DECLARATION

Site Name and Location

Southwestern Portland Cement Company Landfill No. 6
Fairborn, Greene County, Ohio

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Southwestern Portland Cement Company Landfill No. 6 site in Fairborn, Ohio, chosen in accordance with the policies of the Ohio Environmental Protection Agency, statutes and regulations of the State of Ohio, and the National Contingency Plan, 40 CFR Part 300.

Assessment of the Site

Landfill No. 6 is located one mile east of Fairborn, south of State Route 235 and east of Interstate 675, in Bath Township, Greene County, Ohio. The landfill and surrounding affected area encompass approximately 100 acres. The 30-acre landfill contains approximately 1.2 million cubic yards of cement kiln dust, kiln brick, solid waste, clean fill, and cover soil.

Leachate, produced by rainfall and ground water moving through the landfill wastes, discharges from several seeps along the west and south sides of the landfill. The leachate is alkaline, with pH values exceeding 13 standard units (S.U.), and contains higher levels of dissolved minerals than are normally found in surface water.

On July 2, 1992, Ohio EPA ordered Southdown, Inc. (Southdown) to complete a remedial investigation (RI) and feasibility study (FS) and to implement an interim action to address the discharges of leachate at the site. The RI found site-related contaminants in soil, sediment, ground water, and surface water emanating from springs and seeps at the base of the landfill.

Southdown initiated an interim action at the site in late 1993. The landfill was capped and a surface water/leachate collection and treatment system was installed. Leachate is collected in tile drains along the toe of the landfill and is neutralized and stored in two tanks. Rainwater draining across the landfill is collected and stored in basins. Periodically, neutralized leachate and the stored rainwater is mixed and discharged to the wetlands west of the landfill. Southdown holds a National Pollutant Discharge Elimination System permit for this discharge. The surface water/leachate collection and treatment system has operated since May 1995 and has reduced the amount of contaminants discharged to the wetlands along the west and south sides of the landfill.

Since the implementation of the interim action, vegetation has developed in areas of the wetlands that formerly were devoid of plants. However, the midportion of most of the drainageways continues to be barren. In addition, the levels of contaminants in soil, sediment, and ground water at parts of the site present a risk to human health and the environment. Parameters that are found at concentrations above acceptable risk-based levels or other standards include pH, arsenic, and vanadium in sediment; aluminum, arsenic, pH, beryllium, and vanadium in soil; and molybdenum and ammonia in ground water.

Southdown estimated that if no action was taken, the excess lifetime cancer risk for future residents, for all of the pathways evaluated, would be 3×10^{-2} (if 100 people were chronically exposed to hazards created by the site, three people would probably develop cancer during his or her lifetime). This is greater than the 10^{-4} and 10^{-6} risk range established by the National Contingency Plan (NCP). The hazard index for noncarcinogenic risks for future residents was estimated to be 119. A hazard index of 1 is the threshold value below which it is unlikely for even sensitive populations to experience adverse health effects. A hazard index of greater than 1 means there is the possibility of noncancerous effects on humans.

If no action is taken, toxic effects will continue to occur to aquatic life, plants, and wildlife around the perimeter of the landfill and in the vicinity of the drainageways that receive leachate discharges.

Description of the Selected Remedy

The preferred soil/sediment alternative is alternative S-3, the excavation of contaminated soil and sediment and their placement in a satellite landfill adjacent to the existing landfill. This alternative includes the maintenance of the existing landfill cap and the continued operation of the surface water/leachate collection and treatment system.

The preferred ground-water alternative is G-2a, the installation of a ground water collection trench upgradient from the landfill. The surface water/leachate collection and treatment system would continue to operate until the landfill is dewatered. In addition, fencing around the site would be maintained and deed restrictions would be placed on the property to limit the future use of the impacted area.

Statutory Determinations

The selected remedial action is protective of human health and the environment, complies with legally applicable state and federal requirements, is responsive to public participation and input and is cost-effective. The remedy utilizes permanent solutions and treatment technologies to the maximum extent practicable to reduce toxicity, mobility and volume of hazardous substances at the site. The effectiveness of the remedy will be reviewed regularly.

Joseph P. Koncelik, Director

Date 9/22/06

State of Ohio
Environmental Protection Agency

Division of Emergency and Remedial Response

Decision Document for the Remediation of Southwestern Portland Cement Company Landfill No. 6 Greene County, Ohio

September 7, 2006

Bob Taft, Governor
Joseph P. Koncelik, Director

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Joseph P. Koncelik, Director Date

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for Southwestern Portland Cement Company Landfill No. 6

Fairborn, Ohio

1.0 SITE BACKGROUND

1.1 Site History

Landfill No. 6 is located one mile east of Fairborn, south of State Route 235 and east of Interstate 675, in Bath Township, Greene County, Ohio (see Figure 1). The landfill and surrounding affected area encompass approximately 100 acres. The 30-acre landfill contains approximately 1.2 million cubic yards of cement kiln dust, kiln brick, solid waste, clean fill, and cover soil. Past owners of the site include the Southwestern Portland Cement Company and Southdown, Inc. Southdown, Inc. was acquired by CEMEX , S. A. De C. V. (CEMEX) in 2000. As a result of this transaction, Southdown, Inc. became an indirect subsidiary of CEMEX. Following the acquisition by CEMEX, Southdown, Inc. continued to operate as an entity and continued to own and operate the Fairborn facility (including the landfill). Southdown, Inc. changed its name to CEMEX, Inc. in 2001.

The majority of the land within one mile of the landfill is rural. Tracts north, east, and southeast of the landfill have been quarried for limestone. Housing developments in the city of Fairborn are located approximately one mile north and one mile west of the site.

Landfill No. 6 was deposited on the southwestern slope of local topographic high known as Reed's Hill. Reed's Hill was quarried for limestone by the Southwestern Portland Cement Company from 1924 until the early 1940s. Aerial photographs suggest that the disposal of cement kiln dust and solid waste at the site started sometime between 1940 and 1947. Waste disposal appears to have ceased by 1980.

The majority of the waste in the landfill is cement kiln dust, a particulate byproduct of cement production. A material safety data sheet from Southdown, Inc. indicates that the cement kiln dust from the facility is primarily composed of 20-45% calcium carbonate ($CaCO_3$), 10-35% calcium oxide (CaO), 10-22% silicon oxide (SiO), 2-7% magnesium oxide (MgO), and 1-6% potassium sulfate (K_2SO_4) (by weight). Other materials placed in the landfill include residential debris, paper, wooden pallets, shipping containers, general plant trash, spent lubricants, and kiln brick.

Figure 2 shows a cross-section view of the site. The cement kiln dust was deposited on the hillside over the existing soil. The two bedrock formations of concern are the upper Brassfield Formation comprised of limestone and dolomite and the Elkhorn Formation comprised of shale and limestone. Ground water presently flows from the overburden and bedrock into the cement kiln dust. From there the contaminated ground water flows on toward the wetlands and ground water at the base of the hill

Surface water drains west and south from the landfill to wetlands that are the headwaters of Beaver Creek. Prior to the capping of the landfill and the construction of a leachate collection and treatment system, highly alkaline water flowed from the site and contaminated the wetlands and Beaver Creek. Ground water west and south of the landfill is also contaminated.

1.2 Summary of the Remedial Investigation

The RI was conducted by Southdown, Inc. and included a number of tasks to identify the nature and extent of site-related chemical contaminants. The investigation was conducted with oversight by Ohio EPA, and the RI report was approved on February 17, 1995. The tasks included sampling of air, subsurface gas, soil, surface water, and ground water. The data obtained from the investigation were used to conduct a baseline risk assessment and to determine the need to evaluate remedial alternatives. This decision document contains only a brief summary of the findings of the RI and FS. Please refer to the RI report and the FS reports for additional information on contaminant concentrations.

