. Pile contains drums, buckets, air pollution control bags, and other debris which are all eroding into the lake.	Surface Water Soils	elevated As, Pb elevated As, Pb, Se, Zn	
Ash Grove Cement West, Inc. Montana City, Montana	Currently (1990) disposes of CKD by landfilling a draw on the east side of the active quarry. Surface run-off during storms flows into holding ponds for sediment removal before discharge into Prickly Pear Creek. Two catastrophic releases of CKD-bearing sludges from holding pond into creek.	Surface Water	elevated TDS	elevated Pb, Tl

Al=aluminum, As=arsenic, Cd=cadmium, Cl=chloride, Cr=chromium, Cu=copper, F=fluoride, Fe=iron, Pb=lead, Mn=manganese, Mo=molybdenum, Ni=nickel, K=potassium, Se=selenium, Na=sodium, SO_4=sulfate, Tl=thallium, TDS=total dissolved solids, Zu=zinc

Exhibit 5-3

Cases of Potential Damage

Site	Waste Management Practice	Damaged Media	Constituents of Concern (concentrations exceed MCLs)
Texas Industries Midlothian, Texas	60% to 80% of CKD collected in ESP currently (1990) disposed in on-site landfill in a depleted quarry area. 20% to 40% used beneficially off site. CKD formerly disposed in unlined waste pile.	Surface Water	elevated pH, As, Cr, Pb
Holnam, Inc. Artesia, Mississippi	Currently (1990) disposes of non-waste derived CKD in water-filled quarry. Waste derived CKD disposed of in open pile with bermed boundaries.	Surface Water (quarry water, process water discharge into quarry)	elevated pH
Markey Machinery Property Seattle, Washington	Approximately 38,000 cubic meters of CKD was disposed off site on a parcel of land within the city limits of Seattle. Site is an old truck park located within 1,200 meters of a State fishery (Duwamish River) and has substantial nearby population.	Surface Water Ground Water Soils	elevated pH, Pb elevated Pb elevated As, Pb

As=arsenic, Cr=chromium, Pb=lead

5.2 DOCUMENTED GROUND AND SURFACE WATER DAMAGE CASE SUMMARIES

As described above, EPA contacted officials at local and state regulatory agencies and at EPA Regional offices in all states in which cement is produced to gather information documenting the environmental performance of waste management practices for CKD. In addition to interviewing these officials, EPA reviewed files obtained either through the mail or during visits to regulatory agencies. Through the above-described case studies, EPA found documented environmental damages of either ground or surface water associated with CKD management at the following seven facilities:

- Holnam Incorporated, Mason City, Iowa;
- Lehigh Portland Cement Company, Leeds, Alabama;
- Lehigh Portland Cement Company, Mason City, Iowa;
- Portland Cement Company, Salt Lake City, Utah; and
- Southwestern Portland Cement (Southdown, Inc.), Fairborn, Ohio.
- National Gypsum Co./Lafarge Corp., Alpena, Michigan
- Ash Grove Cement West, Inc., Montana City, Montana

EPA has also found cases of potential environmental damage at the following three facilities:

- Texas Industries, Inc., Midlothian, Texas
- Holnam, Inc., Artesia, Mississippi
- Markey Machinery Property, Seattle,Washington

Documented damages at these seven facilities are summarized below, followed by a summary of the three cases of potential damage in Section 5.3.

Cases of Documented Damage

5.2.1 Holnam Incorporated, Mason City, Iowa

The Holnam, Inc. facility (formerly Northwestern States Portland Cement Company) occupies 97 hectares (240 acres), and is located in Cerro Gordo County, Iowa adjacent to the northern boundary of a residential development in Mason City. The plant operates one long dry process kiln and manufactures Types I, II, and III Portland cements and masonry cement.[4]

The site is bordered to the west by a railroad right-of-way, to the north by the property line of the Lehigh Portland Cement Company, to the east by Highway 65 and to the south by streets bordering the residential areas of Mason City. Calmus Creek crosses the northwest portion of the property on its way to Winnebago Creek nearly 1 kilometer (0.62 miles) away. To the east and west are rural agricultural areas.

From 1969 to 1985, plant operators landfilled CKD waste into a large inactive quarry located on the western portion of the facility property. Known as West Quarry, the disposal site was originally 61 hectares in area and 12 meters (m) (39 feet) deep.[5] When disposal activities ceased in 1985, 73 percent of available quarry volume was filled with approximately 1.8 million metric tons (2.0 million tons) of kiln dust, and the open volume of the quarry (now known as West Quarry Pond) was reduced to approximately 16 hectares and was filled with approximately

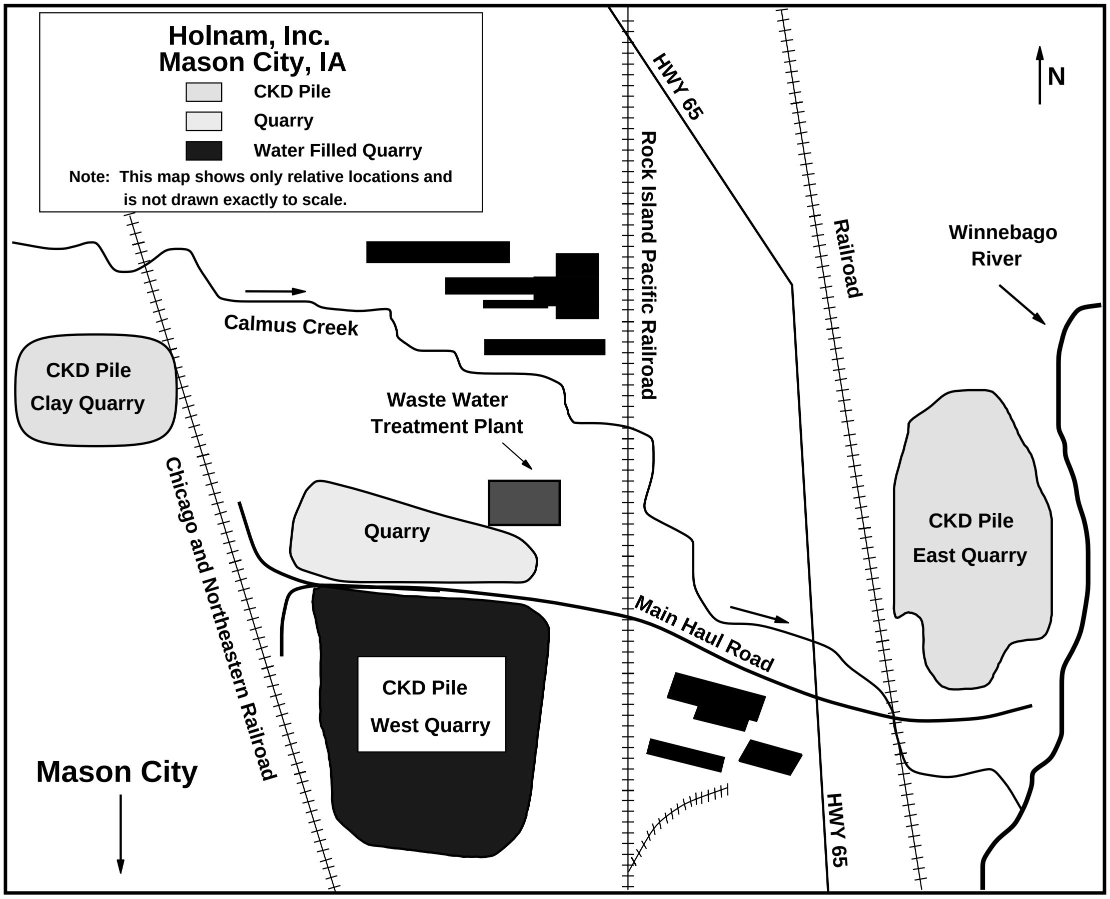
[4] Portland Cement Association, 1991. PCA CKD Survey: Response from Holnam, Inc., Mason City, Iowa.

[5] Northwestern States Portland Cement Company, 1985. *Hydrogeologic Investigation - West Quarry Site, Northwestern States Portland Cement Company, Mason City, Iowa*. Prepared by IT Corporation. July, 1985.

1.59 million kiloliters (420 million gallons) of water.[6] An indeterminate amount of dust also was disposed in East Quarry, located east of Highway 65.[7] No record is available regarding CKD disposal prior to 1969. Exhibit 5-4 provides a diagram of the Holnam site.

Exhibit 5-4

Site Diagram – Holnam Incorporated, Mason City, Iowa



[6] Iowa Department of Natural Resources, 1990. Record of Decision for Northwestern States Portland Cement Company Site, Mason City, Iowa. June, 1990.

[7] Portland Cement Association, 1991. PCA CKD Survey: Response from Holnam, Inc., Mason City, Iowa.

Holnam no longer wastes CKD at its Mason City, Iowa facility. The raw materials in the manufacturing process have been changed so that the kiln dust can be placed back into the product; the dust is 100 percent recycled.

There are two aquifers in the vicinity of the Holnam facility, both of which supply potable water to people living nearby. Mason City municipal wells and the high capacity wells of both Holnam and Lehigh Cement tap sandstones comprising the Jordan aquifer at depths greater than 370 meters. Wells also tap a shallower limestone and dolomite aquifer located within 90 meters of the surface, which supplies the drinking and industrial needs of both facilities. The shallower limestone and dolomite aquifer also supplies the drinking water needs of about 300 residents in a subdivision (Winnebago Heights) located two kilometers north of the site.

Five municipal and five industrial water wells are located within 1.6 kilometers of West Quarry Pond. The municipal wells, located southeast of West Quarry, help supply drinking water to the Mason City public supply system, which serves over 30,000 people. Most residences in the vicinity of Holnam draw water from the municipal water wells. Some of these residences also have shallow private wells used for gardening and other outdoor activities.[8] Of the five industrial wells, two are owned by Holnam and are located on site; two are owned by Lehigh Portland Cement Company, and are located on Lehigh property north of the Holnam facility; and one is owned by the American Crystal Sugar Company, and located to the north within one mile of West Quarry Pond.

In April, 1974, a change in color in the quarry water prompted Northwestern States personnel to initiate a pH monitoring program in the West Quarry. From April 1974 to January 1976, the pH level in the water increased from 8.0 to 8.7. By April, 1976, the pH level had increased sharply to 11.8, and reached 12.8 in late 1980. The Iowa Department of Natural Resources attributed the increase in pH to a collapse of the natural buffering system that was sustaining the quarry water at a near-neutral pH. A quarry dewatering program, initiated in 1987, which reduced the water level in the West Quarry Pond from 12 to 4.6 meters, succeeded in lowering the pH level to 10.6 by 1990.[9]

Also, a report on the water quality of Calmus Creek prepared by the University of Iowa in 1984, describes a blowout, or seep on the northeast side of the West Quarry. Water from this seep, before merging with Calmus Creek, was observed to have a high pH (11.3) and elevated levels of several constituents, including sulfate (1,700 mg/L), sodium (1,280 mg/L), potassium (2,400 mg/L), and phenol (230 µg/L) relative to Calmus Creek (pH: 7.7-8.0, sulfate: 32-44 mg/L, sodium: 4.7-6.6 mg/L, potassium: 2.8-5.0 mg/L, phenol: 2-4 µg/L).[10] Benthic populations of aquatic animals were reported to be non-existent downstream, with very little spawning activity within the affected reach of Calmus Creek. Immediately downstream of the blowout, water in Calmus Creek showed an increase in turbidity (from 20 Natural Turbidity Units (NTUs) to 50 NTUs downstream) and elevated levels of sulfate (65 mg/L) and potassium (47 mg/L) relative to sampling sites upstream of the blowout.[11] In April 1985, the State ordered the facility to cease discharges from the seep area to Calmus Creek. At the same time, the facility was ordered to stop disposal of CKD in the quarry and to conduct a hydrogeologic investigation.[12]

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[8] U.S. Department of Health and Human Services, 1991. *Health Assessment for Northwestern States Portland Cement Company, Mason City, Cerro Gordo County, Iowa*. December, 1991.

[9] *Ibid*.

[10] University of Iowa, 1984. *Calmus Creek Water Quality Study*. Report 85-1.

[11] *Ibid*.

[12] *Ibid*.

In 1985, a hydrologic investigation of the West Quarry site prepared for Northwestern States Portland Cement Company showed waste kiln dust to be the original source of contamination at the site. Reported analyses of waste kiln dust show high levels of magnesium (4,000-5,000 mg/kg), potassium (4,400-13,000 mg/kg), and sulfur (4,100 mg/kg). A 10 percent slurry mixture of water and kiln dust produced a solution with a high pH (11.8-12.4).[13]

The report concluded that water from the West Quarry was also a source of contamination. Samples were characterized by a high pH (>12.0), as well as high concentrations of Total Dissolved Solids (1,800-13,000 mg/L), potassium (430-2,300 mg/L), sodium (48-250 mg/L), chloride (36-130 mg/L), and sulfate 320-3,030 mg/L). Concentrations of chromium (0.06-0.33 mg/L) also exceeded the Federal primary drinking water standard (0.015 mg/L).[14]

The investigation noted that water in the West Quarry is hydrogeologically connected with the surrounding ground water and, as a result, there is potential for migration of the contaminants in the ground water. Water sampled in wells placed between the West Quarry and Calmus Creek showed elevated pH levels (10.3-13.1) that decreased with depth. Also, levels of TDS (6,700-30,000 mg/L), aluminum (1.5-48 mg/L), potassium (1,100-3,900 mg/L), sodium (170-620 mg/L), chloride (71-470 mg/L), and sulfate (160-2,500 mg/L) were generally similar to levels observed in water in the West Quarry. Levels of these constituents in water sampled from background wells were considerably lower (pH: 6.8-7.4, TDS: 900-1,800 mg/L, aluminum: 1.5-4.5 mg/L, potassium: 2.4-3.0 mg/L, sodium: 21-22 mg/L, chloride: 26-65 mg/L, sulfate: 76-380 mg/L).[15]

The facility installed an acid-neutralization system in June 1987, adjacent to Calmus Creek in the northwestern portion of the filled West Quarry. In addition to treating the seep water, the system was used to dewater of the West Quarry Pond. The treated water is discharged to Calmus Creek in accordance with a NPDES permit issued by the Iowa Department of Natural Resources. These actions taken by the facility have eliminated untreated discharges from the West Quarry to Calmus Creek. However, discharge of water from the acid-neutralization facility still poses potential water quality problems in Calmus Creek due to elevated levels of total dissolved solids and phenols.[16]

In May 1985, the facility installed two ground-water extraction wells in the vicinity of the seeps to control the discharge to Calmus Creek. The water that was collected by the wells was circulated back into West Quarry Pond.[17]

The site currently has a series of 16 monitoring wells. Analytical results of ground water discharging to Calmus Creek from sampling conducted in 1988, as part of EPA's Field Investigation Team (FIT) investigation, revealed a pH of 13.1 and sulfate and phenols concentrations of 1,500 mg/L, and 0.16 mg/L, respectively. Both pH and sulfate levels exceed national secondary drinking water standards.

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[13] Northwestern States Portland Cement Company, 1985. *Hydrologic Investigation of the West Quarry Site, Northwestern States Portland Cement Co., Mason City, Iowa*. Prepared by IT Corporation. July.

[14] *Ibid*.

[15] *Ibid*.

[16] Northwestern States Portland Cement Company, 1989. *Remedial Investigation/Feasibility Study on the West Quarry, Mason City, Iowa*. Prepared by Layne Geosciences, Inc. Project No. 61.1099.

[17] *Ibid*.

On August 30, 1990, the Holnam site was listed on the National Priorities List. In its June 1990 Superfund Record of Decision, the Iowa Department of Natural Resources summarized the major concerns at the site as contaminated surface water and ground water. The primary problems have been sharp increases in pH and mineral deposition in on-site ground water and nearby surface water as a result of contact with waste CKD in the West Quarry.[18]

In the June 1990 Record of Decision for this site, the Iowa Department of Natural Resources determined that the selected remedy for the site would include the following actions to control and remediate existing ground-water contamination and to reduce the potential for future contamination of ground water and surface water:

- Dewatering of the West Quarry (completed in September 1989);
- Construction of a permanent drain system in the dewatered West Quarry to collect precipitation run-off and ground-water inflow to the quarry;
- Placement of an engineered clay cap over the area of the West Quarry filled with CKD to minimize infiltration through the kiln dust;
- Installation of bedrock extraction wells to collect contaminated ground water beneath the West Quarry, prevent migration of contaminated ground water from the site, and maintain ground-water levels below the CKD;
- Installation of kiln dust dewatering wells, if necessary; and
- Treatment of contaminated waters to meet Iowa NPDES discharge permit limits for discharge to Calmus Creek.