The nature and extent of contamination at the site and the contaminants of concern attributable to the site are described below:

1.2.1 Soil Contamination

Surface and subsurface were adversely affected through contact with impacted surface and ground water emanating from the landfill. Concentrations of a number of chemicals exceeded background concentrations at one or more sampling locations. This is believed to be attributable to the precipitation of metals in ground water and surface water as pH levels in the water decrease.

1.2.2 Surface Water and Sediment Contamination

Surface water emanating from several seeps and springs at the landfill was chemically similar to impacted ground water with elevated pH, total dissolved solids (TDS), and low hardness. Surface water drains to Beaver Creek. Sediment in drainages originating at the landfill had concentrations of copper, magnesium, arsenic, vanadium, and manganese above background concentrations. The increased metals concentration may result from the adsorption of metals present in surface water onto the sediment.

1.2.3 Ground Water Contamination

Ground water southwest of the landfill contained concentrations of pH, TDS, ammonia, chloride, sulfate, potassium, sodium, arsenic, antimony, beryllium, selenium, cadmium, mercury, molybdenum, nickel, and vanadium greater than background levels.

1.2.4 Impacts to Biological Resources

Impacts to aquatic life, plants, and wildlife were seen around the perimeter of the landfill and near the vicinity of the drainages receiving leachate discharges. The major cause of severe effects was elevated pH (as high as 13 S.U.). These concentrations were sufficiently caustic to cause direct mortality of any vegetation, aquatic life, or wildlife that may have experienced prolonged contact with impacted media.

1.3 Additional Information Obtained By Ohio EPA Subsequent to the Remedial Investigation

On February 4, 2003, Ohio EPA received a report titled *Southdown, Inc. Leachate Treatment System Evaluation at the Cement Kiln Dust Landfill No. 6 Fairborn, Ohio December 3, 1997*, that estimated the costs for treating leachate from the landfill. This report was used by Ohio EPA to develop new cost estimates for the ground-water alternatives.

Ohio EPA measured the pH of ground-water samples from eight upgradient wells at the landfill on November 24 and 25, 2003. Water from well BRW-8 had a pH greater than 9.0 S.U., while the pH of the other wells varied from 6.8 to 7.4 S.U. Water from well BRW-8 was blended with water from BRW-10 at a 50:50 ratio, and the pH of the mixture was 7.2 S.U. This demonstrated that although some upgradient ground water had pH levels that would require treatment before being discharged to surface water, if allowed to blend with other ground water, such as would occur in an interception trench, the resulting mixture would probably not require pH neutralization before being discharged.

In 2004, Ohio EPA conducted single-well aquifer pumping tests on five monitoring wells primarily screened in the Elkhorn Formation. The purpose of these tests was to obtain information needed to model the performance of the different upgradient ground-water alternatives. Using the hydraulic conductivity values obtained from the aquifer test, Ohio EPA modeled ground-water flow at the site and found that the four monitoring wells screened in the landfill would go dry approximately four years after the installation of the upgradient trench. The other upgradient ground-water remedies were either less effective or not effective at all at preventing ground water from entering the landfill.

Ohio EPA revised several of the ground-water alternatives by decreasing the amount of time required to operate the wastewater treatment plant since the plant would not be needed after the landfill dewatered. The costs for the ground-water alternatives were also revised based on information received from CEMEX about how the costs were estimated. The reduction in operation and maintenance costs due to the decrease in time for the operation of the wastewater treatment plant significantly reduced the costs for several of the ground-water alternatives.

1.4 Interim or Removal Actions Taken to Date

Southdown initiated an interim action at the site in late 1993. The landfill was capped, and a surface water/leachate collection and treatment system was installed. Leachate is collected in tile drains along the toe of the landfill and is neutralized and stored in two tanks. Rainwater draining across the landfill is collected and stored in basins. Periodically, neutralized leachate and the stored rainwater is mixed and discharged to the wetlands west of the landfill. Southdown holds a National Pollutant Discharge Elimination System permit for this discharge. The surface water/leachate collection and treatment system has operated since May 1995 and has reduced the amount of contaminants discharged to the wetlands along the west and south sides of the landfill. However during periods of high ground-water flow, the volume of leachate exceeds the treatment system's capacity. When this occurs, flows from the leachate collection system are blocked from entering the treatment plant.

Since the implementation of the interim action, vegetation has developed in areas of the wetlands that formerly were devoid of plants. However, the midportion of most of the drainageways continues to be barren. In addition, the levels of contaminants in surface water, soil, sediment, and ground water at parts of the site present a risk to human health and the environment.

2.0 SUMMARY OF SITE RISKS

A baseline risk assessment was conducted to evaluate current and future risks to human health and ecological receptors associated with contaminants present at the site. The results demonstrated that the existing concentration of contaminants in environmental media pose risks to human and ecological receptors at a level sufficient to trigger the need for remedial actions.

2.1 Risks to Human Health

Table 1. Chemicals of Concern for the Southwestern Portland Cement Landfill No. 6 Site.

Metals	*Semivolatile Organic Compounds*	*Water Quality Parameters*
Aluminium	Benzo(a)anthracene	Ammonia
Antimony	Benzo(a)pyrene	pH
Arsenic	Benzo(b)fluoranthene	Total Dissolved Solids
Beryllium	Benzo(k)fluoranthene	
Boron	Bis(2-ethylhexyl)phthalate	
Cadmium	Dibenz(a,h)anthracene	
Chromium	Indeno(1,2,3-cd)pyrene	
Copper	4-Methylphenol	
Iron	Phenol	
Lead		
Manganese		
Mercury		

Metals	*Semivolatile Organic Compounds*	*Water Quality Parameters*
Molybdenum		
Nickel		
Selenium		
Silver		
Vanadium		
Zinc		

The following exposure pathways were evaluated.

- Dermal contact with and ingestion of surface water
- Dermal contact with and ingestion of sediment
- Dermal contact with and ingestion of ground water
- Dermal contact with and ingestion of surface and subsurface soil

Three exposure scenarios were evaluated: current residents living near the site, future residents living on or near the site, and future workers at the site. The current resident scenario assumes that people will spend time on areas immediately outside the security fence around the landfill. The future resident scenario assumes that people will spend time in areas within the security fence, consume water from an on-site well, and will be exposed to surface and subsurface soil.

The risks associated with current and future residents were unacceptable for noncarcinogens. The hazard index for current residents was 4 while that for future residents was 119, both which exceed the acceptable maximum hazard index of 1. Ingestion of ground water containing metals posed the greatest noncarcinogenic risk.

The risks associated with current and future residents were also unacceptable for carcinogens. The excess carcinogenic risk for current residents is 2 in 10,000 (2×10^{-4}) and for future residents is 3 in 100 (3×10^{-2}) which exceeds the acceptable excess carcinogenic risk range of one in 10,000 to one in 1,000,000 (10^{-4} to 10^{-6}). Most of the carcinogenic risk to current residents comes from exposure to polycyclic aromatic compounds (types of semivolatile organic compounds) in surface water while most of the carcinogenic risk to future residents is due to arsenic in ground water. The exposure assessment was conducted prior to the implementation of the interim action.

2.2 Risks to Ecological Receptors

The ecological risk assessment found that toxic effects occurred to aquatic life, plants, and wildlife around the perimeter of the landfill and near the drainages that received leachate discharges south and west of the site. The major cause of severe effects to ecological receptors was elevated pH. Sediment and soil profiles and observations of stressed vegetation, indicative of high pH levels, are confined to surface waters, sediment, and soil in drainages, and to soil within a 10- to 15-foot wide strip on either bank of the drainages. There were no effects predicted for any federal or state-designate threatened or endangered species because none of these species are associated with the site.

3.0 FEASIBILITY STUDY

A FS was conducted by Southdown, Inc. to define and analyze appropriate remedial alternatives. The study was approved by Ohio EPA on April 13, 1997. On September 30, 1998, the FS report was amended to address a proposed change in the discharge location of the surface water/leachate collection system from the wetlands to the Fairborn wastewater treatment plant. As of this writing, the surface water/leachate collection system continues to discharge to the wetlands. The RI and FS are the basis for the selection of Ohio EPA's preferred remedial alternative.

4.0 REMEDIAL ACTION OBJECTIVES

As part of the RI/FS process, remedial action objectives (RAOs) were developed in accordance with the NCP, 40 CFR Part 300, which was promulgated under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, and in accordance with U.S. EPA guidance. RAOs consist of medium-specific or operable unit-specific goals for protecting human health and the environment. RAOs specify the contaminants of concern, exposure routes and receptors, and an acceptable contaminant level or range of levels for each exposure route. They provide a general description of what the cleanup will accomplish.

The RAOs developed for the site are:

- Maintain the landfill cap to prevent ground-water recharge and to minimize the percolation of water into and through the landfill.

- Eliminate the potential for unacceptable human and plant/wildlife exposure to cement kiln dust in soil, sediment, and surface water.

- Eliminate, as needed, unacceptable migration of cement kiln dust leachate to Beaver Creek.

- Eliminate, as needed, unacceptable cement kiln dust constituent concentrations in downgradient ground water beyond the perimeter of the landfill.

Preliminary remediation goals (PRGs) are the more specific statements of the desired endpoint concentrations or risk levels, for each exposure pathway, that are believed to provide adequate protection of human health and the environment based on preliminary site information. Initial PRGs are developed early in the RI/FS process and are based on applicable or relevant and appropriate requirement (ARARs) and other readily available information, such as concentrations associated with 10^{-6} cancer risk or a hazard quotient equal to 1 for noncarcinogens calculated from U.S. EPA toxicity information.

Risk-based PRGs were developed for a potential residual carcinogenic risk level of 1 in 1,000,000 and a non-cancer hazard quotient of 1 using a range of potentially exposed receptors, such as industrial workers and on-site residents. The carcinogenic risk level refers to the increased likelihood that someone exposed to the chemical releases from the site would develop cancer during his lifetime as compared with a person not exposed to the site. For example, a 1 in 1,000,000 risk level means that if 1,000,000 people were chronically exposed to the hazards created by the site, one would probably develop cancer during his or her lifetime. Note that these risks refer only to the incremental risks created by exposures from the site. They do not include the risks of cancer from other non-site related factors to which people may be exposed. Noncarcinogenic risks are generally expressed in terms of a hazard quotient or index, which combines the concentration of chemical exposures with the toxicity of the chemicals (quotient refers to the effects of an individual chemical whereas index refers to the combined effects of all chemicals).

The PRGs were developed to ensure that remedial actions reduce the projected risk to humans to acceptable levels. The U.S. EPA, through the NCP defines acceptable remediation goals for known or suspected carcinogens to be concentration levels that represent an upper bound excess lifetime cancer risk, above that of the background, to an individual of between 1 in 10,000 and 1 in 1,000,000 using information on the relationship between dose and response with the 1 in 1,000,000 risk level as the point of departure (the level of risk at which further remedial action is considered unnecessary). Noncarcinogenic risks are also to be reduced to an acceptable level, which corresponds to a hazard index of 1, at which harmful effects are generally not observed in exposed persons. In a similar manner, important ecological resources such as waters of the state or endangered species will also be protected.

Initial PRGs may be modified based on exposure, uncertainty, and technical feasibility factors. As data are gathered during the RI and FS, PRGs are refined into final contaminant-specific cleanup goals.

The PRGs were calculated using U.S. EPA's Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remedial Goals) EPA/540/R-92/003, December 1991. According to the procedures in RAGS, non-zero maximum contaminant level goals (MCLGs) as listed by the Safe Drinking Water Act and Ohio Administrative Code §3745-81-11 and §3745-81-12 are substituted where appropriate, for the risk-based numbers. The final cleanup goals for the site are the PRGs developed during the RI and FS. The cleanup goals are listed below.

Table 2. Summary of Ground Water, Surface Water, Soil, & Sediment Cleanup Goals

Chemical	Ground Water (ug/L)	Surface Water (ug/L)	Surface Soil & Sediment (mg/kg)	Subsurface Soil (mg/kg)
Semivolatile Organic Compounds				
Benzo(a)anthracene	0.083[A]		0.9[A]	0.9[A]
Benzo(a)pyrene	0.0083[A]		0.09[A]	0.09[A]
Benzo(b)fluoranthene	0.083[A]		0.9[A]	0.9[A]
Benzo(k)fluoranthene	0.83[A]			
Bis(2-ethylhexyl)phthalate	19[C]			
Dibenzo(a,h)anthracene			0.09[A]	0.09[A]
Ideno(1,2,3-cd)pyrene			0.9[A]	0.9[A]
4-Methylphenol		6.2[C]		
Phenol		370[C]		
Metals				
Aluminum			20,600	
Antimony	6[B]	190		
Arsenic	42[B]	100	14[B]	11[B]
Beryllium	3.4[B]		1.1[B]	1.1[B]
Boron	5700[B]			
Cadmium	10[A]	2.9[C]		
Chromium (total recoverable)		210[C]		
Copper		27[C]		
Iron		1000[C]	60,000[D] (soil) 27,500[B] (sed)	
Lead		22[C]		
Manganese		100[C]	1904[B]	1375[A]
Mercury		0.91[C]		
Molybdenum	90[A]			
Nickel	170[B]	200[C]		
Selenium	10[C]	5[C]		
Silver		1.3[C]		
Vanadium		45[C]	39[B]	1925[A]
Zinc		230[C]		
Conventional Water Quality Parameters				
Ammonia	2,280[B]	1,800[C]		
pH		6.5-9.0 S.U.[C]	8.5 S.U.[D]	
Total dissolved solids (TDS)		1,500,000[C]		

Values for hardness-dependent metals are based on 300 mg/L $CaCO_3$.
[A]-Human health based cleanup goal
[B]-Background upper tolerance limit based cleanup goal
[C]-ARAR based cleanup goal
[D]-Ecological effects based cleanup goal

5.0 SUMMARY OF REMEDIAL ALTERNATIVES

Six soil and eight ground-water remedial alternatives were considered in the FS. A brief description of the major features of each of the remedial alternatives follows in Table 3, Soil and Sediment Remedial Alternatives and Table 4, Ground water Remedial Alternatives. More detailed information about these alternatives can be found in the FS report.

Table 3. Soil and Sediment Remedial Alternatives*

Alternative	*Description*
S-1. Interim action/long-term monitoring (no action)	Operate the existing surface water/leachate collection & treatment system with no additional remedial action. Includes limited soil and sediment sampling.
S-2. Cap soil/sediment in place	Install a new cap over soil/sediment exceeding cleanup levels. The cap would consist of clay, bentonite or synthetic materials beneath a soil and vegetation cover.
S-3. Excavate soil/sediment and cap on-site	Excavate soil/sediment that exceeds cleanup levels, backfill with clean fill, and place soil/sediment in prepared area adjacent to landfill and cap.
S-4. Excavate soil/sediment and dispose off-site	Excavate soil/sediment that exceeds cleanup levels, backfill with clean fill, and transport off-site for disposal.
S-5. Stabilize soil/sediment in situ, and cap	Stabilize soil/sediment with concentrations exceeding cleanup levels, cap stabilized soil/sediment.
S-6. Reroute part of Beaver Creek's stream bed and cap sediment in place	Excavate a clean parallel trench to divert water around the contaminated area and cap existing stream bed.

*Alternatives S-2 through S-6 include the interim actions described in S-1.