The initial remedial actions taken at this facility, dewatering of the West Quarry Pond, and neutralization of pond water, have proved to have some positive impact. However, according to the Superfund Record of Decision, additional remedial actions are still necessary to reduce the potential risk of future contamination. These include construction of a permanent drain, placement of a clay cap over the quarry, and installation of bedrock extraction wells.

The disposal of CKD in unlined, abandoned quarries is a common waste management practice utilized at cement plants. Damages at this site resulting from this disposal practice consist of impairment of Calmus Creek from the overland flow of high pH water from West Quarry Pond, and ground-water discharges to the creek. These discharges have elevated the pH of the stream above the State's water quality standard. This damage has been documented in several studies, the most recent being conducted in 1989. On-site ground-water contamination also has been identified at this site. The contaminants of concern include pH, total dissolved solids, potassium, sulfate, and phenols. These constituents have been observed at levels that exceed primary and secondary drinking water standards.

5.2.2 Lehigh Portland Cement Company, Leeds, Alabama

Lehigh Portland Cement Company's Leeds plant is located in Jefferson County, approximately 24 kilometers (km) (15 miles) east of Birmingham, Alabama. The plant has operated a single dry-process kiln at the site since 1976 and manufactures Types I, II, and III Portland cement and masonry cement. In 1990, the facility utilized coal for 96 percent of its fuel

[18] Iowa Department of Natural Resources, 1990. Record of Decision for the Northwestern States Portland Cement Company Site, Mason City, Iowa. June, 1990.

needs, and natural gas for the remaining four percent. The plant currently recycles all of its CKD; there is no land disposal of CKD either on or off site.[19]

The entire plant encompasses 270 hectares (668 acres) and is located within a 100-year floodplain with karst topography and faulted bedrock. The population within a 2 km radius of the plant was 7,000 in 1990, and the nearest residence is 91 meters (m) (300 feet) to the northwest of the plant's boundary. No public or private drinking water wells exist within two kilometers of the plant.[20]

Prior to 1978, the previous owners of the facility, the Atlas Cement Company and U.S. Steel, disposed of an undetermined portion of its waste CKD in two on-site piles. These piles lie within 150 meters of the plant's limestone quarry, which is located to the south of the plant's kiln.[21] Neither the State of Alabama nor Lehigh personnel know the total amount of CKD disposed in the piles, or if any material is co-disposed with the dust. One of these piles is currently seeded with grass.

Both waste CKD piles drain into a sedimentation pond, the water from which is pumped uphill and dispersed as a spray in a grove of pine trees. Run-off from the spray flows downslope away from Moores Creek, the natural drainage channel located south of Lehigh's limestone/clay quarry. Moores Creek receives stormwater run-off from the plant property through five NPDES outfalls.[22] The site layout is shown in Exhibit 5-5.

During the 1980s, the Alabama Department of Environmental Management's (ADEM) Water Division observed two incidents of elevated pH in Moores Creek caused by storm-water run-off from both dust piles and the plant proper. In April 1984, ADEM issued a NOV to Lehigh Portland Cement for violations of the Water Division's regulations.[23] In February 1987, ADEM issued a Notice of

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[19] Portland Cement Association, 1991. PCA CKD Survey: Response from Lehigh Portland Cement Company, Leeds, Alabama.

[20] *Ibid*.

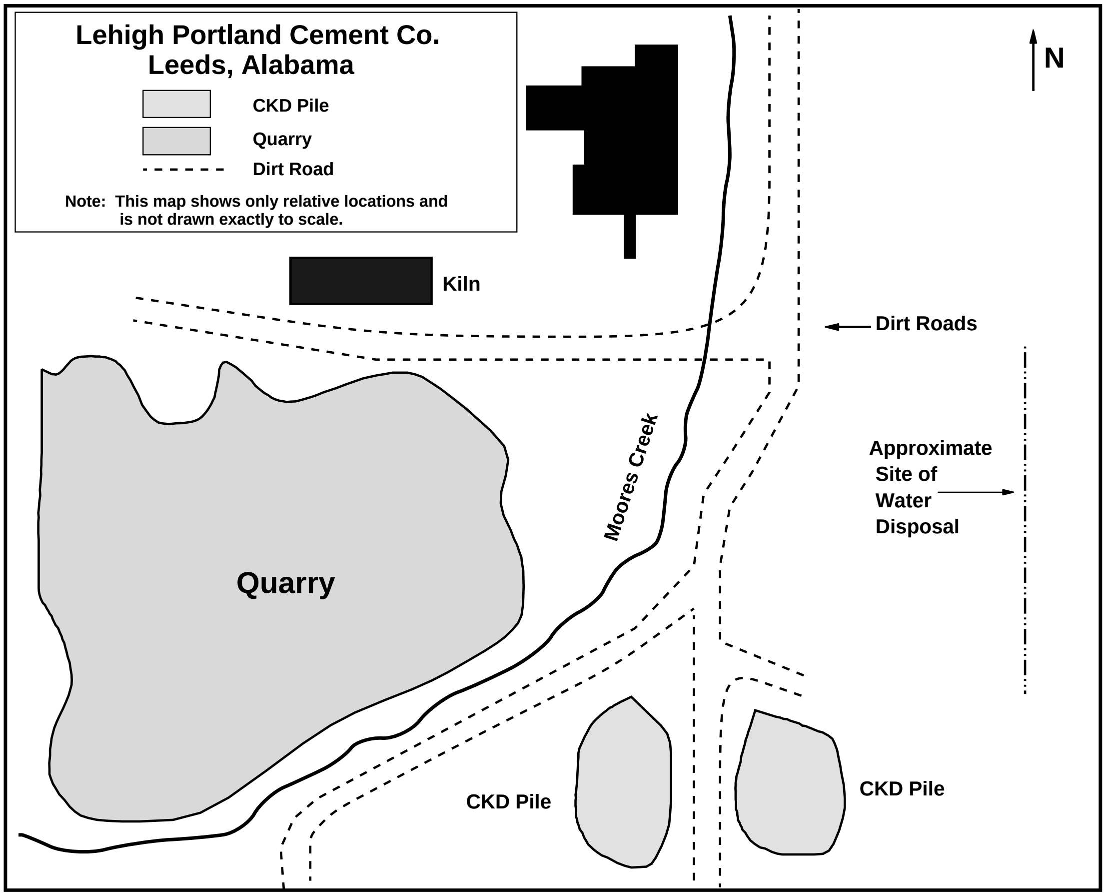
[21] Lehigh Portland Cement Company, 1993. Personal communication with Charlie Klotz, Safety Training, and Environmental Manager, Leeds, Alabama facility.

[22] Lehigh Portland Cement Company, Leeds, Alabama, 1993. Personal communication with Charlie Klotz, *op.cit.*

[23] Alabama Department of Environmental Management, 1984. Letter from H.H. Beiro, Pollution Control Specialist, to M.F. McCarthy, Lehigh Portland Cement Co., Leeds, Alabama. April 19, 1984.

Exhibit 5-5

Site Diagram – Lehigh Portland Cement Company, Leeds, Alabama



Noncompliance for exceedances of limits for pH and total suspended solids (TSS) specified in the facility's NPDES permit during the fourth quarter of 1986.[24]

In the April 1984 NOV to Lehigh, ADEM noted that surface run-off from the facility's waste CKD stockpiles had elevated the pH of Moore's Creek, the receiving stream, from a level of 6.9 upstream of the plant to a level of 9.5 downstream of the plant, constituting a violation of the State's Water Quality Standard for pH in the stream of 8.5. In response, Lehigh Portland collected seven samples in May 1984, at the stream's "low flow" from various points on Moore's Creek (both upstream and downstream of the plant), and at the base of one of the dust piles.[25] Samples collected above and below Outfall #003 (located at the southern end of the limestone/clay quarry) yielded pH levels of 9.12 and 8.84, respectively. Lehigh Portland stated in a letter to ADEM accompanying the sampling results, that "areas of the old, consolidated kiln

[24] Alabama Department of Environmental Management, 1987. Notice of Noncompliance from S. Jenkins to M. McCarthy, Lehigh Portland Cement Company. February 3, 1987.

[25] Lehigh Portland Cement Company, 1984. Letter from R. Gebhardt to H. Beiro, ADEM. May 30, 1984.

dust piles that look like water courses are not; no water runs down them even during very heavy rains"; however, the facility offered no explanation for the elevated pH levels in the stream.[26]

Lehigh Portland initiated several ADEM-approved pollution abatement measures[27] in an attempt to control run-off into Moores Creek. In 1986, Lehigh Portland installed diversion ditches and an unlined sedimentation pond to the south of the clay pit and the dust piles, to allow settling of CKD in run-off from the piles prior to its discharge to Moores Creek through Outfall #006.[28] Lehigh Portland also seeded the dust piles with grass in the summer and fall of 1986 in an effort to control run-off.

Lehigh Portland's Leeds facility was again cited by ADEM in February, 1987, for violations of its NPDES permit.[29] The violations consisted of three exceedances of the pH limit of 9.0 for Outfall 006 during the fourth quarter of 1986 (measured pH: 9.2-10.0), and an exceedance of the daily average total suspended solids limit for the same outfall (25 mg/L) measuring 112.5 mg/L. During the first quarter of 1987, the daily average TSS for Outfall 006 exceeded the permit limit of 25 mg/L for each month (January: 88 mg/L, February: 58 mg/L, March: 51.5 mg/L).[30]

By May 1987, after determining that vegetation alone would not sufficiently control the run-off, Lehigh Portland sealed the discharge pipe from the sedimentation pond to Outfall 006 to prevent further discharge to Moore's Creek.[31] The plant also installed a pump and spray system to recirculate the water from the sedimentation pond away from Moores Creek. An emergency spillway to Moore's Creek was retained in the event of emergency overflow. According to the ADEM's Water Division, no additional violations or noncompliance with permit conditions have been observed, as determined through the Division's review of the plant's Discharge Monitoring Reports (the Division does not regularly inspect or monitor discharges at this facility). In addition, no ground-water contamination below the sedimentation pond has been observed.[32,33]

Damage at this site consists of the impairment of the water quality of Moore's Creek through the discharge of run-off from inactive CKD disposal piles. The discharge elevated the pH of the stream to levels exceeding the State's designated water quality standard for the stream; the discharge also exceeded the discharge limit for pH specified in the facility's NPDES

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[26] *Ibid*.

[27] Alabama Department of Environmental Management, 1985. Letter from Kirk S. Kreamer, ADEM, to A.P. Mahatekar, AmTech Services, Inc., August 21, 1985.

[28] Amtech Services, Inc., 1986. Letter from M. Holder, Professional Engineer, AmTech Services, Inc. to P. Prysey, ADEM. July 24, 1986.

[29] Alabama Department of Environmental Management, 1987. Notice of Noncompliance from S. Jenkins to M.F. McCarthy, Lehigh Portland Cement Co., Leeds, Alabama. February 3, 1987.

[30] Alabama Department of Environmental Management, 1987. DMR Violation Report, 1st Qtr. 1987, for Lehigh Portland Cement Co., Leeds, Alabama.

[31] Lehigh Portland Cement Company, 1987. Letter from L. Copple to S. Jenkins, Alabama Department of Environmental Management. February 20, 1987.

[32] Alabama Department of Environmental Management, 1992. Personal communication with S. Jenkins. January, 1992.

[33] Alabama Department of Environmental Management, 1992. Personal communication with C. McRoy. October, 1992.

permit. This was documented on two separate occasions during the 1980s, a period in which the CKD waste piles were inactive. The initial remedial action taken by Lehigh Portland, vegetating the piles and installing a sedimentation pond to extract CKD from the discharge, proved ineffective as demonstrated by the noncompliance with the NPDES-permitted discharge limits. The final remedial action, eliminating discharge through the outfall, has been effective to date.[34]

5.2.3 Lehigh Portland Cement Company, Mason City, Iowa

The Lehigh Portland Cement Company (LPCC) site, in operation since 1911, is located at 700 25th Street Northwest, on the north side of Mason City, Cerro Gordo County, Iowa. The facility operates one kiln, and manufactures Types I and III Portland cement.[35]

The site covers approximately 61 hectares (150 acres) and is bordered on the south by Calmus Creek (a tributary of the Winnebago River), and on the east by U.S. Highway 65. The facility is located in an urban area and a small residential neighborhood is located approximately 2.4 kilometers (km) (1.5 miles) to the north. The Lime Creek Nature Center (LCNC) is approximately 1.6 km northeast of the site. The plant is located within the 100-year floodplain. The Northwestern States Portland Cement Company site (now owned by Holnam, Inc.) is immediately south of the Lehigh site. Calmus Creek flows between these two sites to the Winnebago River, which is located approximately 450 meters (m) (1,476 feet) north and east of the two facilities.[36]

The LCNC, although separate from the plant area, has been the site of past disposal of CKD by the Lehigh Portland Cement Company. The LCNC covers 247 hectares and is owned by the County of Cerro Gordo and operated as an outdoor recreation area. It was opened to the public in May 1984. Portions of the current LCNC were formerly owned by Lehigh Portland Cement Company. The property was transferred to Cerro Gordo County in 1979.[37]

In 1990, Lehigh Portland, utilizing normal fossil fuels (85 percent coal, 8 percent natural gas, 7 percent coke), generated approximately 171,984 metric tons (189,577 tons) of CKD, of which 162,789 metric tons (95 percent) was recycled and used as raw material in the kiln. An estimated 8,620 metric tons of wasted CKD were landfilled in a clay quarry. This landfill first began receiving CKD waste in 1986.[38]

Prior to disposal in the current landfill, Lehigh Portland deposited CKD in locations throughout facility property, including an exhausted quarry north of the plant (now known as the CKD Reclamation Area), as well as other on-site inactive quarry areas (now partially re-filled with water) located northeast of the plant proper, including Area "C" Pond, Arch Pond, Blue Waters Pond, and West Quarry Pond. Prior to 1979, when Lehigh Portland owned the LCNC property, plant operators also disposed of waste CKD in an abandoned quarry on the west side of the property (now water-filled and known as Quarry Pond), and in a 16 hectare site located along the west bank of the Winnebago River, known as the "Badlands". The actual amount of

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[34] EPA has also promulgated rules that will require control of surface run-off; thus, if implemented, these regulations should prevent similar types of violations in the future.

[35] U.S. Environmental Protection Agency, 1991. Record of Decision: Lehigh Portland Cement, Mason City, Iowa. Prepared by the Office of Emergency and Remedial Response. June, 1991.

[36] *Ibid*.