Table 4. Ground Water Remedial Alternatives **

Alternative	*Description*
G-1. Interim Action/Long-term monitoring	Operate the existing surface water/leachate collection and treatment system with no additional remedial action. Includes performance monitoring and a deed restriction on the property.
G-2a. Upgradient collection trench	Install a ground water collection trench upgradient from the landfill. Includes continued operation of the surface water/leachate collection and treatment system until landfill dewaters.
G-2a. Downgradient collection trench	Install a ground water collection trench downgradient from the landfill. Collected ground water would be treated as necessary and discharged to the sanitary sewer. Includes expansion and continued operation of the surface water/leachate collection and treatment system.

Table 4. Ground Water Remedial Alternatives **

Alternative	*Description*
G-2b. Upgradient extraction wells	Install ground water extraction wells upgradient from the landfill. Includes continued operation of the surface water/leachate collection and treatment system until landfill dewaters.
G-2b. Downgradient extraction wells	Install ground water extraction wells downgradient from the landfill. Treat the collected ground water as necessary and discharge to the sanitary sewer. Includes expansion and continued operation of the surface water/leachate collection and treatment system.
G-2b1. Extraction wells at outbreaks	Install a limited number of extraction wells at seeps to collect impacted ground water at times of high ground water elevations. The collected ground water would be treated and discharged to the sanitary sewer. Includes expansion and continued operation of the surface water/leachate collection and treatment system.
G-3. Upgradient slurry wall	Install a cement-bentonite slurry wall around the upgradient sides of the landfill to divert ground water from flowing into the landfill. Hydraulic relief may also be required to prevent ground water mounding. Includes continued operation of the surface water/leachate collection and treatment system until landfill dewaters.
G-3. Perimeter slurry wall	Install a cement-bentonite slurry wall around the perimeter of the landfill to prevent ground water from flowing into the landfill. Hydraulic relief may also be required to prevent ground water mounding. Includes continued operation of the surface water/leachate collection and treatment system until landfill dewaters.

**Alternatives G-2 through G-3 include the interim actions described in G-1.

6.0 COMPARISON AND EVALUATION OF ALTERNATIVES

6.1 Evaluation Criteria

In selecting a remedy for a contaminated site, Ohio EPA considers the following eight evaluation criteria as outlined in U.S. EPA's NCP promulgated under CERCLA (40 CFR 300.430):

1. Overall protection of human health and the environment. Remedial alternatives shall be evaluated to determine whether they can adequately protect human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site.

2. Compliance with all applicable or relevant and appropriate requirements (ARARs). Remedial alternatives shall be evaluated to determine whether a remedy will meet all of the applicable or relevant and appropriate requirements of state and federal environmental laws or other to be considered criteria (TBCs) such as MCLGs or health-based cleanup levels.

3. Long-term effectiveness and permanence. Remedial alternatives shall be evaluated to determine the ability of a remedy to maintain reliable protection of human health and the environment over time once pollution has been abated and RAOs have been met. This includes assessment of the residual risks remaining from untreated wastes, and the adequacy and reliability of controls such as containment systems and institutional controls.

4. Reduction of toxicity, mobility, or volume through treatment. Remedial alternatives shall be evaluated to determine the degree to which recycling or treatment are employed to reduce toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site.

5. Short-term effectiveness. Remedial alternatives shall be evaluated to determine the following: (1) short-term risks that might be posed to the community during implementation of an alternative; (2) potential impacts on workers during remedial action and the effectiveness and reliability of protective measures; (3) potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation; and (4) time until protection is achieved.

6. Implementability. Remedial alternatives shall be evaluated to determine the ease or difficulty of implementation and shall include the following as appropriate: (1) technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy; (2) administrative feasibility, including activities needed to coordinate with other offices and agencies and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions); and (3) availability of services and materials, including the availability of adequate off-site treatment, storage capacity, and disposal capacity and services; the availability of necessary equipment and specialists, and provisions to ensure any necessary additional resources; the availability of services and materials; and the availability of prospective technologies.

7. Cost. Remedial alternatives shall evaluate costs and shall include the following: (1) capital costs including both direct and indirect costs; (2) annual operation and maintenance costs (O&M), and (3) net present value of capital and O&M costs. The cost estimates include only the direct costs of implementing an alternative at the site and do not include other costs, such as damage to human health or the

environment associated with an alternative. The cost estimates are based on the FS and additional information including aquifer pumping tests and upgradient water quality testing obtained in 2003, 2004, and 2005. That information provided a basis for a better estimate of the volume of ground water needing treatment.

8. Community acceptance. Remedial alternatives shall be evaluated to determine which of their components interested persons in the community support, have reservations about, or oppose. Public comments on the preferred plan were evaluated and responsiveness summary prepared (see Appendix).

Evaluation criteria 1 and 2 are threshold criteria required for acceptance of an alternative that has accomplished the goal of protecting human health and the environment and complied with the law. Any acceptable remedy must comply with both of these criteria. Evaluation criteria 3 through 7 are the balancing criteria for selecting the best remedial alternatives. Evaluation criterion 8, community acceptance, is a modifying criterion that is determined by the comments received during the public comment period.

6.2 Analyses of Evaluation Criteria for Soil and Sediment

This section looks at how each of the evaluation criteria is applied to each of the soil and sediment remedial alternatives found in Section 5.0 and compares how the six alternatives achieve the criteria.

6.2.1 Overall Protection of Human Health and the Environment

All of the alternatives except for S-1 and S-6 meet this criterion.

Alternative S-1 does not include any actions beyond the continued operation of the interim action (landfill cap and leachate collection and treatment system) that will reduce contaminant concentrations in soil and sediment. Sampling results from 1993 through 1998 show many instances where soil and sediment cleanup levels have been exceeded. No statistically valid trends showing decreases in soil and sediment contaminant concentrations have been identified.

Alternative S-2, capping soil and sediment in place, breaks the exposure pathway by preventing contact with soil and sediment that exceed cleanup levels. Residual risk would be posed by the encapsulated soil and sediment plus the waste in the existing landfill because if a cap was breached, exposure to waste would occur. This alternative would permanently disturb wetlands.

Alternative S-3, excavating and landfilling soil and sediment at another on-site location, breaks the exposure pathway by preventing contact with sediment and soil that exceed cleanup levels. Residual risk would be posed by the encapsulated soil and sediment plus the waste contained in the existing landfill because if a cap was breached, exposure to waste would occur. This alternative would temporarily disturb wetlands.

Alternative S-4 satisfies the criterion by removal of soil and sediment that exceed cleanup levels but would also temporarily disturb wetlands at the site.

Alternative S-5 would treat soil and sediment resulting in no additional residual risk posed by the site beyond that posed by the untreated waste contained in the landfill. However, S-5 would permanently disturb wetlands.

Alternative S-6 only applies to sediment in Beaver Creek and does not address contaminated soil and sediment at other locations. Thus, S-6 does not satisfy this criterion.

6.2.2 Compliance with ARARs

The FS identifies potential federal and state ARARs for the site. ARARs are separated into three categories: chemical-specific, action-specific, and location-specific. There are no chemical-specific ARARs for any of the soil and sediment contaminants. Therefore, only location- and action-specific ARARs apply.

The ARARs that pertain to alternative S-1 are limited to the ARARs applicable to the ongoing operation of the leachate/surface water collection and treatment system.

All of the alternatives will comply with the federal and state (Ohio Revised Code and Ohio Administrative Code) action-specific ARARs. These ARARs include Ohio's laws and rules for air pollution, hazardous waste, and solid waste; Ohio's Water Quality Standards and Water Use Designations and Criteria; and Section 404 of the federal Clean Water Act.

All of the alternatives will comply with federal and state location-specific ARARs. These ARARs include the inspection and licensing components of Ohio's solid waste regulations, Ohio's Water Quality Standards and Water Use Designations and Criteria, and Section 404 of the federal Clean Water Act. Construction in the wetlands for the interim action was authorized under the provisions of the Nationwide Permit, 33 CFR 330 Appendix A (B) (38) for the cleanup of hazardous and toxic waste. Any additional loss of wetlands would necessitate the re-examination and possible modification of the Nationwide Permit.

6.2.3 Long-Term Effectiveness and Permanence

Alternative S-5 appears to satisfy the criterion of long-term effectiveness and permanence to a greater degree than the remaining alternatives because it employs treatment. However, there is some uncertainty associated with this remedy because of the difficulty of mixing stabilizing agents in place. Alternative S-5 also includes a cap which means that waste would remain in place with associated residual risk. Periodic inspection and maintenance would be required to ensure cap integrity and to minimize residual risk.

Alternative S-4 would result in no additional residual risk at the site because contaminated soil and sediment would be disposed of off-site at an Ohio licensed and permitted landfill.

Although land disposal at a properly designed facility is reliable, additional residual risk would remain at that remote location.

Residual risk in addition to the waste contained in the landfill would remain under alternatives S-2 and S-3 because these alternatives would leave contaminated soil and sediment at the site. Periodic inspection and maintenance would be required to ensure cap integrity and to minimize residual risk.

6.2.4 Reduction of Toxicity, Mobility or Volume Through Treatment

Alternative S-5 is the only alternative that includes treatment. Alternatives S-1, S-2, S-3, S-4, and S-6 do not reduce toxicity, mobility, or volume through treatment.

6.2.5 Short-Term Effectiveness

Alternative S-1 poses no short-term risk to the community or workers because no construction is required. Alternatives S-2 through S-6 would result in minimal short-term risks to on-site workers and can be managed through the use of the appropriate personal protective equipment and sound construction practices. Risks to the surrounding community during implementation of alternatives S-2 through S-6 are minimal.

The short-term ecological risks that would occur during construction and implementation of alternatives S-2 through S-6 might be significant. Alternatives S-2 and S-5 require the capping of contaminated soil and sediment in place. This would permanently disturb wetlands and require their replacement. Alternatives S-3 and S-4 would temporarily disturb wetlands because of the removal of soil and sediment. This disturbance would be short-term because the soil and sediment would be replaced and the natural topography of the land restored. Alternative S-1 is the only alternative that does not disturb wetlands.

Alternatives S-2 through S-5 would achieve protection upon completion of construction. Alternative S-6 would achieve partial protection because it only applies to sediment in Beaver Creek. The FS estimates that Alternative S-2 would require three months to implement, S-3 three to four months, S-4 three months, S-5 four months, and S-6 two months.

6.2.6 Implementability

Alternative S-1 would only require long-term monitoring and is technically and administratively feasible. No additional construction is necessary.

Alternatives S-2, S-3, S-4, S-5, and S-6 are technically implementable. Capping and excavation are proven technologies. Therefore, a low degree of difficulty or uncertainty is associated with these alternatives.

Alternative S-5 involves a greater degree of uncertainty than the other alternatives because it is more difficult to control the mixing of stabilization agents with soil and sediment in place than if the soil and sediment were excavated and treated.

Administratively, alternatives S-2 through S-6 would require federal and state authorization for construction in jurisdictional wetlands. Construction in the wetlands for the interim action was authorized under the provisions of the Nationwide Permit, 33 CFR 330 Appendix A (B) (38) for the cleanup of hazardous and toxic waste. Any additional loss of wetlands would necessitate the re-examination of the Nationwide Permit. If necessary, the permit would be modified.

6.2.7 Cost

The costs for the soil and sediment alternatives, based on a 30-year life cycle, are shown in the following table.

Table 5. Costs for Soil and Sediment Alternatives

	Costs		
Alternative	*Capital*	*Operation & Maintenance (annual)*	*Present Worth*
S-1: Interim Action/Long Term Monitoring	$ 0	$ 6,500	$ 130,000
S-2: Cap Soil/Sediment in Place	$ 580,000	$ 6,600	$ 710,000
S-3: Excavate Soil/Sediment & Cap On-Site	$ 670,000	$ 2,100	$ 710,000
S-4: Excavate Soil/Sediment & Dispose Off-Site	$ 1,100,000	$ 0	$ 1,100,000
S-5: Stabilize Soil/Sediment In Place	$ 1,300,000	$ 6,600	$ 1,400,000
S-6: Reroute Beavercreek Streambed & Cap Sediment In Place	$ 210,000	$ 6,600	$ 340,000

Note: Costs are in 1996 dollars.

6.2.8 Community Acceptance

Ohio EPA received comments from interested parties during the public comment period and at the public meeting held March 23, 2006, in Fairborn, Ohio. Those comments and Ohio EPA's responses are included in the responsiveness summary attached to this decision document. Following the evaluation of the pubic comments, the selected alternative S-3 remains as the remedy for the site.

6.3 Analyses of Evaluation Criteria for Ground Water

This section looks at how each of the evaluation criteria is applied to each of the ground water remedial alternatives found in Section 5.0 and compares how the eight alternatives achieve the criteria.

6.3.1 Overall Protection of Human Health and the Environment

All of the alternatives except for alternatives G-1, G-2b (upgradient), G-2b.1, and G-3 (perimeter) meet the criteria of overall protection of human health and the environment.

Alternative G-2a (upgradient) and alternative G-3 (upgradient) prevent ground water from entering the landfill thereby preventing further generation of leachate and eliminating any residual risk to human health and the environment beyond that posed by the waste in the landfill.

Alternative G-2b (upgradient) uses extraction wells in an attempt to prevent ground water from entering the landfill. Ohio EPA's ground-water flow model for the site indicates that this remedy will not be effective. Several of the upgradient wells cannot sustain the specified pumping rate of 2 gallons per minute without going dry. If the pumping rates are adjusted to match the hydraulic conductivity of the formation the wells are screened in, the landfill does not drain. This remedy does not protect human health and the environment since leachate will continue to be generated resulting in residual risk.

Alternative G-3 (perimeter) uses a perimeter slurry wall to prevent ground water from entering the landfill. Ohio EPA's ground-water flow model for the site indicates that this remedy will not be effective. Ground water from the Elkhorn Formation, below the slurry wall, will enter the landfill and the landfill will behave like a bathtub and the waste will become saturated with water. This remedy does not protect human health and the environment since leachate will continue to be generated resulting in residual risk.

The four remaining alternatives: G-2b.1, G-2a (downgradient), G-2b (downgradient), and G-1, do not prevent the continued generation of leachate resulting in residual risk. Additionally, the downgradient alternatives would de-water approximately 25 acres of site wetlands.

Alternatives G-1 and G-2b.1 do not provide overall protection of human health and the environment. These alternatives would not improve the quality of downgradient ground water at the site, which continues to exceed the cleanup goals. Although arsenic, nickel, and selenium concentrations have decreased to levels approaching their cleanup levels in downgradient ground water, ammonia and molybdenum continue to exceed the cleanup levels.

6.3.2 Compliance with ARARs

Alternatives G-2a (upgradient), G-2a (downgradient), G-2b (downgradient), and G-3 (upgradient) will comply with chemical-specific ARARs such as the Clean Water Act, Ohio Water Quality Standards and federal Water Quality Criteria by meeting applicable permit requirements and water quality standards. Alternatives G-1, G-2b (upgradient), G-2b1, and G-3 (perimeter) do not comply with chemical-specific ARARs.

Alternatives G-2a (upgradient), G-2a (downgradient), G-2b (downgradient), and G-3 (upgradient) will comply with federal and state action-specific ARARs including Ohio's solid and hazardous waste laws and rules and Ohio's rules and laws regulating the discharge of pollutants to waters of the state. Alternatives G-2a (upgradient), G-2a (downgradient), G-2b (downgradient), and G-3 (upgradient) will also comply with the city of Fairborn's water and sewer ordinances. Alternatives G-1, G-2b (upgradient), G-2b1, and G-3 (perimeter) do not comply with Ohio's rules and laws regulating the discharge of pollutants to waters of the state.