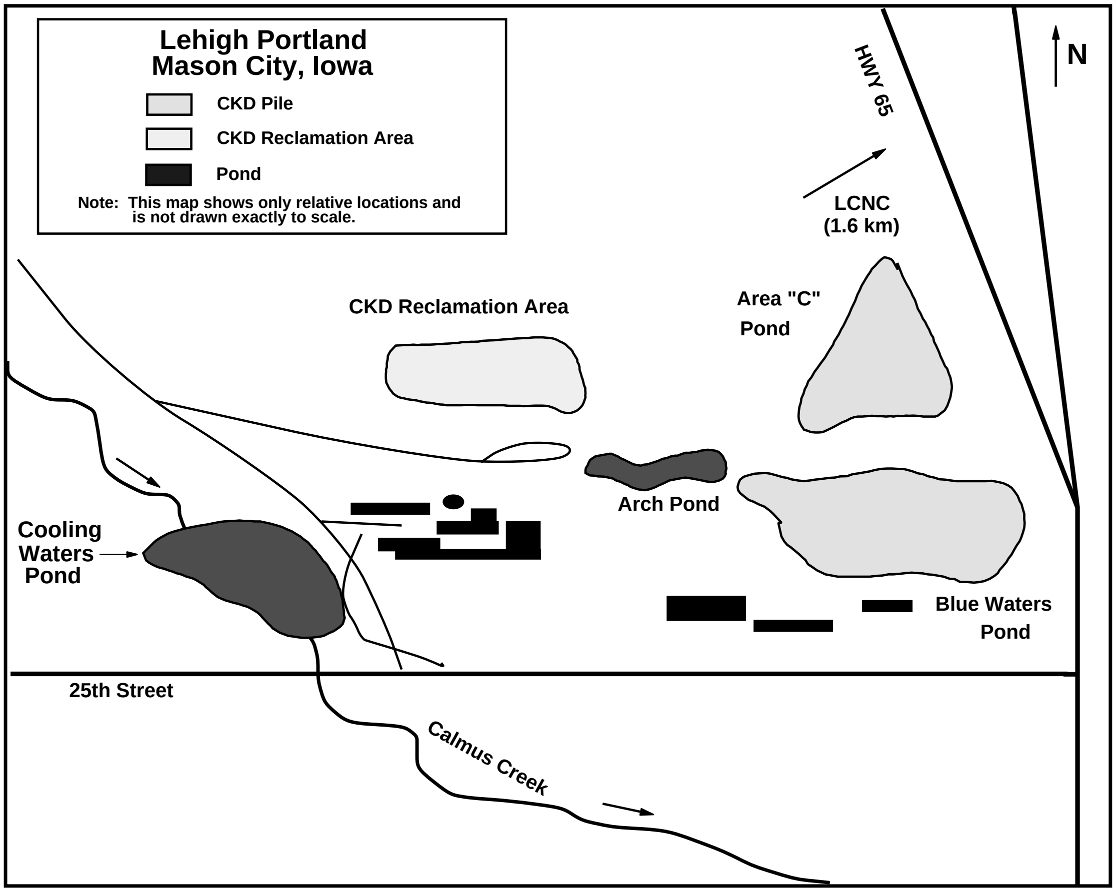
[37] *Ibid*.

[38] Portland Cement Association, 1991. PCA CKD Survey: Response from Lehigh Portland Cement Company, Mason City, Iowa.

CKD disposed of on site may exceed 900,000 metric tons.[39,40] CKD disposal areas and plant operations are shown in Exhibits 5-6 (CPCC site) and 5-7 (LCNC site).

Exhibit 5-6

Site Diagram – Lehigh Portland Cement Company, Mason City, Iowa

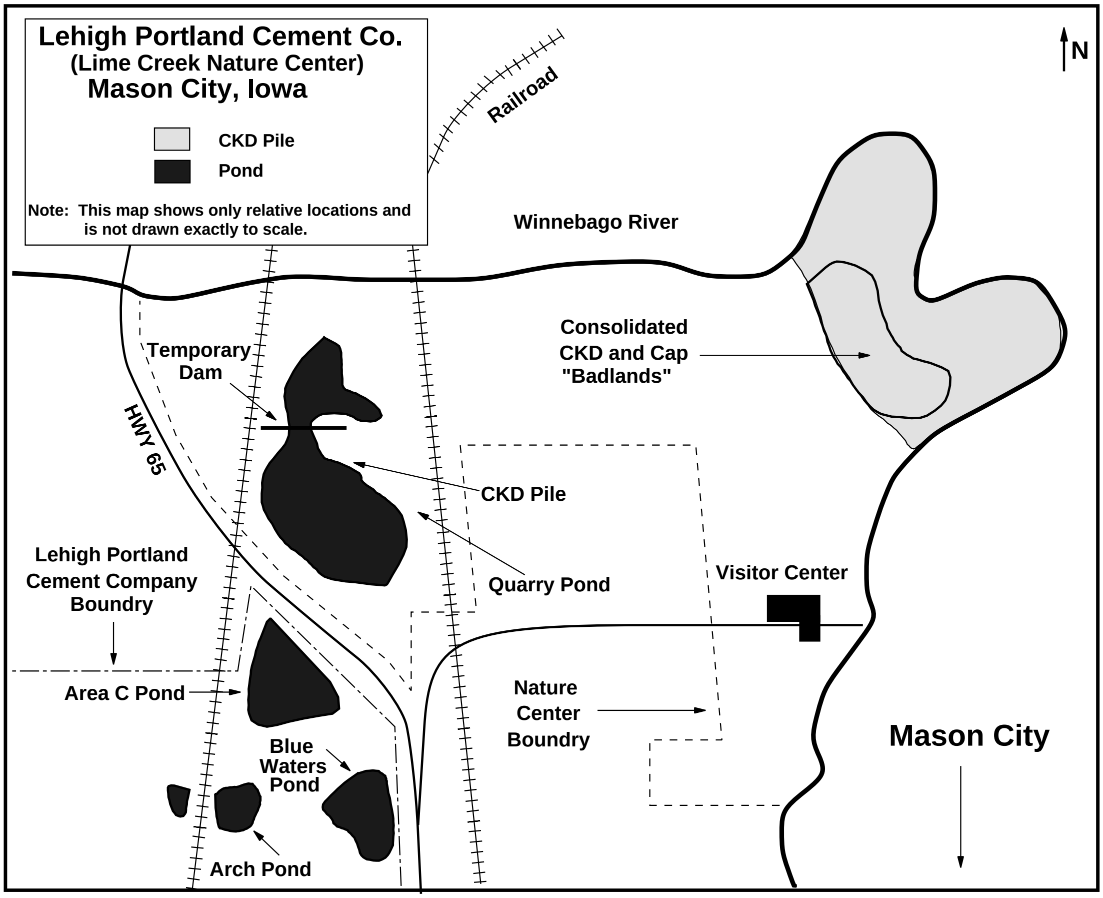


[39] U.S. Environmental Protection Agency, 1988. *Final Report Site Investigation: Lehigh Portland Cement Company, Mason City, Iowa*. Prepared by Ecology and Environment Field Investigation Team for Region VII. March, 1988.

[40] U.S EPA, 1991. Record of Decision: Lehigh Portland Cement, IA. *op.cit.*

Exhibit 5-7

Site Diagram – Lime Creek Nature Center (Lehigh Portland Cement), Mason City, Iowa



The LPCC site was placed on the National Priorities List (NPL) on August 30, 1990. In litigation, Lehigh identified a number of concerns regarding the hazard ranking score. After reviewing the issues regarding the calculation of the score on the hazard ranking system, the Agency decided not to contest Lehigh's challenge to the listing decision. The listing was vacated by mutual consent in October 1992. Removal of that site from the NPL does not affect clean-up at the site.

There are two aquifers in the vicinity of the Lehigh Portland facility, both of which supply potable water to people living nearby. Wells serving the population of Mason City tap a sandstone aquifer greater than 370 meters in depth. Lehigh Portland, as well as the adjacent Holnam facility, utilize a shallower limestone and dolomite aquifer located within 90 meters of the surface. This aquifer supplies the drinking and industrial needs of both facilities. In addition, it supplies the drinking water needs of about 300 residents in a subdivision located north of the site. In 1987, EPA Field Investigation Team (FIT) personnel at Lehigh Portland observed shallow (1-3 meter depth) static water levels in pre-existing on-site ground-water monitoring wells.[41] Quarry floors are below this depth, hence any CKD waste disposed in them was likely deposited directly into the shallow (1-90 meter) aquifer.

[41] U.S. Environmental Protection Agency, 1988. Final Report, Site Investigation, Lehigh Portland Cement, Mason City, Iowa. *op.cit.*

Problems with the site were first identified in 1981 during a routine hydrochemical test of Blue Waters Pond, one of four water-filled abandoned quarries on Lehigh property. The results of the test indicated that the pond water was alkaline (pH: 10.6) and exceeded the State standard (pH: 9.0) for discharge into warm water streams.[42] At this time, Lehigh had installed an overflow control structure at the southeastern corner of Blue Waters Pond. The flow control structure allowed water from the pond to be discharged directly to Calmus Creek to eliminate possible back-flooding of critical equipment.[43]

Lehigh hired an independent consulting firm to determine the source of the high pH waters. Twenty-eight surface water samples from various locations were collected and analyzed. The results of the report identified three potential sources, of which Arch Pond contributed the most significant quantities of high pH water to Blue Waters Pond. As a result, the facility transferred the water from Blue Waters Pond to the Area "C" Pond and retained the water behind two earthen dikes. These dikes have since failed due to high rainfall.[44]

In August 1984, the State of Iowa conducted a Comprehensive Work/Quality Assurance project on Calmus Creek, which is located approximately 300 meters south and downgradient of Blue Waters Pond. This investigation found that surface water contamination was directly related to the Lehigh facility as a result of discharges from the pond into the creek via a tile drain outlet southeast of the plant. The discharged water had a pH of 11.4, and total dissolved solids of 4,700 mg/L, including 2,000 mg/L potassium and 829 mg/L sulfates. The investigation also determined that the Arch Pond immediately west of the Blue Waters Pond could also contribute an unknown quantity of run-off from the western half of the plant to Calmus Creek.[45]

The study concluded that the biological quality of Calmus Creek had deteriorated as a result of effluent discharges from the Lehigh plant and the Holnam facility site located to the south. The study stated that because of the deterioration of the chemical balance in Calmus Creek and the quarry ponds, the number and variety of fish and benthic organisms were found to be substantially reduced downstream of the tile drain. As a result of this study, Lehigh was required to eliminate the discharge into Calmus Creek.[46]

Subsequently, at some unknown time, dikes were constructed to separate Arch Pond, the Area "C" Pond, and Blue Waters Pond, and an aboveground piping system was installed to pump water from Blue Waters Pond into the Area "C" Pond. Lehigh also constructed a lined ditch to channel the surface water run-off collected by the drain system from the adjacent highway back into the tile drain located southeast of Blue Waters Pond. The long-term goal of this effort was to eliminate Blue Waters Pond by backfilling and regrading the area.

An EPA site investigation conducted in April 1987 confirmed that the on-site quarry ponds and shallow ground-water table are contaminated locally and that contaminants have the potential to migrate off site to Calmus Creek and the Winnebago River. Seepage has occurred from the quarry ponds and is contaminating the ground water. The FIT investigation concluded that contamination could occur during high intensity rainfall events, leading to ground-water

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[42] Lehigh Portland Cement, 1989. *Site Investigation Protocol for the Lehigh Portland Cement Company Plant, Mason City, Iowa*. Prepared for Lehigh Portland by Layne GeoSciences, Inc. October, 1989.

[43] *Ibid*.

[44] *Ibid*.

[45] Iowa Department of Water, Air and Waste Management, 1984. *Calmus Creek Water Quality Study, May-August, 1984*.

[46] U.S. EPA, 1991. Record of Decision: Lehigh Portland Cement, IA. *op.cit.*

infiltration and flooding, and that the potential exists for human and biological exposures to the hazards present at the site.[47]

Surface water samples taken from each of the on-site quarry ponds (Blue Waters, Arch and Area "C" ponds), which contain disposed CKD, showed elevated levels of pH, metals, potassium, sodium, and sulfate relative to samples taken from Calmus Creek and the Winnebago River. Levels of total aluminum (0.82-1.8 mg/L), total sodium (28.0-180.0 mg/L), and total potassium (120.0-290.0 mg/L) in samples from the ponds were nearly ten times greater than levels of the same compounds found in samples taken from Calmus Creek (aluminum: 0.15 mg/L, sodium: 7.2 mg/L, potassium: undetected) and the Winnebago River (aluminum: 0.12 mg/L, sodium: 0.92 mg/L, potassium: 0.77 mg/L). Sulfate concentrations in the same ponds ranged from 270 mg/L to 1,160 mg/L and were as much as 34 times background levels in the creek and river (34.0-47.0 mg/L). Except for West Quarry Pond (pH: 8.52), which showed a pH close to levels found in Calmus Creek (pH: 7.84), and the Winnebago River (pH: 8.49), values of pH in pond waters were uniformly high (pH: 11.19-11.23). Arsenic was detected in waters from Arch Pond (0.051 mg/L) at about the same level as the Federal drinking water standard (0.05 mg/L), while lead was detected in the duplicate sample from Blue Waters Pond (0.038 mg/L) at a level 2.5 times the Federal drinking water standard (0.015 mg/L).[48]

The sample from the tile drain outlet into Calmus Creek, which drains Blue Waters Pond, had a pH value close to background (7.90), and had no detectable levels of arsenic or lead. Levels of potassium (19.0 mg/L), sodium (11.0 mg/L), and sulfate (63.5 mg/L), however, were elevated above background levels in Calmus Creek and the Winnebago River.[49]

Three pre-existing water wells, which are used to monitor ground-water flow and chemistry, were sampled during the EPA site investigation. These wells are located between the Area "C" Pond and Blue Waters Pond (MW #2), between the Arch Pond and Blue Waters Pond (MW #3), and hydrologically downgradient from Blue Waters Pond, between the pond and the Winnebago River at the eastern facility boundary (MW-#1). All three wells are less than 20 meters deep (MW #1: 19.1 meters, MW #2: 12.8 meters, MW #3: 9.1 meters) and penetrate the shallow ground-water table (static water levels: 1.2-2.7 meters below ground level). Samples collected from wells MW #2 and MW #3 had elevated levels of pH (11.06, 12.04 respectively), above the national secondary drinking water standard (9.5). In addition, arsenic was present in well MW #3 at a concentration (dissolved 0.072 mg/L) 1.4 times the Federal drinking water standard (0.05 mg/L). Zinc was found in MW #3 at levels five to six times background concentration, but below Federal drinking water standards. MW #1 had a pH close to background levels (pH: 7.9), however levels of calcium (130 mg/L) and potassium (1.9 mg/L) were elevated relative to upgradient wells MW #2 and MW #3. One deep on-site Lehigh drinking water well was also sampled. This well did not exhibit concentrations of constituents above primary or secondary MCLs.[50]

In 1989, Lehigh hired Layne GeoSciences to perform the Remedial Investigation/Feasibility Study for the site. Nine monitoring wells were installed on the site, one being a nested well. The first of four sampling rounds was conducted in June 1990. Elevated pH values, total dissolved solids, and similar contaminants as prior studies were found in the ground water and surface water. The pH levels ranged from background to as high as 11.43 in one well. Total dissolved solids in this well were also as high as 7,000 mg/L. The pH levels in

[47] U.S. EPA, 1988. Final Report, Site Investigation, Lehigh Portland Cement, Iowa. *op.cit.*

[48] *Ibid*.

[49] *Ibid*.

[50] *Ibid*.

the on-site ponds were higher than previously detected (13.0 in Arch Pond), with TDS levels at 11,000 mg/L.[51]

In the fall of 1990, it was also determined by the Iowa Department of Natural Resources that the LCNC needed to be investigated for the same contaminants as the Lehigh site. As with the Lehigh site, the primary concerns in the LCNC area include elevated pH and TDS levels. The CKD samples that were collected showed high values for extractable and final pH (11 - 12.7). Elevated pH levels were detected in the Quarry Pond (9.5) and one monitoring well (#14, pH: 10.4). This high pH was not found in the LCNC water well, which is assumed to be downgradient of the CKD deposits.

There are two specific contamination concerns at the LCNC site:

- Elevated ground-water pH beneath the Badlands area; and
- Elevated ground-water pH and TDS levels in the Quarry Pond.

Local ground water and surface water have been affected at this site by high pH levels, an increase in total dissolved solids content, and elevated concentrations of potassium, sulfate, and sodium. These constituents have been monitored at levels that exceed national drinking water standards. In addition, ground-water contamination is evident beneath the Lime Creek Nature Center, a past off-site disposal area for CKD. These damages have been documented in several studies, and the situation has not changed significantly since 1989.

5.2.4 Portland Cement Company, Salt Lake City, Utah

From 1965 to 1983, the Portland Cement Company of Utah (PCU) disposed of CKD at five sites in and around Salt Lake City, Utah. The largest of these sites, designated as Portland Cement Co. site numbers two and three (Kiln Dust #2 & #3), is estimated to be 29 hectares (71 acres) in area and is listed on the NPL. Lone Star Industries purchased PCU in 1979, and has been identified by the EPA and the Utah Department of Environmental Quality (UDEQ) as one of several Potentially Responsible Parties.[52,53]

The Kiln Dust #2 & #3 site is located in Salt Lake City approximately 2.5 kilometers (km) (1.6 miles) southeast of the Utah International Airport, and 1.6 kilometers south of Interstate 80. The site consists of three adjacent CKD disposal areas, site #2, site #3, and the West Site. The property is bounded on the north and east by city streets, and on the south and west by the Jordan River Surplus Canal.[54]

Land use in the vicinity of the site is characterized by mixed residential and commercial development. The immediate area surrounding the site is zoned for commercial and light industrial use. East of the site are residential areas. Vacant areas or agricultural lands are

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[51] Lehigh Portland Cement Company, 1991. *Remedial Investigation/Feasibility Study for the Lehigh Portland Cement Company Plant, Mason City, Iowa*. Prepared by Layne GeoSciences, Inc. April, 1991.

[52] U.S. Environmental Protection Agency, Region VIII, and Utah Department of Health and Environmental Quality, 1990. *Declaration for the Record of Decision, Portland Cement Company (Kiln Dust #2 & #3), Operable Unit 1, Salt Lake City, Utah*. July, 1990.

[53] United States Bankruptcy Court, Southern District of New York, 1991. *Proof of Claim of the State of Utah Department of Environmental Quality*, Case No. 90-B-21277, in reference to New York Trap Rock Corporation, Lone Star Industries, Inc. *et.al.*, Debtors.

[54] U.S. EPA and UDEQ, 1990. Declaration for the Record of Decision, Portland Cement Company, Salt Lake City Utah. *op.cit.*

common in the surrounding area. The EPA, in the 1990 Record of Decision, estimates between 6,000 and 12,000 people live within one mile of the site.[55] Exhibit 5-8 provides a diagram of the site.

Between 1965 and December 1983, approximately 378,700 cubic meters (m^3) (495,718 cubic yards) of CKD was disposed in site #2, site #3, and the West Site, by PCU and/or Lone Star Industries. The waste CKD was disposed of as a slurry on site 2, while on site 3 it was disposed of in dry form. Within the boundaries of site #2, site #3 and the West Site, CKD is present in thicknesses ranging from one meter to more than two meters (m) (3.3-6.6 feet).[56] Co-disposed with the CKD is 327 metric tons (360 tons) of chromium brick. At the West Site, CKD is mixed in discontinuous layers with an indeterminate amount of industrial debris, including rubble, soils, scrap iron, concrete slabs, asphalt, common bricks, alumina kiln bricks, and common trash.[57]

Two drainage features pass through or are adjacent to the site. A drainage ditch, known as the City Drain, flows through the site, carrying urban storm run-off in a northwesterly direction. The Jordan River Surplus Canal carries water from the Jordan River northwestward to the Great Salt Lake. The City Drain is part of an urban storm sewer system and the water it carries is protected by the State of Utah. The water in the Surplus Canal is protected by the State of Utah for nongame fish, water-oriented wildlife, and agricultural uses.[58]

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[55] *Ibid*.

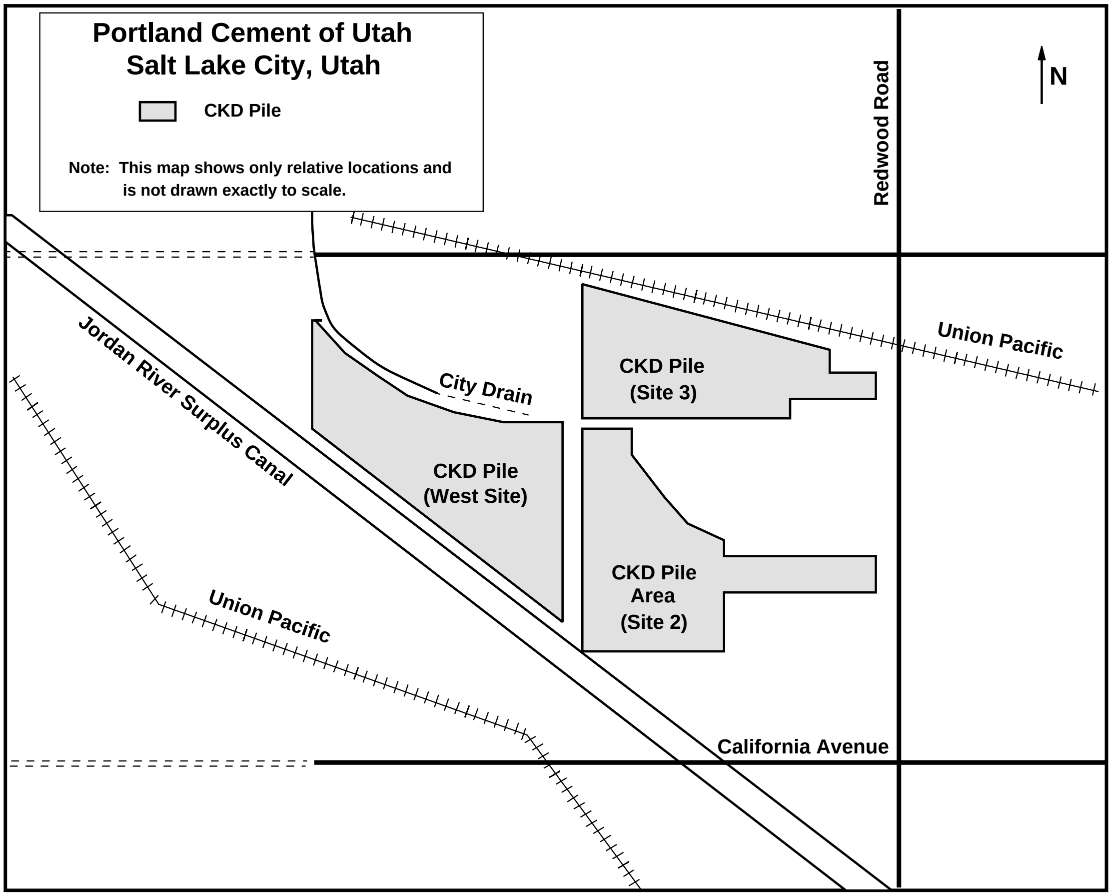
[56] *Ibid*.

[57] *Ibid*.

[58] *Ibid*.

Exhibit 5-8

Site Diagram – Portland Cement Company, Salt Lake City, Utah



Near-surface ground water underneath the site is characterized by a shallow, unconfined ground-water body, and local, perched water bodies. Both of these water bodies are above a deeper confined aquifer, which is the principal source of ground water in Salt Lake Valley. Although the local gradient of the shallow aquifer is generally to the northeast, toward the Jordan River, it is strongly influenced by the Jordan River Surplus Canal, the City Drain, and an underground sewer drain along the west side of CKD disposal areas #2 and #3.[59]

The 1990 EPA Record of Decision summarizes the results of several studies of the Kiln Dust #2 and #3 CKD disposal site. Disposed kiln dust contains the elements arsenic (3.0-27 mg/kg), cadmium (2.1-5.5 mg/kg), chromium (8.7-28 mg/kg), lead (90-1,274 mg/kg), and molybdenum (8.7-51.7). Of these, concentrations of molybdenum and lead are generally above those found in typical soils of the western United States (molybdenum: 3-7 mg/kg, lead: 10-700 mg/kg). Concentrations of metals showed little variation among site #2, site#3, and the West Site.[60]

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[59] U.S. EPA and UDEQ, 1990. Declaration for the Record of Decision, Portland Cement Company, Salt Lake City, Utah. *op.cit.*

[60] *Ibid*.

Analytical results of ponded water at the site are also summarized in the 1990 EPA Record of Decision. Ponded water was observed in several pools along the edges of disposal sites #2 and #3, and within the boundaries of site #3. Based on samples collected during regular observations at the site since 1984, the reported results show elevated levels of arsenic (2.53 mg/L maximum), chromium (3.00 mg/L maximum), and lead (0.37 mg/L maximum) above Federal drinking water limits, reaching as high 50 times the standard for arsenic (0.05 mg/L), 30 times the standard for hexavalent chromium (0.1 mg/L), and nearly 25 times the standard for lead (0.015 mg/L).[61] According to the Record of Decision, state officials observed ponded water migrating off site through a ditch that flows west into the City Drain.

The Record of Decision for the site concluded that the soil, ground water, and surface water are contaminated with CKD constituents both on and off site. A contaminant plume is present in the shallow ground water (approximately 2 meters below the surface) beneath the site and off site.[62] The plume is highly alkaline (pH: 12.6 maximum) and contains elevated concentrations of arsenic (11.4 mg/L maximum), lead (0.45 mg/L maximum), chromium, and other constituents including cadmium (6.04 mg/L maximum), fluoride (123 mg/L maximum), sulfate (15,500 mg/L maximum), and total dissolved solids (90,000 mg/L maximum). The plume has been detected immediately north of the site near a sewer alignment, and flows north across the site.[63] Ground-water sampling results from the Remedial Investigation indicate exceedances of the primary drinking water standards for pH, arsenic (2.3 × MCL), cadmium (4 × State MCL), chromium, and lead (30 × MCL). Remediation of the ground water cannot begin until the sources of contamination are controlled or removed.

Surface water samples collected from the City Drain, which flows through the site, indicate exceedances of the primary drinking water standards for pH and arsenic.[64]

Fugitive dust emissions also have been observed by state officials during high wind events, but apparently no NOVs have been issued. Modeling results of fugitive air emissions show airborne particulate concentrations in excess of the EPA 24-hour Significant Impact Limit of 5μg/m^3, for an area extending 3.5 kilometers north of disposal site #3.[65]

In a 1990 Declaration for the Record of Decision, the State of Utah indicated, and EPA concurred, that excavation and off-site disposal of the CKD was their preferred alternative for remediation of the site. Remediation will begin approximately 18 months after completion of the remedial design.[66] The CKD will be removed to an off-site, state-approved, noncommercial, double-lined, industrial landfill in Salt Lake City, yet to be constructed. The bricks and soil will be treated on site. EPA and the State of Utah have yet to determine the method of treatment. Further ground-water monitoring will be conducted during the Remedial Action to determine whether the contamination is lessening or if the ground water has to be treated.[67]

[61] *Ibid*.

[62] U.S. EPA and UDEQ, 1990. Declaration for the Record of Decision. *op.cit.*

[63] *Ibid*.

[64] *Ibid*.

[65] *Ibid*.

[66] *Ibid*.

[67] U.S. EPA and UDEQ, 1990. Declaration for the Record of Decision. *op.cit.*

5.2.5 Southwestern Portland Cement (Southdown, Inc.), Fairborn, Ohio

The Southdown, Inc. facility (formerly Southwestern States Portland Cement Company) site is located on approximately 1,620 hectares (4,000 acres), 2 kilometers (km) (1.2 miles) east of the City of Fairborn in Bath Township, Greene County, Ohio. The facility has operated one dry-process kiln since at least 1930. Prior to Southwestern Portland's purchase of the property in 1924, the site was owned by Universal Atlas Cement Company. During 1990, the principal commercial products manufactured at the facility included Types I, IA, II, and III Portland cement, masonry cements, and expansive cements.[68] A limestone quarry currently operated by the facility is located north of the site.

In 1990, the facility fueled its kiln with pulverized coal, waste tires, liquid hazardous waste-derived fuel, and fuel oil (for start-up only). Along with fossil fuels (coal: 68,600 metric tons (75,618 tons), oil: 504 kiloliters (133,089 gallons)), an estimated 4,170 metric tons of tires and 10,230 kiloliters of liquid hazardous waste were burned by Southwestern Portland in its cement manufacturing process.[69]

Facility property boundaries are adjacent to Mad River and the Beaver Creek watershed. A portion of the site (acreage unknown) is located in the 100-year floodplain. Wetlands that drain into Beaver Creek have been identified adjacent to the western property boundary. South and west of facility property are glacial deposits of unconsolidated gravel, sand, and clay that contain the aquifers that supply drinking water to the city of Fairborn. As of December 1991, approximately 35 people resided within the facility boundary, and an additional 30,000 residents lived within one mile of the plant. Both public and private drinking water wells are located within one mile of the facility boundary.[70]

An estimated 707,800 metric tons of CKD waste were landfilled in quarries owned by Southwestern Portland from 1924 through 1978.[71] Two tenths of one percent of all disposed material is chromic oxide brick, which was co-disposed along with CKD by Southwestern Portland from 1965 to 1978. CKD disposal occurred at 10 landfills dispersed within the facility property boundary. Universal Atlas Cement also may have disposed of CKD prior to 1924 into Landfill #1. The landfills are unlined and do not have leachate collection systems.[72]Plant operations and CKD disposal areas are shown in Exhibit 5-9.

Since the facility ceased its landfilling operations in 1980, CKD has been managed by temporarily storing the waste in five cement storage silos. A significant portion of the CKD at this facility is also recycled and used as raw material in the kiln.[73]

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[68] Portland Cement Association, 1991. PCA CKD Survey: Response from the Southwestern Portland Cement Company, Fairborn, Ohio.

[69] *Ibid*.

[70] *Ibid*.

[71] Southdown, Inc., 1991. *Site Assessment of Southwestern Portland Cement Properties Near Fairborn, Ohio: Phase 1, Preliminary Investigations, Part 1*. Prepared by Panterra Corporation. March 11, 1991.

[72] Ohio Environmental Protection Agency, 1992. Personal communication with M. Lehar. January, 1992.

[73] Portland Cement Association, 1991. PCA CKD Survey. *op.cit.*

The Ohio Environmental Protection Agency (OEPA) is concerned about the potential of contaminant releases at Southwestern Portland from Landfill #1 and Landfill #6.[74] Landfill #1 covers 73 hectares and contains an estimated 11 million cubic meters (14.4 million cubic yards) of CKD-bearing fill.[75] It is adjacent to Mud Run, a tributary to the Mad River which is classified as a state resource water (recreational fishery). Landfill #6, an 11 hectare site, contains an estimated 920,000 cubic meters of CKD, co-disposed with kiln brick, plant and domestic trash, clean fill, and cover soil.[76] It is adjacent to 21 hectares of wetlands and overlies buried sand and gravel deposits that contain aquifers tapped by public water supply wells. Landfill #1 is the closest (1.6 kilometers) of all ten disposal sites to Fairborn's North Well Field. Landfill #6 is within 2.8 kilometers of four public water supply wells serving the needs of the 38,000 residents of the City of Fairborn.[77]

Contaminant releases have been observed in surface and ground waters associated with Landfill #6. Exhibit 5-10 summarizes the results of several sampling efforts that have been completed for this site. Surface water samples collected by OEPA (unpublished data) from seeps and streams around the toe of the landfill during March 1993 had elevated levels of arsenic (1 to 3 times OEPA standard), iron (8 to 31 times OEPA standard), and selenium (1 to 3 times above OEPA standard) above OEPA limits for drinking water. Levels of lead were at, or slightly below the Federal drinking water standard (0.015 mg/L). Ground-water samples collected at the same time near the seeps had elevated levels of arsenic (24 times OEPA standard), iron (31 times OEPA standard), and selenium (1.8 times OEPA standard) above OEPA drinking water limits. The surface water samples had very alkaline pH levels, reaching as high as 13.6.

The EPA has summarized reported analyses of surface waters and ground waters associated with Landfill #6.[78] As shown in Exhibit 5-10, surface water samples collected from December,

[74] Ohio Environmental Protection Agency, 1993. Personal communication with Thomas Schneider, Site Coordinator. April, 1993.

[75] *Ibid*.

[76] Ohio Environmental Protection Agency, 1993. *Fact Sheet: Southwestern Portland Cement Company -- Landfill No. 6, Fairborn, Ohio*. March, 1993.

[77] Ohio Environmental Protection Agency, 1986. *Preliminary Assessment, Southwestern Portland Cement, Fairborn, Ohio (Landfill #6), Part 3 - Description of Hazardous Conditions and Incidents*. July 18, 1986.

[78] Ohio Environmental Protection Agency, 1992. *Director's Final Findings and Order in the Matter of Southdown, Inc., 506 East Xenia Drive, Fairborn, Ohio*.