Alternatives G-2a (upgradient), G-2a (downgradient), G-2b (downgradient), and G-3 (upgradient) will meet location-specific ARARs including the federal Clean Water Act, Fairborn POTW Discharge Standards, Ohio Water Quality Standards, and Ohio Water Use Designations and Criteria. Alternatives G-1, G-2b (upgradient), G-2b1, and G-3 (perimeter) do not comply with the federal Clean Water Act, Ohio Water Quality Standards, and Ohio Water Use Designations and Criteria.

6.3.3 Long-Term Effectiveness and Permanence

Alternatives G-2a (upgradient) and G-3 (upgradient) satisfy the criteria of long-term effectiveness and permanence to a greater degree than the remaining alternatives by eliminating the generation of leachate by preventing ground water from passing through the landfill. Alternative G-3 (upgradient) includes wells to relieve hydraulic pressure on the slurry wall. A failure of these wells could result in damage to the slurry wall and the mounding of ground water in Powell Park. Alternative G-2a is superior to the other upgradient alternatives because it relies to a lesser extent on the maintenance of mechanical systems.

Alternatives G-1, G-2a (downgradient) and G-2b (downgradient) allow the continued generation of leachate with subsequent management. Alternatives G-1, G-2b (upgradient), G-2b1, and G-3 allow the continued generation of leachate without effective management.

6.3.4 Reduction of Toxicity, Mobility or Volume Through Treatment

All of the alternatives rely on the operation of the surface water/leachate collection and treatment system to reduce the toxicity of the collected leachate and impacted ground water. Further treatment would occur at the Fairborn wastewater treatment plant.

6.3.5 Short-Term Effectiveness

The short-term risks to the community during the implementation of all of the alternatives would be managed through the maintenance of the perimeter fence and the implementation of a deed restriction to limit public access.

Short-term risks to site workers would be managed by adhering to safety protocols previously established for the site as a result of the interim action. Short-term risk to site workers is limited to the continued leachate outbreaks at the perimeter of the landfill. Alternatives G-2a (upgradient), G-2b (upgradient), and G-3 (upgradient) would be constructed in areas where there is little potential for contact with impacted ground water and therefore meet the short-term effectiveness criteria more fully with respect to site workers than the remaining alternatives because the risks can be managed through established construction practices. Alternatives G-2a (downgradient), G-2b (downgradient), G-2b.1, and G-3 (perimeter) require construction in areas of known contamination. Risks to workers would be managed through health and safety protocols developed specifically for each alternative and would also include the use of personal protective equipment in areas containing impacted ground water.

No construction and therefore no environmental impacts from construction are associated with alternative G-1. All of the remaining alternatives may have a short-term impact on the environment due to construction and increased turbidity in site runoff. These impacts would be managed through the implementation of established construction practices.

All of the alternatives except for G-1 and G-3 (upgradient) would de-water wetlands due to the diversion and/or removal of ground water that surfaces beyond the perimeter of the landfill. G-2a (upgradient) would de-water approximately one acre, G-2b.1 would de-water approximately two acres, G-2b (upgradient) would de-water approximately 7 acres, and G-3 (perimeter) would de-water approximately 20 acres. G-2a (downgradient) and G-2b (downgradient) would de-water approximately 25 acres.

The feasibility study estimates that the time until protection is achieved (when all contaminant concentrations are at or below established cleanup levels) in downgradient ground water for G-2a (downgradient) and G-2b (downgradient) is approximately 9 years. Alternatives G-2a (upgradient) and G-3 (upgradient) would achieve protection in approximately 15 years.

The leachate outbreaks would be eliminated with the implementation of G-2a (downgradient) and G-2b (downgradient). Following the implementation of G-2a (upgradient), the residual water in the landfill would take up to 4 years to drain, according to Ohio EPA's model and 6.4 years according to the feasibility study. The leachate outbreaks would probably not be eliminated until the residual water drained. Leachate outbreaks will continue to occur if alternatives G-1, G-2b (upgradient), G-2b1, and G-3 (perimeter) are implemented.

6.3.6 Implementability

Alternative G-1 is already in place. Alternatives G-2a (upgradient), G-2b (upgradient), G-2b1, G-3 (perimeter), and G-3 (upgradient) are technically feasible as they rely on readily available technology and have a relatively low degree of difficulty and uncertainty associated with construction and operation.

Alternatives G-2a (downgradient) and G-2b (downgradient) are not as technically feasible as the above-mentioned alternatives because it would be difficult to integrate these alternatives into the existing interim action without disrupting the ongoing collection and treatment of leachate and shallow ground water.

Administratively, implementation of each of the alternatives is feasible. The upgradient alternatives would comply with ARARs more readily than the downgradient alternatives because the downgradient components require construction in the wetlands. Construction in the wetlands for the interim action was authorized under the provisions of Nationwide Permit 33 CFR 330 Appendix A (B) (38) for the cleanup of hazardous and toxic waste. Any additional loss of wetlands would necessitate the re-examination of the nationwide permit. If necessary, the permit would be modified. All of the alternatives may require modification of the existing National Pollutant Discharge Elimination System permit.

6.3.7 Cost

The costs for the ground-water alternatives are shown in the following table. The costs are based on a 30-year life cycle except for the treatment plant operation costs for G-2a (upgradient trench) which are estimated for four years and the treatment plant operation costs for G-3 (upgradient slurry wall) which are estimated for seven years.

Table 6. Costs for Ground-Water Alternatives

		Costs	
Alternative	*Capital*	*Operation & Maintenance (annual)*	*Present Worth*
G-1: Interim Action/Long-term monitoring	$ 0	$ 104,000	$ 2,120,000
G-2a: Upgradient collection trench	$ 767,000	$ 104,000	$ 1,528,000
G-2a: Downgradient collection trench	$ 844,000	$ 294,000	$ 7,022,000
G-2b: Upgradient extraction wells	$ 694,000	$ 104,000	$ 3,597,000
G-2b: Downgradient extraction wells	$ 958,000	$ 309,000	$ 7,439,000

Alternative	*Capital*	*Operation & Maintenance (annual)*	*Present Worth*
G-2b1: Extraction wells at outbreaks	$ 652,000	$ 124,000	$ 3,451,000
G-3: Upgradient slurry wall	$ 1,560,000	$ 104,000	$ 2,561,000
G-3: Perimeter slurry wall	$ 3,331,000	$ 104,000	$ 5,732,000

Notes: Costs estimated by Ohio EPA in 2006.
Costs are in 1996 dollars.

6.3.8 Community Acceptance

Ohio EPA received comments from interested parties during the public comment period and at the public meeting held March 23, 2006, in Fairborn, Ohio. Those comments and Ohio EPA's responses are included in the responsiveness summary attached to this decision document. Following the evaluation of the pubic comments, the selected alternative G-2a (upgradient) remains as the remedy for the site.

7.0 SELECTED REMEDIAL ALTERNATIVE

The preferred soil/sediment alternative is S-3, excavate soil/sediment and cap on-site. Ohio EPA has determined that alternative S-3 meets the required threshold criteria. It employs technology that is easy to implement and is the least expensive of the alternatives that meet the threshold criteria.

The preferred ground water alternative is G-2a, upgradient collection trench. This alternative was selected because it would reduce the toxicity and volume of contaminated ground water, and when compared to the other ground-water alternatives, would best achieve long-term effectiveness and permanence because it would rely less on mechanical systems. It is also the least expensive ground-water alternative.

7.1 Alternative S-3, Excavate Soil/Sediment & Cap On-Site

This alternative requires the excavation of contaminated soil and sediment and their placement in a satellite landfill adjacent to the existing landfill. This alternative includes the maintenance of the existing landfill cap and the continued operation of the surface

Remedial Action Objectives

1. Maintain the landfill cap to prevent ground-water recharge and to minimize the percolation of water into and through the landfill.
2. Eliminate the potential for unacceptable human and plant/wildlife exposure to cement kiln dust in soil, sediment, and surface water.
3. Eliminate, as needed, unacceptable migration of cement kiln dust leachate to Beaver Creek.
4. Eliminate, as needed, unacceptable cement kiln dust constituent concentrations in downgradient ground water beyond the perimeter of the landfill.

water/leachate collection and treatment system. In addition, fencing around the site would be maintained and use restrictions would be placed on the property to limit the future use of the impacted area. The feasibility study estimated the size of the area of soil and sediment to be removed based on data collected in the remedial investigation. Ohio EPA will require CEMEX to conduct additional sampling during the remedial design to delineate the area requiring removal.

7.2 Alternative G-2A, Upgradient Collection Trench

This alternative consists of the installation of a ground-water collection trench upgradient from the landfill to prevent ground water from entering the landfill. The surface water/leachate collection and treatment system would continue to operate until the landfill dewaters.

7.3 Performance Standards

Soil and Sediment

1. Soil and sediment with chemical concentrations exceeding the cleanup goals (see Table 2) have been removed and placed in the satellite landfill. Compliance with this performance standard is necessary to achieve RAO 2.

2. The satellite landfill has been constructed in accordance with the detailed plans approved by Ohio EPA and in compliance with applicable portions of Ohio Administrative Code Rule 3745-27-08. Compliance with this performance standard is necessary to achieve RAO 2.

3. The satellite landfill is intact, functioning, and being properly maintained in accordance with the operation and maintenance (O&M) plan approved by Ohio EPA. Compliance with this performance standard is necessary to achieve RAO 2.

4. The site fence is intact and functioning to ensure that site access is restricted. Compliance with this performance standard is necessary to achieve RAO 2.

5. A use restriction in a recorded environmental covenant (ORC §5301.80 et. seq.) has been recorded with the Greene County Recorder's Office at the time of construction completion to prevent the excavation of the landfills at the site. The performance

Remedial Action Objectives

1. Maintain the landfill cap to prevent ground-water recharge and to minimize the percolation of water into and through the landfill.
2. Eliminate the potential for unacceptable human and plant/wildlife exposure to cement kiln dust in soil, sediment, and surface water.
3. Eliminate, as needed, unacceptable migration of cement kiln dust leachate to Beaver Creek.
4. Eliminate, as needed, unacceptable cement kiln dust constituent concentrations in downgradient ground water beyond the perimeter of the landfill.

standard shall be achieved upon recording the use restriction and its continued enforcement. Compliance with this performance standard is necessary to achieve RAOs 1 and 2.

Ground Water

1. The upgradient ground-water collection trench is installed in accordance with detailed plans approved by Ohio EPA and is operating and has prevented leachate outbreaks in accordance with the Ohio EPA approved design plans and construction schedule. Compliance with this performance standard is necessary to achieve RAO 2.

2. Contaminant concentrations in downgradient ground water are in compliance with the cleanup standards for ground water (see Table 2) within 15 years of completion of construction and initiation of operation of the ground-water collection trench. Compliance with this performance standard is necessary to achieve RAO 4.

3. Contaminant concentrations in surface water (including leachate outbreaks) are in compliance with the cleanup standards for surface water (see Table 2) within 15 years of completion of construction and initiation of operation of the ground-water collection trench. Compliance with this performance standard is necessary to achieve RAOs 2 and 3.

4. The water levels in monitoring wells within the landfill have decreased to such an extent that the landfill is de-watered within 4 years of completion of construction and initiation of operation of the ground-water collection trench. Compliance with this performance standard is necessary to achieve RAOs 1, 2, 3, and 4.

5. The wastewater treatment plant is operating and in compliance with the Fairborn pretreatment ordinance. Compliance with this performance standard is necessary to achieve RAOs 2, 3 and 4.

Remedial Action Objectives

1. Maintain the landfill cap to prevent ground-water recharge and to minimize the percolation of water into and through the landfill.
2. Eliminate the potential for unacceptable human and plant/wildlife exposure to cement kiln dust in soil, sediment, and surface water.
3. Eliminate, as needed, unacceptable migration of cement kiln dust leachate to Beaver Creek.
4. Eliminate, as needed, unacceptable cement kiln dust constituent concentrations in downgradient ground water beyond the perimeter of the landfill.

8.0 GLOSSARY

Aquifer	A saturated permeable geologic unit that can transmit significant quantities of water.
ARARs	Applicable or relevant and appropriate requirements. Rules that strictly apply to remedial activities at the site or whose requirements would help achieve the remedial goals for the site.
Baseline Risk Assessment	An evaluation of the risks to human health and the environment posed by a site.
Carcinogen	A substance that causes cancer or is believed to cause cancer.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. 9601 et seq. The federal law that regulates cleanup of hazardous substances sites under the U.S. EPA Superfund Program.
Decision Document	A statement issued by the Ohio EPA giving the director's selected remedy for a site and the reasons for its selection.
Ecological Receptor	Animals or plant life exposed to chemicals released from a site.
Exposure Pathway	Route by which a chemical is transported from the site to a human or ecological receptor.
Feasibility Study	A study conducted to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can be presented to a decision-maker and an appropriate remedy selected.
Hazardous Substance	A chemical that may cause harm to humans or the environment.
MCLGs	Maximum Contaminant Level Goals. Non-zero cleanup standards listed by the Safe Drinking Water Act which are substituted for risk-based numbers.
NCP	National Oil and Hazardous Substances Contingency Plan, codified at 40 C.F.R. Part 300. A framework for remediation of hazardous materials sites specified in CERCLA.
O&M	Operation and Maintenance. Long-term measures taken at a site, after the initial remedial actions, to assure that a remedy remains protective of human health and the environment.
Preferred Plan	The plan that evaluates the preferred remedial alternative chosen by the Ohio EPA to remediate the site in a manner that best satisfies the evaluation criteria.
PRGs	Preliminary Remediation Goals. Specific statements of the desired endpoint concentrations or risk levels, for each exposure pathway, that are believed to provide adequate protection of human health and the environment based on preliminary site information.
RAOs	Remedial Action Objectives. Medium-specific or operable-unit specific goals for protecting human health and the environment.
Remedial Investigation	A study conducted to collect information necessary to adequately characterize the site for the purpose of developing and evaluating effective remedial alternatives.
TBCs	To-be-considered criteria. Non-promulgated advisories or guidance issued by Federal or State governments that are not legally binding and do not have the status of potential ARARs. However, TBCs will be considered along with ARARs as part of the site risk assessment and may be used in determining the necessary level of cleanup for protection of human health and the environment.

FIGURE

APPENDIX

RESPONSIVENESS SUMMARY

Responsiveness Summary for the Revised Preferred Plan for Southwestern Portland Cement Landfill No. 6

On January 24 2006, Ohio EPA public noticed the revised preferred plan for the site. The notice established a public comment period that ended March 31, 2006, and announced a public hearing for March 23, 2006. Public comments could be submitted in writing during this period or given orally at the public hearing.

Ohio EPA's *Preferred Plans and Decision Documents Procedures* allows for the re-evaluation of the preferred alternative in light of comments and new information received. Although Ohio EPA received a substantial number of comments, it is the Agency's judgement that no change to the preferred alternative is required.

The comments received (in italics) and Ohio EPA's responses are presented below.

Public Hearing Comments from Bob Sowers

1. *My question is to repeat the question I had earlier. EPA's presentation indicated that there was some surface contamination on the west side of I-675. I would like to ask if that site will be re-tested? And if still contaminated, if that soil will be removed and the area in question remediated?*

   The remedial investigation found contaminated soil and sediment west of I-675, and Ohio EPA's remedy for soil and sediment includes this area. However, given that the sampling data is more than 12 years old, there is some question as to whether this area is still contaminated. Therefore, Ohio EPA will require the collection of additional soil and sediment samples in order to delineate the extent of contamination as part of the design of the remedy.