Exhibit 5-9
Site Diagram – Southwestern Portland Cement, Fairborn, Ohio

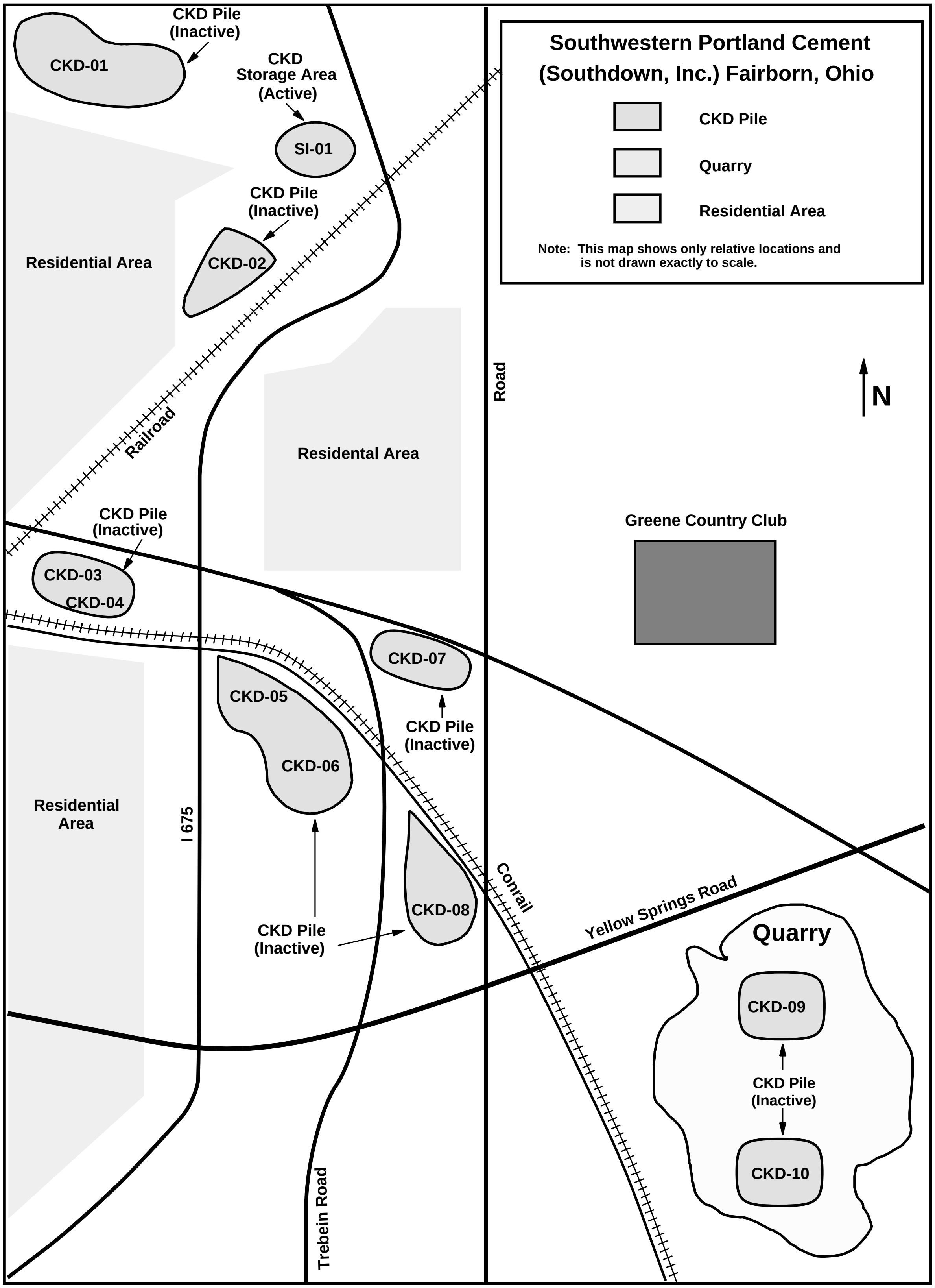

Exhibit 5-10

Summary of Exceedances[a] of State Metals Limits
Southwestern Portland Cement - Fairborn, Ohio
Landfill #6

Date/Media Sampled[b]			
3/93: Ground water[c,n]	3/93: Surface water[d,n]	3/93: Surface water[e,n]	3/93: Surface water[f,n]
As: 1.2 **Fe: 9.4** **Hg: 0.0016** **Ni: 0.23** **Se: 0.018** **Zn: 0.05** **pH: 13.38**	**As: 0.09** **Fe: 9.24** **Se: 0.026** **pH: 12.89**	**As: 0.14** **pH: 12.88**	**As: 0.157** **Fe: 5.14** **Se: 0.028** **pH: 13.6**
3/93: Surface water[g]	3/93: Composite Ground Water[h,o]	12/90-3/91: Surface Water[i,o]	10/90: Surface Water[j,o]
Fe: 2.39 **pH: 12.8**	**As: 0.927** **Cd: 0.024** **Cr: 0.105** **Pb: 0.108** **Ni: 0.283** **Se: 0.022** **pH: 12.08**	**As: 0.83** **Cd: 0.02** **Cr: 0.100** **Pb: 0.037** **Ni: 0.283** **pH: 12.9**	**As: 0.388** **Pb: 0.070** **Se: 0.07**

Exhibit 5-10 (continued)

Summary of Exceedances[a] of State Metals Limits
Southwestern Portland Cement - Fairborn, Ohio
Landfill #6

Date/Media Sampled[b]			
11/90: pH readings[k,p]	Drinking Water[l]	Agricultural Water[l]	Background[m]

pH6: 13.44 **pH8: 9.76** **pH9: 13.63** **pH10: 13.70** **pH11: 13.30**	As: 0.05 P Ba: 1.0 P Cd: 0.01 P Cr: 0.05 P Cu: 1.0 S Fe: 0.3 S Pb: 0.05 P Mn: 0.5 S Hg: 0.002 P Se: 0.01 P Ag: 0.05 P Zn: 5.0 S pH: 7 - 10.5 S	As: 0.1 Be: 0.1 Cr: 0.1 Cu: 0.5 Fe: 5.0 Pb: 0.1 Hg: 0.01 Ni: 0.2 Se: 0.05 Zn: 25.0	As: <0.05 Be: <0.004 Cd: <0.001 Cr: <0.01 Cu: 0.02 Fe: 0.12 Pb: <0.003 Mn: <0.005 Hg: <0.20 Ni: <0.01 Se: <0.005 Ag: <0.001 Zn: 0.02 pH: 7.10

[a] Constituent concentrations higher than State standards are marked in **bold**. No violation of water standards is implied.
[b] All concentrations in mg/L except pH in standard units.
[c] Ground water from seep (MW-3) located at toe of landfill.
[d] Surface water sample (WN-2) from drainage from toe of landfill.
[e] Surface water sample (SW-16) from seep at toe of landfill.
[f] Surface water sample (SW-17) from seep at toe of landfill.
[g] Surface water sample (SW-15) collected from stream at west toe of landfill.
[h] Composite of ground-water samples from on-site monitoring wells. Reported constituent levels are the highest concentrations observed during the sampling period.
[i] Surface water and leachate samples from landfill. Listed constituent levels are the highest concentrations observed during the sampling period.
[j] Surface water sample of ponded leachate collected south of landfill.
[k] Readings from surface streams around the southern and western edge of landfill.
[l] Water Quality Standards, State of Ohio.
[m] Ground-water well located upgradient from Landfill #6.
[n] Ohio EPA, 1993, Unpublished surface water and ground-water monitoring data from Landfill #6, Southwestern Portland Cement Co, Fairborn, Ohio.
[o] Ohio EPA, 1992, Administrative Order against Southwestern Portland Cement Co., Greene Co., Ohio.
[p] EPA, 1991, Table 4-3: Field Investigation Team (FIT)-collected pH readings.

1990 to March, 1991 around Landfill #6 showed elevated levels of arsenic 17 times OEPA standard), cadmium (2 times OEPA standard), and chromium (2 times OEPA standard) above Ohio EPA drinking water limits. Levels of nickel were 1.4 times the State limit for agricultural waters. Highly alkaline ground waters (pH > 12) sampled during January and February, 1991, had similar degrees of exceedance for arsenic, cadmium, chromium, and nickel. In addition, levels of lead were reported to be as high as 7 times the Federal drinking water limit (0.015 mg/L). The pH readings from surface streams collected in November, 1990 were reported as high as 13.7.

In July 1992, the OEPA issued an administrative enforcement order against the facility for past disposal activities at Landfill #6. In the order's findings of fact, OEPA determined that the wastes disposed of in Landfill #6, including CKD, contained arsenic, lead, mercury, nickel, selenium, zinc, cadmium, chromium, copper, and phenolics, and, therefore, are industrial wastes. OEPA also determined that the leachate, because of its high pH (up to 13.7), is a hazardous waste, and when released from Landfill #6, constitutes disposal of hazardous waste. According to State law, the deposit (i.e., disposal) of industrial waste and hazardous waste in surface and ground waters constitutes pollution (i.e., damage) of State waters. The order requires that a CERCLA Remedial Investigation and Feasibility Study be conducted for this area.[79] To date, no remedial actions have been undertaken at this site.

Surface water and ground-water samples collected from streams around Landfill #1 are characterized by high pH, but only arsenic, iron, and selenium are elevated above State water quality standards. In a reconnaissance of the site in June, 1991, the Ohio EPA reported levels of arsenic (0.06 mg/L) 1.2 times the OEPA drinking water limit of 0.05 mg/L, iron (0.51 mg/L) three times the OEPA secondary drinking water limit (0.3 mg/L), and selenium (0.021 mg/L) 2.1 times the OEPA drinking water limit of 0.01 in surface water from a seep at the point of emergence along the north toe of the landfill. The pH of the water was highly alkaline (11.58) and exceeded the State drinking water standard of 10.5.[80] Elevated levels of arsenic (0.12 mg/L, 2.4 times OEPA drinking water limit) and iron (4.1 mg/L, 13.6 times Ohio EPA drinking water limit) in ground water associated with a seepage along the northwest slope of Landfill #1 also were reported in a site assessment of the landfill prepared for Southdown.[81]

The OEPA has also reported elevated levels of copper, lead, zinc, and selenium in excess of standards for warmwater wildlife habitats, in surface water samples collected along the margin of Landfill #1.[82] Although the concentrations of these elements are below the general State drinking water standards (copper: < 10 - 45 ppb, lead: 10 ppb, zinc: 16 - 60 ppb), these elements are considered elevated due to the very low water hardness of these samples (12-41 ppm $CaCO_3$) relative to normal water hardness (200-400 mg/L $CaCO_3$). The low water hardness increases the sensitivity of aquatic organisms to these constituents. The State limits for lead in waters with low hardness (12-41 ppm $CaCO_3$) range from 9.1 ppb to 42 ppb. The ranges for copper and zinc are 2.1-7.2 ppb and 20-55 ppb, respectively.[83]

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[79] *Ibid*.

[80] Ohio Environmental Protection Agency, 1991. Memo from Louise T. Snyder, DWQPA, SDWO on the Southwestern Portland Cement facility, Landfill #1. September 9, 1991.

[81] Southdown, Inc., 1992. *Subarea 1 Site Evaluation, Southwestern Portland Cement Company, Fairborn, Ohio*. Prepared by Ground Water Associates, Inc, April, 1992.

[82] Ohio Environmental Protection Agency, 1991. Memo from Louise Snyder, *op.cit.*

[83] *Ibid*.

Damages at this site include contamination of on-site surface water and ground water. Damages have been documented in several studies. The contaminants of most concern to human health at both CKD landfills include pH and arsenic. The metals arsenic, selenium, chromium, lead, and pH have all been observed at levels exceeding either primary or secondary drinking water standards. These damages have resulted from the disposal of CKD in unlined landfills. No remedial actions have been initiated for this site. However, a 1992 Administrative Order issued by the Ohio Department of Natural Resources requires the company to undertake a remedial investigation and feasibility study for Landfill #6.

5.2.6 National Gypsum Co./Lafarge Corp., Alpena, Michigan

National Gypsum Company owned and operated a cement manufacturing facility northeast of Alpena, Michigan on the shore of Lake Huron's Thunder Bay. In 1986, Lafarge Corporation purchased the facility from National Gypsum and is the current owner and operator. Cement has been manufactured at this site since at least the 1890s.[84]

During the 1980s, National Gypsum disposed of its CKD in a waste pile located northeast of the facility along the edge of Lake Huron. The site covers more than 30 hectares (77 acres) and is approximately 300 meters (984 feet) x 600 meters, with CKD piled as high as 18 meters above the level of the lake.[85] The site has been inactive since 1986, when Lafarge took over operations. All CKD in this pile was generated prior to Lafarge's decision to burn hazardous waste fuels.[86] A site layout is provided in Exhibit 5-11.

Evidence of environmental release of CKD originating from the pile has been documented by the Michigan Department of Natural Resources (MDNR). During a site visit in March, 1993, MDNR inspectors reported CKD washing into a large erosion ditch (1 meter wide x 3 meters deep) leading to Lake Huron, along with other debris, including airbags, drums, kiln brick, and other miscellaneous debris co-managed with the dust. In addition, waves from the lake were reported to be actively eroding the pile along 6- to 9-meter high banks on the south end of the shoreline.[87] MDNR has provided the Agency with photographs and videotapes showing CKD washing into Lake Huron by means of flow down erosion channels on the pile and wave action along the shore.[88]

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[84] Michigan Department of Natural Resources, 1993. Personal communication with JoAnn Merrick, Acting Chief, Compliance and Enforcement Section, Waste Management Division, Michigan Department of Natural Resources. July, 1993.

[85] Michigan Department of Natural Resources, 1993. Letter from John W. Vick, Environmental Response Division to Rebecca Beasly, Assistant General Council, National Gypsum Company. May, 1993.

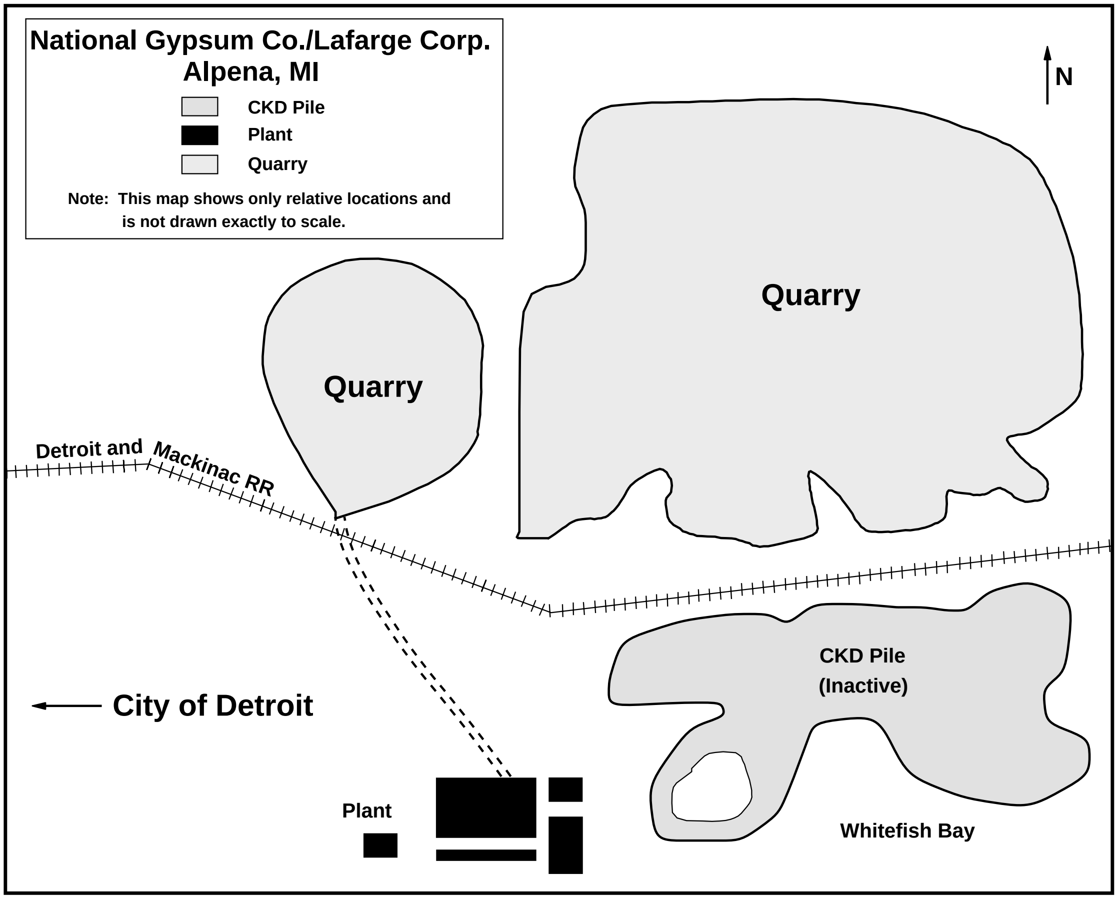
[86] Michigan Department of Natural Resources, 1993, Interoffice Communication from Jim Sygo, Chief, Waste Management Division, to Russell Harding, Deputy Director. April, 1993.

[87] Michigan Department of Natural Resources, 1993. John W. Vick letter. *op. cit.*

[88] Michigan Department of Natural Resources, 1993. Photos of National Gypsum CKD pile taken during MDNR site visits on March 30, 1993 and April 22, 1993. Videotape of National Gypsum CKD pile taken by John W. Vick on April 30, 1993.

Exhibit 5-11

Site Diagram – National Gypsum Co./LaFarge Corp., Alpena, Michigan



Evidence of contamination was found in soil and surface water samples obtained from the pile near the shore of Lake Huron. As shown in Exhibit 5-12, surface water samples from the erosion ditch and nearby Lake Huron show levels of arsenic and lead in excess of standards specified under the Michigan Environmental Response Act (MERA, 1982 PA 307, as amended). Grab samples of soil from the beach and upslope from the shore on the CKD pile had elevated levels of arsenic, selenium, lead, and zinc, all above default values for soil cleanup.[89]

MDNR considers the presence of heavy metals in CKD and nearby surface waters to be a "release of hazardous substances under MERA," which "represents a threat to public health and the environment." MDNR has advised both National Gypsum Co. and Lafarge Corp. that they are in violation of the Michigan Water Resources Commission Act (MWRC, PA 1929, as amended).[90]

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[89] Michigan Department of Natural Resources, 1993. John W. Vick letter, *op.cit.*

[90] *Ibid*.

Exhibit 5-12

Summary of Exceedances of State Metals Limits
National Gypsum Co./Lafarge Corp., Alpena, Michigan

Date: Media Sampled	Constituent/Observed Concentration	State Standard*
3/93: Surface Water; Shore of Lake Huron adjacent to CKD pile.	As: 30 ppb	As: 0.02 ppb
3/93: Surface Water: Erosion ditch on CKD pile 20 feet from shore.	Pb: 32 ppb	Pb: 8 ppb
3/93: Soil Sample: Surface grab sample taken from CKD pile.	As: 6.52 ppm Se: 0.546 ppm Zn: 53 ppm	As: 5.8 ppm‡ Se: 0.41 ppm‡ Zn: 47 ppm‡
3/93: Soil Sample: Surface grab sample taken from beach northeast of erosion ditch.	As: 27.1 ppm Pb: 36 ppm Zn: 115 ppm	As: 5.8 ppm‡ Pb: 21 ppm‡ Zn: 47 ppm‡
3/93: Soil Sample: Surface grab sample taken from sediment at mouth of erosion ditch.	As: 23.2 ppm Pb: 51 ppm Se: 3.15 ppm Zn: 134 ppm	As: 5.8 ppm‡ Pb: 21 ppm‡ Se: 0.41 ppm‡ Zn: 47 ppm‡

* Standards specified under the Michigan Environmental Response Act (MERA) (1982 PA 307, as amended).
‡ MERA Type A soil cleanup criteria

Currently, MDNR is negotiating with both companies to initiate interim response actions to prevent further erosion and deposition of contaminants into Lake Huron.[91]

5.2.7 Ash Grove Cement West, Montana City, Montana

Ash Grove Cement West's Montana City facility is located on a 197 hectare (486 acre) site less than 10 kilometers (km) (6.2 miles) south of the city of Helena, Montana. The plant utilizes a wet process to manufacture cement in one kiln, which has an annual capacity of

[91] Michigan Department of Natural Resources, 1993. Personal communication with John W. Vick, Environmental Quality Analyst, Environmental Response Division.

269,510 metric tons (297,079 tons).[92] Facility boundaries are adjacent to the unincorporated town of Montana City, with an estimated 300 residents living within 0.8 km of the facility's boundary. No known sensitive areas (e.g., wetlands or endangered species habitats) are located nearby. However, there are private drinking water wells within 0.8 km of the facility's boundary.[93]

In 1990, the facility utilized predominantly natural gas, coal, and coke for its fuel needs. These fuels were supplemented by 8,270 kiloliters (2.18 million gallons) of waste pitch.[94] In 1991, Ash Grove West applied for precompliance certification to burn hazardous waste under the Boiler and Industrial Furnace rule, but was denied status by Region 8.

Waste CKD is landfilled in a draw on the east side of the quarry. In 1990, Ash Grove West in Montana City generated an estimated 29,000 metric tons of CKD, of which 19,000 metric tons were landfilled (the remainder being returned to the kiln). Prior to 1989, CKD was co-managed with shale overburden mined from quarry operations. Since the fall of 1989, CKD has been monofilled over the co-managed pile. At the end of 1991, the landfill was estimated to hold 77,000 metric tons of cumulative material.[95]

Stormwater run-off flows into one of two holding ponds, each of which discharges south of the plant proper via permitted outfalls into Prickly Pear Creek. Run-off from the active CKD landfill flows into a lower holding pond where it percolates through a gravel dam and discharges into Prickly Pear Creek (outfall is currently valved shut).[96,97] Run-off from a second upper pond discharges into Prickly Pear Creek, 245 meters (800 feet) further upstream from the discharge outfall from the lower pond.[98] CKD disposal areas are shown in Exhibit 5-13.

In December 1990, the State of Montana Department of Health and Environmental Sciences filed a Letter of Complaint and Application for Injunction against Ash Grove West, Inc. for violations of discharge permit limits at the Montana City facility.[99] In its claim, the Department describes two catastrophic releases from the plant's wastewater ponds into Prickly Pear Creek. Both releases involved quantities of CKD which flowed into the creek.

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[92] Portland Cement Association, 1992. PCA CKD Survey: Response from Ash Grove West, Inc., Montana City, Montana.

[93] *Ibid*.

[94] *Ibid*.

[95] Portland Cement Association, 1992. PCA CKD Survey: Response from Ash Grove West, Inc., Montana City, Montana.

[96] *Ibid*.

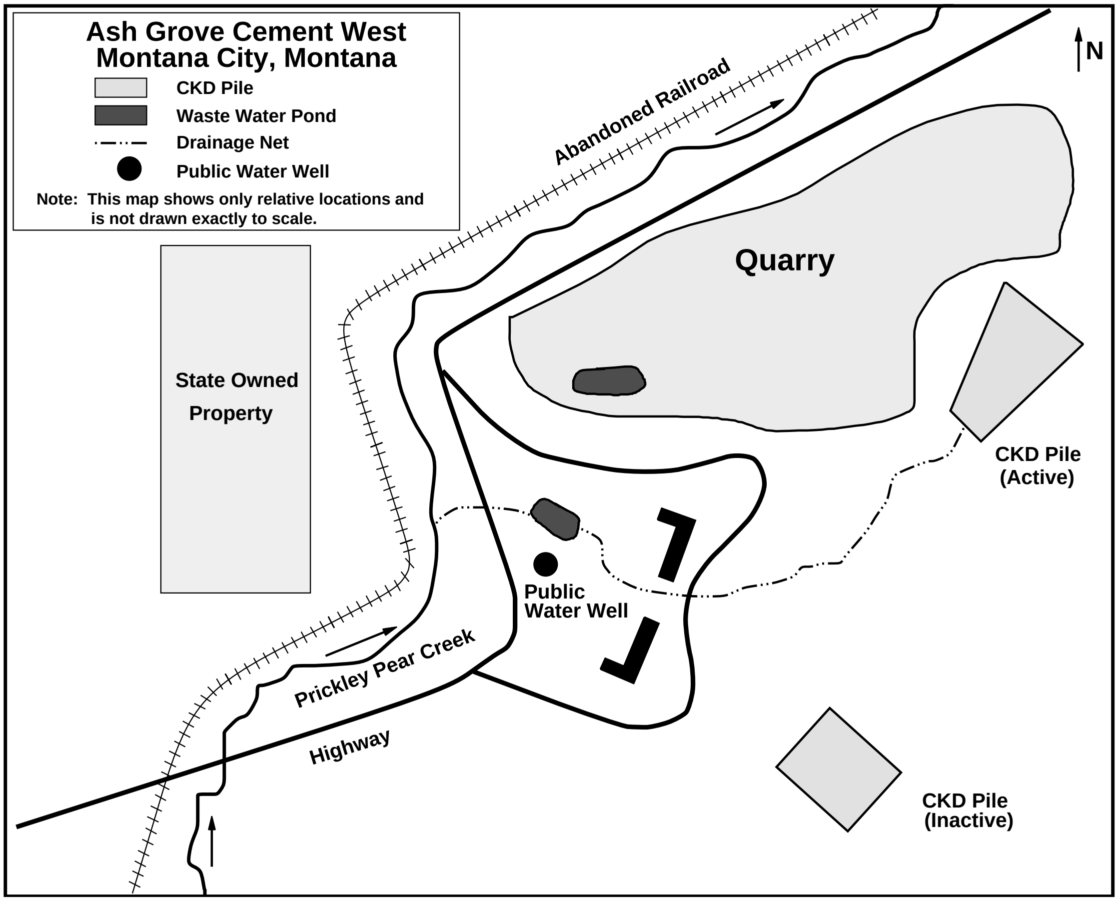
[97] Ash Grove Cement West, Montana City, Montana facility, 1993. Personal communication with plant personnel. July, 1993.

[98] *Ibid*.

[99] Department of Health and Environmental Sciences, State of Montana, 1990. *State of Montana ex. rel. v. Ash Grove Cement West, Inc*. Complaint and Application for Injunction, Cause No. 8442, Montana 5th Judicial District Court, Jefferson County. December 11, 1990.

Exhibit 5-13

Site Diagram – Ash Grove Cement West, Montana City, Montana



As described in the Complaint, the first violation, which occurred on June 28, 1990, involved the release into Prickly Pear Creek of substantial quantities of sludge which had been previously excavated that morning from the bottom of the lower wastewater pond. A late morning/early afternoon storm washed substantial quantities of the excavated materials into Prickly Pear Creek. Subsequent measurements of creek waters downstream of the discharge point showed a total suspended solids level of 586.8 mg/L, compared to 10.1 mg/L upstream of the discharge point.[100] This is a violation of the plant's State effluent limit of 50 mg/L for total dissolved solids.[101]

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[100] *Ibid*.

[101] Department of Health and Environmental Sciences, State of Montana, 1990. *State of Montana ex. rel. v. Ash Grove Cement West, Inc.*, Consent Decree, Stipulation and Order, Cause No. 8442, Montana 5th Judicial Court, Jefferson County.

In the second violation, on August 16, 1990, the lower holding pond failed after Ash Grove pumped dense liquid sludge from the slurry tanks into the holding pond. Catastrophic failure of the holding pond resulted in discharges into Prickly Pear Creek that raised the concentration of total dissolved solids from 5.2 mg/L upstream to 37,368 mg/L near the discharge point, and 4,453 mg/L 150 meters downstream from the discharge point.[102] This is also a violation of the plant's State limit of 50 mg/L for total dissolved solids.

Ash Grove acknowledged in a Consent Decree that both events allowed materials to pollute Prickly Pear Creek in violation of State law. In addition to exceeding the State permit limit for total dissolved solids, the discharges increased the turbidity above naturally occurring conditions, and "created a nuisance, harmed aquatic life, and formed objectionable emulsions and deposits . . ."[103]

5.3 CASES OF POTENTIAL DAMAGE TO GROUND AND SURFACE WATER

The Agency has identified cases of potential damage at three sites: (1) Texas Industries facility in Midlothian, Texas, (2) Holnam facility in Artesia, Mississippi and, (3) Markey Machinery Property in Seattle, Washington. In these cases there is information available to indicate that surface water located on site has been contaminated above Maximum Contaminant Levels (MCLs), but there is no data to indicate whether or not such levels have interacted with either nearby ground water or other surface waters off site. For example, at the Texas Industries facility, exceedances of metal standards were found in small, isolated puddles that were in no obvious communication with any other body of surface water. Furthermore, there is no known ground-water contamination at the Holnam facility.

5.3.1 Texas Industries, Inc., Midlothian, Texas

The Texas Industries facility is located in Ellis County on a 643 hectare (1,587 acre) tract of land 3.5 kilometers (km) (2.17 miles) southwest of Midlothian, Texas.[104] The plant manufactures approximately 1,088,900 metric tons (1,200,286 tons) of Portland cement per year in four wet process rotary kilns, and is authorized to burn hazardous waste for energy recovery.[105] Land use in the vicinity is predominantly agricultural, with low-density rural residential areas located adjacent to facility property boundaries to the east, south, and northwest.[106]

Each kiln produces 40 to 45 metric tons of CKD per day, all of which is wasted from the system. Sixty to 80 percent of the CKD is pelletized in a pug mill and landfilled on site, while the

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[102] Department of Health and Environmental Sciences, State of Montana, 1990. Complaint and Application for Injunction, *op.cit.*

[103] Department of Health and Environmental Sciences, State of Montana, 1990. *State of Montana ex. rel. v. Ash Grove Cement West, Inc.*, Consent Decree, Stipulation, and Order, Cause No 8442, Montana 5th Judicial District Court, Jefferson County. December 19, 1990.

[104] Texas Industries, Inc., 1992. *Part B Permit Application to EPA and the Texas Water Commission*. Prepared by Entellect Environmental Services for Texas Industries, Inc. p. 1-9.

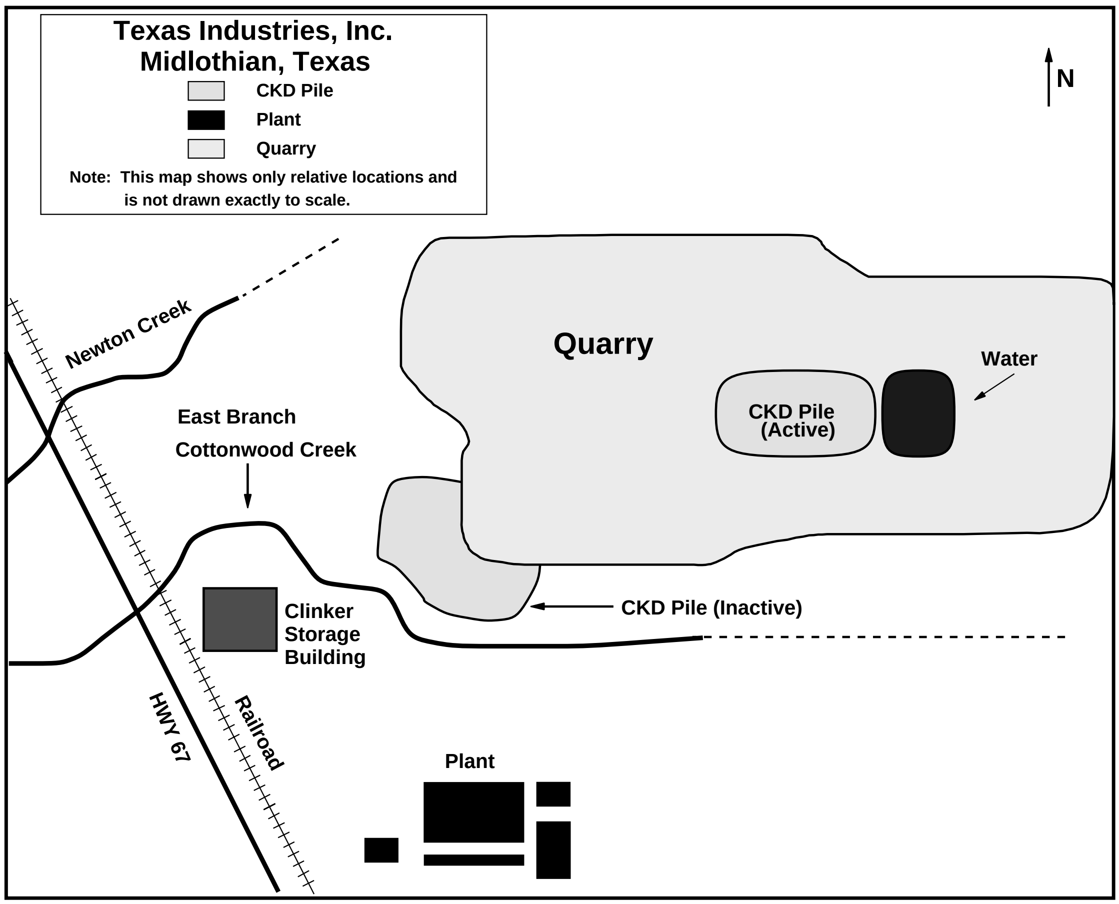
[105] U.S. EPA Region 6, 1992. *Complaint, Compliance Order, and Notice of Opportunity for Hearing in the Matter of Texas Industries, Inc., Midlothian, Texas*. Docket No. RCRA VI-203-H, Hazardous Waste Management Division. September, 1992.

[106] Texas Industries, Inc., 1992. *op.cit.*

remaining 20 to 40 percent is sold either as roadbed filler or as a stabilizer.[107] The facility has two on-site CKD landfills, an active landfill in a depleted quarry area, and an inactive capped landfill located in the quarry to the southwest of the active disposal area.[108] A diagram of the site is provided in Exhibit 5-14.

Exhibit 5-14

Site Diagram – Texas Industries, Inc., Midlothian, Texas



Temperate climactic conditions in the region feed intermittent streams that flow over impermeable clayey soils. Surface run-off from the plant proper discharges into the eastern branch of Cottonwood Creek, and 5 kilometers further downstream into Joe Poole Lake, a public drinking water reservoir. Surface run-off from the inactive pile flows into the East Branch

[107] Texas Industries, Inc., 1992. Personal communication with plant operators during EPA CKD sampling visit. March, 1992.

[108] *Ibid*.

of Cottonwood Creek,[109] while run-off from the active CKD disposal area spills into the quarry and is confined to the facility property.[110] The quarry floor (18 meter (60 feet depth) is fractured, and there is a large body of ponded water near the active disposal pile. Perched water tables are within 11 meters of the surface and are above the quarry floor.[111] Beneath the facility the uppermost aquifer is located 73 meters below grade.[112]

CKD from the Texas Industries facility is known to contain leachable chromium. Samples of CKD collected by the Texas Water Commission (TWC) in 1991, directly from beneath one kiln (Kiln #4) had chromium levels in leachate of 0.44 mg/L. Kiln dust from the active landfill had a level of chromium below, but close to 0.08 mg/L. One sample of CKD from a "fugitive dust landfill" had a total chromium content of 881 mg/kg.[113]

During January 1992, inspectors from the TWC noticed pools of reddish-brown liquid seeping from the inactive pile during a RCRA compliance inspection of Texas Industries' hazardous waste treatment, storage, and disposal facilities.[114] This seepage, believed to be storm run-off,[115] was noted as an "Area of Concern" in a Notice of Violation letter to the facility describing violations of solid waste rules.[116] Analysis of a sample of this liquid showed levels of arsenic of 0.2 mg/L and lead of 0.03 mg/L.[117]

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[109] Texas Water Commission, 1993. Personal communication with Sam Barrett, Field Investigator. July, 1993.

[110] Texas Industries, Inc., 1992. Personal communication with facility personnel during EPA CKD sampling visit. March, 1992.

[111] Texas Water Commission, 1990. RCRA Facility Assessment Facility Checklist for Texas Industries, Incorporated, Peter F. Lodde, reviewer.

[112] *Ibid*.

[113] Texas Water Commission, 1991. Letter from Allen Hayes, Environmental Quality Specialist, to files regarding a review of laboratory analyses of samples collected on October 21 and 22, 1991, from North Texas Cement Co., Texas Industries, Inc., and Box Crow Cement Co. November 18, 1991.

[114] Texas Water Commission, 1992. Interoffice communication from Sam Barrett, Field Investigator, to files regarding compliance inspection at Texas Industries, Inc., Midlothian, Texas. February, 1992.

[115] Texas Water Commission, 1992. Personal communication with Sam Barrett, Field Investigator. June, 1992.

[116] Texas Water Commission, 1992. Letter from Mary B. Adrian, Section Leader, Enforcement Section, TWC, to E.L. Faciane, Staff Vice-President, Environmental Affairs, Texas Industries, p.3. April 15, 1992.

[117] Texas Water Commission, 1992. Interoffice memorandum from Sam Barrett, Field Investigator to files regarding record review of analytical results of samples collected from Texas Industries, Inc. during inspections on January 27, 1992, March 10, 1992, and April 10, 1992. October 21, 1992.

The seepage was again observed during a subsequent inspection of the facility in March 1992. Sample analysis showed the liquid to be extremely alkaline (pH: 13), with levels of arsenic of 0.46 mg/L and chromium at 1.07 mg/L.[118] As a result of the March 1992, inspection, EPA Region 6 filed a Letter of Complaint with Texas Industries, Inc. for violations of RCRA Subtitle C regulations.[119]

Although seepage from the old landfill was observed only as localized pools, there exists a potential for contaminants to migrate beyond plant boundaries. First, the cap on the old disposal area can become eroded[120] and allow stormwater access to disposed CKD. Secondly, the old disposal pile is in close proximity (90 meters) to the East Branch of Cottonwood Creek. Uncontrolled run-off from the old disposal pile would flow into both Cottonwood Creek and adjacent Newton Creek.[121] Furthermore, the probability of an uncontrolled release of CKD into either creek would be highest during a storm event. The characteristic low permeability of soils (10^{-5} cm/sec)[122] within plant boundaries and in the immediate vicinity reduces the effect of rainfall infiltration into the ground, decreasing the volume of surface run-off during a storm event.

As a result of an inspection of both CKD disposal areas in March 1990, the TWC concluded a potential exists for contaminant release from the landfills.[123] TWC based its finding on the presence of the shallow (11 meter depth) water table. CKD in the active area is disposed on the quarry floor at a depth of 18 meters, which is below the level of the perched water table (11 meters).[124] In addition, the volume of disposed dust is high (estimated to be 28,350 cubic meters (37,059 cubic yards and nearby ponded water.[125] The shallow ground-water table combined with the high volume of waste in the active disposal area, the lack of a landfill liner, and the proximity of the active landfill to ponded water combine to create an "unknown potential" for release.[126]

5.3.2 Holnam, Inc., Artesia, Mississippi

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[118] Texas Water Commission, 1992. Letter from Sam Barrett to files regarding samples taken at Texas Industries, *op. cit.*

[119] U.S. Environmental Protection Agency, Region 6, 1992. *Complaint, Compliance Order, and Notice of Opportunity for Hearing in the Matter of Texas Industries, Inc.* Docket Number RCRA VI-203-H. September 30, 1992.

[120] Texas Water Commission, 1992. Personal communication with Sam Barrett, Field Investigator.
November, 1992.

[121] Texas Water Commission, 1993. Personal communication with Sam Barrett, Field Investigator. July, 1993.

[122] Texas Industries, Inc., 1992. *Part B Permit Application*. *op.cit.*

[123] Texas Water Commission, 1990. RCRA Facility Assessment Facility Checklist, *op.cit.*

[124] *Ibid*.

[125] *Ibid*.

[126] *Ibid*.

The Holnam facility is located in Lowndes County, about 5 kilometers (km) (3.1 miles) south of Artesia, Mississippi along Route 45. Facility property encompasses an estimated 120 hectares (300 acres) and is partly located in the 100-year flood plain. The surrounding land use is predominantly rural and agricultural. In 1990, an estimated 60 residents lived within two kilometers of the facility property boundary, with the nearest residence located 900 meters (2,953 feet) to the northwest. At least one private drinking water well is located within the facility's boundary.[127]

Holnam's Artesia facility utilizes one wet process kiln with a 454,000 metric ton (500,440 ton) capacity to produce clinker. In 1992, the plant produced 426,670 metric tons of clinker while burning coal (95,750 metric tons) almost exclusively for its energy needs. The facility started burning hazardous waste as a fuel supplement in June, 1993.[128]

Non-waste derived CKD at Holnam is disposed in an abandoned, water-filled quarry located northeast of the kiln. An estimated 253,000 metric tons of CKD is landfilled in the quarry along the eastern edge. Two other waste CKD disposal areas also exist within facility boundaries at Holnam. A large, older CKD disposal area, with an indeterminate amount of CKD, is located 300 meters east of the active disposal area. In 1993, Holnam created a new disposal area 9 to 12 meters south of the quarry disposal area, to manage hazardous waste-derived CKD.

The quarry lake is filled to a depth of 3.2 meters with 632,000 kiloliters (167 million gallons) of water, comprised of rain water and industrial process water. Water from the quarry lake is pumped to make raw-material slurry and process water for the wet scrubbers. Industrial process water, originating from the clinker cooler scrubber, flows into the quarry from a discharge point located on the southwest side of the quarry lake.[129] Stormwater run-off from the quarry lake discharges via an NPDES permitted outfall into a tributary of the South Branch.[130] Exhibit 5-15 shows the Artesia site.

In May 1993, while collecting samples of CKD and clinker, the Agency measured elevated levels of pH, in surface waters and discharge points within the property boundaries of Holnam's Artesia facility. The pH of water in the quarry lake (described in Agency field notes as a settling pond) was measured at 11.0 at a point along the northeast corner of the abandoned quarry where grading permitted access to the edge of the water. In an open culvert near the discharge point into the quarry lake, clinker cooler water had a measured pH of 11.6. Water in a retention basin at the site of the old CKD waste pile had a measured pH of 11.2.[131] The Agency has no data regarding the potential for release at this site.

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[127] Portland Cement Association, 1991. PCA CKD Survey: Response from Holnam, Inc., Artesia, Mississippi.

[128] United States Environmental Protection Agency, 1993. Unpublished field notes from Phase II CKD sampling trip. May 25, 1993.

[129] U.S. Environmental Protection Agency, 1993. Unpublished field notes collected during visit to Holnam, Inc., Artesia, Mississippi, May 25, 1993.

[130] State of Mississippi, 1992. Permit for stormwater run-off for Holnam, Inc., Artesia, Mississippi; NPDES Permit No. MSR320017.

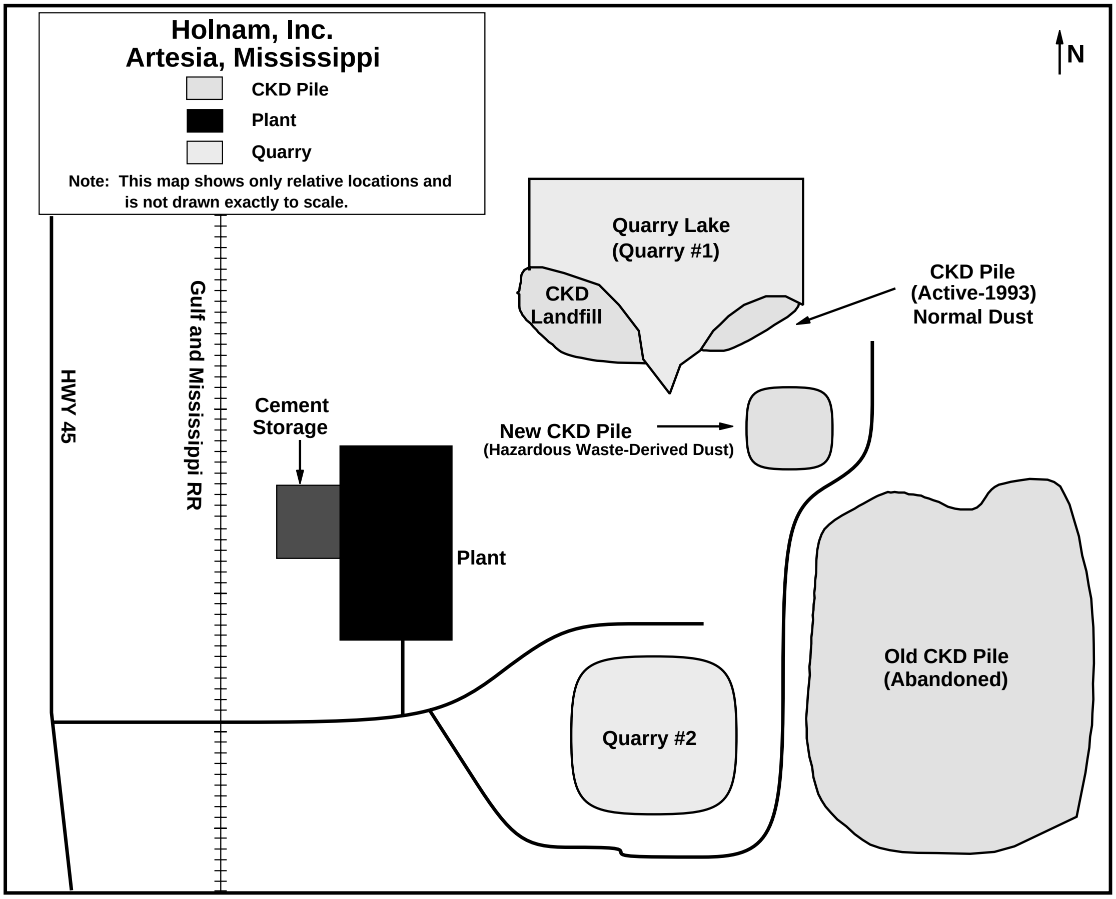
[131] U.S. EPA, 1993. Unpublished field notes collected during CKD sampling visit to Holnam, Artesia, Mississippi. *op.cit.*

5.3.3 Markey Machinery Property, Seattle, Washington

The Markey Machinery Property site is a rectangular, 1.8 hectare (4.4 acre) CKD landfill on industrial property within the city limits of Seattle, Washington.[132] Between 1977 and 1978 an estimated 38,250 cubic meters (m^3) (50,000 cubic yards [yd^3]) of CKD was disposed on the property

[132] GeoEngineers, Inc., 1989. *Environmental Site Assessment, CKD Landfill, Markey Machinery Property, Seattle, Washington*. Prepared for Helsell, Fetterman, Martin, Todd, & Hokanson. August, 1989.

Exhibit 5-15
Site Diagram – Holnam, Inc., Artesia, Mississippi



as fill, allegedly by Ideal Cement.[133] The site, an old truck park, is located within 1,220 meters (4,003 feet) of the Duwamish River, which is classified as a fishery by the State.[134] Although properties immediately adjacent to the site are industrial,[135] there is a nearby population of over 2,600 residents within 0.8 kilometers (0.5 miles) of the site.[136]

The site is immediately adjacent to surface drainage. Along the north boundary is the eastward flowing Ham Creek, which intersects the Duwamish River further downstream. The

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[133] *Ibid*.

[134] Department of Ecology, State of Washington, 1992. *Site Hazard Assessment, Markey Property, Parcel 4, south 96th Street/10th Avenue South, Seattle, Washington*. September, 1992.

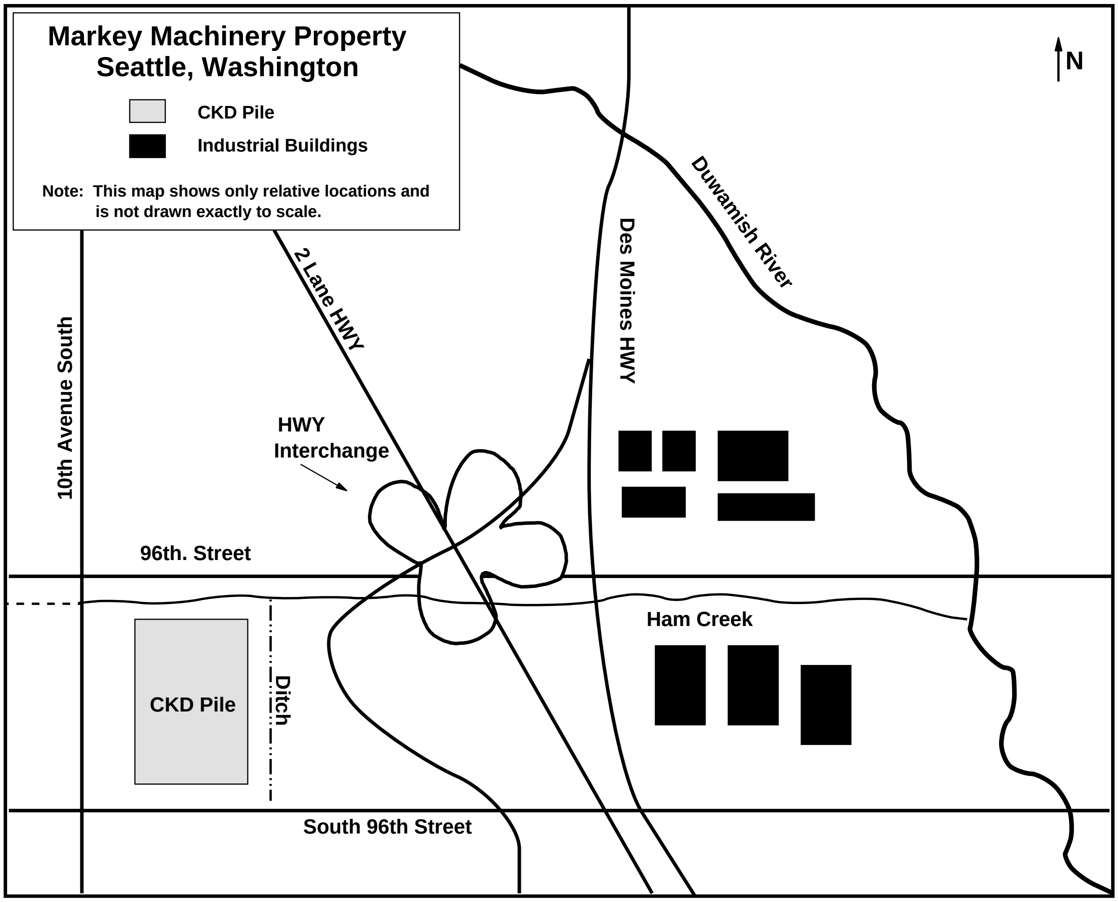
[135] GeoEngineers, Inc., 1989. *op.cit.*

[136] Department of Ecology, State of Washington, 1992. *op.cit.*

east boundary of the site is marked by a ditch with intermittent flow which drains into Ham Creek.[137] Total annual rainfall averages nearly 86 cm (34 inches).[138] The vertical depth to ground water at the site is less than eight meters.[139] The site is shown in Exhibit 5-16.

Exhibit 5-16

Site Diagram – Markey Machinery Property, Seattle, Washington



Analyses of four samples of CKD collected from test pits at the site in 1989, showed elevated concentrations of heavy metals, including arsenic, cadmium, copper, lead, and zinc that were higher than for uncontaminated soils.[140] Two of these samples were collected at locations along the southern margin of the landfill at the furthest distance away from the

[137] GeoEngineers, Inc., 1989. *op.cit.*

[138] Department of Ecology, State of Washington, 1992. *op.cit.*

[139] *Ibid*.

[140] GeoEngineers, Inc., 1989, *op.cit.*

overlying waste debris. Levels of lead (960-1,730 ppm) and arsenic (150-210 ppm) in samples of CKD from the Markey site exceed State soil cleanup standards specified in the Model Toxics Control Act (lead: 250 ppm, arsenic: 20 ppm).[141] Levels of cadmium (1.6-3.8 ppm) exceed the State soil cleanup standard (2.0 ppm)[142] in three out of four samples.[143] The average pH of laboratory leachate from the four samples is highly alkaline (12.4) and just below the State Dangerous Waste criterion of 12.5.[144]

Analyses of ground-water samples collected in 1989 showed the concentrations of dissolved metals to be below established drinking water limits. At the same time, the level of lead in the wells ranged from less than 5 ppb to 8 ppb,[145] and slightly exceeded the State cleanup level for ground water (5.0 ppb)[146] in three out of four wells. Analysis of water level measurement in four ground-water monitoring wells at the site suggests the predominant flow of shallow ground water is northeast toward Ham Creek.[147]

Analysis of surface water has shown the impact of the presence of CKD at Markey Property. A surface water sample collected in 1989 from the ditch along the eastern boundary had an elevated pH of 10.2 and a concentration of lead (0.36 ppm) 24 times the Federal limit for drinking water (0.015 ppm; conversion assumes the density of water to be 1.0 g/cm^3).[148] A sample of standing water along the southern boundary of the site had an alkaline pH of 9.4, and a concentration of lead (0.025 ppm).

The State of Washington Department of Ecology has ranked the Markey Property CKD landfill site a "3" on a scale of one to five, with one representing the highest level of concern and five the lowest.[149] The ranking is a measurement of potential risk to human health and the environment relative to other contamination sites in the State.[150]

Several site characteristics contribute to release potential at the Markey Property site, including: 1) the quantity of CKD used as fill (38,250 m^3); 2) the lack of run-on or run-off

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[141] Department of Ecology, State of Washington, 1991. *The Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC*. As Amended, February, 1991. p. 108.

[142] *Ibid*.

[143] GeoEngineers, Inc., 1989. *op.cit.*

[144] *Ibid*.

[145] GeoEngineers, Inc., 1989. *op.cit.*

[146] Department of Ecology, State of Washington, 1992. *The Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC. As amended*. February, 1992. p. 93.

[147] *Ibid*.

[148] GeoEngineers, Inc., 1989. *op.cit.*

[149] Department of Ecology, State of Washington, 1992. *Site Hazard Assessment, Markey Property, Parcel 4, South 96th Street/10th Avenue South, Seattle, Washington*. September, 1992.

[150] Department of Ecology, State of Washington, 1992. *Washington Ranking Method, Scoring Manual*. As amended. April, 1992.

controls, cover, liner, or leachate containment system at the site; 3) the site's close proximity to populated areas; and, 4) the close proximity of the site to environmentally sensitive surface waters such as the Duwamish River.[151] Enhancing the potential risk that this site poses to human health and the environment are confirmed releases of lead to surface and ground waters around the site.[152]

5.4 DOCUMENTED AIR DAMAGES

In addition to examining documented cases of damage to surface- and ground-water, EPA reviewed available information for evidence of damage to the air media. In most cases, the standard of proof of air damage was an administrative ruling in the form of an NOV of a State or Federal regulation, issued by a State or Federal inspector[153]. For many cases, however, although the Agency was provided with anecdotal information from an interview with a State official, the Agency was unable to locate sufficient documentation to qualify them as damage cases. Additionally, air damage information was gleaned from Hazardous Waste Site Preliminary Assessment forms. The cases that met the standard of proof and the other cases that are less well-documented suggest that cement kilns can be a significant cause of localized air quality problems.

In conducting this study, EPA identified 21 incidents at 12 facilities that met one of the tests of proof. NOVs were issued for these incidents, with three cases eventually settled through a judicial settlement. Six of these facilities have received more than one NOV. With the exception of two cases associated with the accumulation of fugitive dust, all of the cases were associated with visible emission violations (opacity) related to equipment and process malfunctions associated with the dust management system. This usually involved the baghouse, clinker cooler, or dust screw conveyors. The 21 incidents that meet the test of proof are outlined in Exhibit 5-17, Summary of Air Damages.

In general terms, if a visual inspection performed according to Method 9[154] shows opacity to be in excess of 20 percent, the facility is found to be in violation. Most states have adopted the standard of 20 percent, with some states promulgating more stringent standards, such as 10 percent.

Opacity limits are independently enforceable standards set out in the Clean Air Act (see 40 CFR, Part 60, New Source Performance Standards). Opacity is defined as the power of the plume to obscure a background. Opacity is also an indirect measure of particulate matter. EPA uses opacity as an indicator of a problem with the combustion process or an air control device. Since high opacity correlates with high particulate matter, it may signify a health hazard. If opacity is high, EPA will ask for a compliance test to see if the facility meets the PM10 standard[155].

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[151] Department of Ecology, State of Washington, 1992. Site Assessment, Markey Property. *op.cit.*

[152] *Ibid*.

[153] In many cases it was difficult to discern whether CKD was the source of the violation, since some notices merely listed the air control rule that was violated. Where there is no description linking CKD to the violation, the cases are not considered documented damage cases.

[154] 40 *CFR* 60.60.

[155] This stack test measures the size of particulate matter.

Exhibit 5-17

Summary of Air Damage Case Findings

SITE	DESCRIPTION OF VIOLATION	TEST OF PROOF	REGULATING AUTHORITY
Atlantic Cement Company, Ravena, NY	Opacity of kiln stack emissions exceeded 20 percent for a total of 29.3 minutes during an observation time of 60 minutes. The highest opacity was 81 percent.	N.O.V. October 21, 1983	USEPA Region 2 issued N.O.V. NY State Department of Environmental Conservation took enforcement lead
Hercules Cement Company Stockertown, PA	State determined that emissions from the baghouse dust disposal area exceeded the limits of the State's Air Pollution Control Rules and Regulations[a]	N.O.V./Consent Order April 21, 1978	Pennsylvania Department of Environmental Resources
Keystone Portland Cement Bath, PA	Between May 22, 1979 and February 1, 1980, the State observed and notified the company of various particulate emissions, fugitive particulate emission, and visible emission violations caused by point and area air contamination sources: clinker discharge, rock dump, kiln No. 2 waste dust tank, finish mills, No. 2 cement kiln seal, dust dump, raw material storage, No. 1 kiln waste dust system and plant roadway.[b]	N.O.V./Consent Order August 27, 1980	Pennsylvania Department of Environmental Resources
Blue Circle, Atlanta, GA	Excessive opacity from Kiln #1 expansion joint; 20 percent opacity. "Probable" violation of emissions standard at kiln baghouse exhausts. Inspection resulted from citizen complaints of particulate matter collecting on cars, swimming pool, lawn chairs and other items outside homes, originating at Blue Circle.	N.O.V. August 10, 1990 N.O.V. September 25, 1987	Georgia Department of Environmental Resources
Holnam, Inc., Holly Hill, SC	Visible emissions exiting from cement kiln #1 and #2 were observed exceeding the maximum allowable State and Federal limit of 20% opacity. The clinker dust and/or emissions from the baghouse were observed exceeding the maximum allowable 10% opacity.	N.O.V. July 16, 1991 N.O.V. July 11, 1991	South Carolina Department of Health and Environmental Control

Exhibit 5-17 (continued)

Summary of Air Damage Case Findings

SITE	DESCRIPTION OF VIOLATION	TEST OF PROOF	REGULATING AUTHORITY
Santee Cement Company (now Holnam, Inc.) Holly Hill, SC	Opacity excess emissions totalling approximately 12% for the quarter (14,011 minutes) due to equipment/process malfunctions associated with kiln #2.	N.O.V. May 15, 1990	South Carolina Department of Health and Environmental Control
	Opacity excess emissions 13.2% of the quarter (17,605 minutes) due to equipment/process malfunctions associated with kiln #2.	N.O.V. February 26, 1990	
	Opacity emissions in excess of 20% were observed being emitted from kiln #1 for more than six minutes in a one hour period.	N.O.V. August 10, 1989	
Giant Cement Harleyville, SC	In excess of opacity limits from the stack serving kiln #4 and #5 and from the clinker handling and storage area.	N.O.V./Consent Order February 20, 1991	South Carolina Department of Health and Environmental Control
Lafarge Corporation Alpena, MI	Excessive visible emissions from pugmill/pelletizer used to mix CKD and water. This process was observed in operation and visible emissions readings were conducted of the CKD pellets dropping off the conveyor and onto the disposal pile. 76.67% opacity.	N.O.V. August 5, 1991	Michigan Department of Natural Resources
Lone Star Industries Cape Girardeau, MO	Opacity was found to be in excess of 15% from clinker cooler and in excess of 30% from the main kiln stack. This was in violation of the court settlement described below between DNR and Lone Star.	N.O.V. February 4, 1991	Missouri Attorney General (Missouri Department of Natural Resources)
	Existing air pollution control equipment was not of sufficient size to handle periods of high dust loading. Lone Star was violating State's opacity regulation as well as New Source Performance Standards.[c]	Court Settlement September 24, 1990	Missouri Department of Natural Resources
Lone Star Industries Pryor, OK	A sizable accumulation of baghouse waste dust was present on the property outside of the building. In violation of Oklahoma air pollution control regulations governing fugitive dust.	N.O.V. October 3, 1990	Oklahoma State Department of Health
Holnam, Inc. Ada, OK	Excessive particulate emissions from kiln dust storage area blowing off of plant property.	N.O.V. July 23, 1991	Oklahoma State Department of Health

SITE	DESCRIPTION OF VIOLATION	TEST OF PROOF	REGULATING AUTHORITY
National Cement Lebec, CA	Excessive emissions from kiln baghouse. Emissions ranged from 40 to 100% opacity.	N.O.V. October 7, 1992	Kern County, California Air Pollution Control District
Kaiser Cement (now Mitsubishi Cement) Lucerne Valley, CA	Particulate emissions from baghouse controlling kiln emissions, above allowable limits.	N.O.V. September 23, 1987	San Bernadino, California Air Pollution Control District
Calveras Cement Co. Monolith, CA	Excessive dust from ductwork carrying gases from kiln to baghouse; grey plume 20%-40% opacity. Excessive emissions from chute to kiln baghouse; 60%-100% opacity. Excessive emissions from dust collection bin west of rotary kiln; 35%-50% opacity.	N.O.V. August 5, 1992 N.O.V. February 7, 1992 N.O.V. August 22, 1991	San Joaquin Unified Air Pollution Control District (Kern Co., CA)

[a] Hercules agreed to install air pollution control equipment to eliminate dust emissions from the baghouse area.

[b] Keystone Portland agreed to take corrective measures to keep the above-described emissions to a minimum.

[c] Settlement between Missouri Department of Natural Resources, the State Attorney General, and Lone Star. In order to satisfy the regulations and ensure they could meet the regulation, Lone Star undertook an agreement to reduce emissions by 100 tons per year through the installation of new air pollution control equipment. The agreement provided for a 30 percent opacity limit until new air pollution control equipment was installed.

EPA also identified 50 citizen complaint forms from the files of three states aimed at seven different cement kiln plants. In the case of the Blue Circle Cement plant in Atlanta, Georgia, such complaints resulted in an NOV (Exhibit 5-17). In this case, a number of citizens in the vicinity of the cement plant complained of particulate matter originating at the plant, collecting on their cars, lawn chairs, window sills and other items located outside of their homes. Although at the time of the inspection, the opacity of the plume did not appear excessive, considering the large exhaust area of the baghouse monitors to the atmosphere, State officials concluded that mass emissions probably exceeded Georgia Air Quality Rules. Generally, the other citizen complaints were similar in nature to those received for Blue Circle Cement.

In addition, nine citizens complained of respiratory problems believed to be associated with emissions originating from the cement kiln plant. The health complaints were unsubstantiated, however.

5.5 CKD MANAGEMENT SCENARIOS OF CONCERN

There are a few CKD management scenarios which may pose a high calculated risk under specific reasonable worst case conditions. These situations are highlighted below. The risks associated with these scenarios are described in more detail in Chapter 6. While they are believed to be relatively infrequent, they are, nevertheless, plausible given the range of observed concentrations of constituents in CKD.

In particular, disposal of CKD in exposed, unlined piles that are adjacent to actively tilled agricultural fields may present higher risks (Exhibit 5-18). Analysis shows there is a greater potential for risk through the foodchain from the ingestion of vegetables, meat, milk, and soil contaminated by arsenic and dioxins through atmospheric deposition of CKD from nearby piles. The close proximity of an active agricultural field to the exposed CKD pile has been observed twice in the course of EPA site visits.

The Agency is also concerned about the practice of management of CKD underwater, and in quarries, in particular. CKD disposal in a quarry that later filled with water is a prominent factor in two cases of documented damage, one of which is a National Priorities List Superfund site. Investigations at these sites noted that CKD-contaminated waters were likely sources of contamination of surrounding surface waters and groundwaters.

Although the Agency's calculated risk associated with the management of CKD under water is low, the Agency did not assume karst topography (an irregular topography with sinks, underground streams, and caverns) when it modeled CKD management underwater in quarries. This risk could be higher in scenarios where CKD is managed in areas with limestone bedrock and karst topography. Cavernous limestones are highly jointed and fractured and can conduct large volumes of groundwater rapidly for significant distances. Water-CKD mixtures migrating through cavernous limestones can enter shallow groundwater bodies with little or no attenuation, exposing to risk all nearby population that may drink the water and degrading the environmental quality of nearby groundwaters and surface waters.

Exhibit 5-18

Example of CKD Disposal Adjacent to an Agricultural Field

CHAPTER FIVE

DOCUMENTED DAMAGES FROM MANAGEMENT OF CKD

LIST OF EXHIBITS