2. *EPA's presentation again indicated or postulated that the collection trench upgradient will collect all of the groundwater. What if it doesn't? What if there is some groundwater moving through lower formations? Will CEMEX still continue to operate the lower collection area and treat that if it's shown that there is lower groundwater or ground table water moving through the landfill?*

   Ohio EPA's ground-water flow model shows that the landfill will dewater approximately four years after the upgradient trench is constructed. Ground water will still be collected in leachate collection trench during this period and will require treatment. After four years it is expected that leachate will no longer be found in the trench, and the operation of the trench and wastewater treatment plant can be suspended. If the upgradient trench remedy fails, and the landfill continues to generate significant amounts of leachate, the leachate collection trench and wastewater treatment plant will continue to operate.

Public Hearing Comment from Suzanne Patterson

3. *My question concerns the wetlands. It says here in this information that was given to me by the EPA, any additional loss of wetlands would necessitate the re-examination and possible modification of the nationwide permit. I'd like to know who and how often there will be an inspection of these wetlands?*

   As part of the operation and maintenance phase of the project, CEMEX will be responsible for monitoring the condition of the wetlands and requesting a modification of the nationwide permit should a loss of wetlands occur that is attributable to the remedy. In addition, periodic inspections will be required by the Remedial Design/Remedial Action Orders necessary to implement the site remedy.

Public Hearing Comment from Megan Marhelski

4. *I think there are four items to be addressed in the final remediation alternatives. The first one is the potential for groundwater flow from bedrock into the landfill. The second one is the effectiveness of the wetlands as an additional remediation technology. The third is the use of the wetlands as a potential discharge point for the trench system prior to the discharged water reaching the stream that flows towards 675. And the fourth one is the trench maintenance time frame.*

   Ohio EPA's latest ground-water flow model for the site indicates that after the installation of the upgradient trench, water from the Elkhorn and Whitewater Formations is expected to flow into the original soil beneath the cement kiln dust but not move into the cement kiln dust. Water from the Brassfield Formation is expected to be captured by the trench.

   The wetlands existed before the landfill and are classified as waters of the state. Therefore, it would be inappropriate to use them for treating the leachate. The damage to the wetlands is one of the reasons that prompted Ohio EPA to take action.

   The feasibility study shows the water from the upgradient trench as being conveyed to the Fairborn sanitary sewer system. This was based on the expectation in the feasibility study that the water from the upgradient trench would require treatment before being discharged. Ohio EPA believes, based on its treatability study and an evaluation of the upgradient ground water quality data from the remedial investigation, that no treatment will be required and that the water can be discharged to the wetlands at the base of the landfill.

   As part of the remedial action, CEMEX will be required to submit an operation and maintenance plan that should specify how the trench will be maintained. Ohio EPA will require that CEMEX maintain the trench as long as it is needed.

Public Hearing Comments from Mike Henry

5. *As Mr. Martin said, it's not the same landfill that it was in the early 90's. We have also set up out in the lobby a table that has additional information. We've got before and after photos. We have got sampling trends of constituents and a leaping power point presentation that is available if you have the time to look at it. We will be submitting written comments to Ohio EPA. We want to stress to the public tonight that Landfill No. 6 currently does not pose a threat to human health or the environment. Inside the security fence the site is home to at least 30 deer, quail, pheasant, wild turkeys, coyotes, hawks, Canadian Geese, herrings, usual squirrels, raccoons, chipmunks, possums, and those are just the things that I've seen. At one time last year we actually had beavers on site that were starting to dam up the water. So again, and fill No. 6 is not the same place that it was in the early 90's when it had large areas of stressed soil and vegetation. And the reason it's not the same place is that CEMEX made the choice back then to spend about $7 million to install the impermeable cap over the landfill and to build a system of trenches and piping to collect and treat leachate water. These soil and groundwater remedial systems have been in place for over ten years now and they've been very successful. The area is returning to its natural state. Again, if you have a moment, stop by the table out there and take a look at some of the before and after photos. In addition to improving aesthetic appearance, constituent concentrations have declined significantly in the last ten years. In 2005 only six constituents and four wells were above remedial action levels. 23 constituent well pairs showed decreasing concentration trends, while 19 to 35 site wells never had any constituents above remedial action levels. The current remedial system is working effectively and will continue to do so in the coming years. Again, if you'd like to see plots of the results of over ten years of sampling, stop back at the table. Because the existing remedial system is doing its job well, we believe the revised preferred plan in its current form is not necessary. The additional expenditure and site disturbance proposed will not improve site risk any increment above what the current remedial systems in place have already done.*

Despite the implementation of the interim action, monitoring data demonstrate that the levels of contaminants in surface water and ground water present an unacceptable risk to human health and the environment. The status of soil and sediment at the site is not fully known since a sufficient number of soil and sediment samples have not been collected at any one time to conduct the necessary statistical analysis to evaluate attainment of the soil and sediment remediation goals. Contaminant levels have decreased in some ground-water monitoring wells but appear to be either increasing or have reached an asymptotic level that is greater than the remediation goals in monitoring wells MW-4, MW-6, and MW-14. While the interim action has improved conditions, the site is still not cleaned up.

6. *In fact, the risk analysis in the latest edition of the preferred plan is based on data obtained before the landfill was capped and water collection and treatment system put in place. We performed the same evaluation using current data from the site and found that under current conditions concentrations above remedial action levels are confined only to site groundwater. With current and future site controls in place, no one will be exposed to that water. CEMEX will also comply with the preferred plan provision for an environmental covenant land use restriction to be recorded with Greene County. This deed covenant will insure that exposure pathways scenarios originally estimated or excessive risk for calculated for residence - - soil and drinking, site surface and groundwater prior to installation of the cap and treatment system can never happen in the future. The risk calculation site in the preferred plan are the drivers the agency is using to justify that further action is necessary. That risk calculation does not consider ten years and $7 million worth of site remediation already performed, nor does it consider the use of restrictive covenant on future land use. The risk estimate may have characterized the site prior to construction of the cap and leachate system, which was really an earlier implementation of the final plan, but it no longer characterizes the site as it currently exists. If risk to human health and the environment is not improved by additional remedial action, why take the action? We do not believe the additional actions proposed by the preferred plan will result in reduced risk from what the site is today.*

The statement that "under current conditions concentrations above remedial action levels are confined only to site groundwater" is problematic. Ohio EPA collected sediment samples that exceeded the pH cleanup goal from the site in 2003. CEMEX's own long-term monitoring data shows violations of the surface water quality standard for pH in the pond on the west side of the site.

The statement that "prior to construction of the cap and leachate system, which was really an earlier implementation of the final plan" is incorrect. The cap and leachate system was an interim action.

Although the alternatives in the approved feasibility study include use restrictions to limit site access and to prevent excavation, none of these alternatives propose the use of an environmental covenant to restrict future land and ground-water use. Such a proposal would have to be incorporated into the feasibility study and subjected to individual and comparative analysis against the eight remedy selection criteria under the National Contingency Plan (NCP). This modification of the no-action ground-water alternative would include the environmental covenant to prevent human exposure and would delay the completion of the project since the feasibility study would have to be revised and then reviewed and approved by Ohio EPA. Furthermore, if a no-action/environmental covenant alternative was added to the feasibility study, it would not be selected because it would fail the threshold criteria by not preventing exposure of plants and animals to contaminated surface water, soil, and sediment and would not comply with Ohio law because there would be violations of Ohio's water quality standards in the wetlands downgradient from the landfill.

Ohio EPA has conducted an exposure assessment using current site data. The site still poses an unacceptable risk to human health and the environment.

7. *In addition to our assertion that there is no risk proposed by the site in its current condition, we have questions about the preferred plan's choice of the upgradient interceptive trench and its future success in dewatering the landfill. From what we can tell from information we have, the proposed trench is not deep enough to intercept all water migrating to the landfill. This precise argument was used by the agency in Section 8.3.1 of the preferred plan when it dismissed alternative G3, Perimeter Slurry Wall, stating that water from the Elkhorn formation would enter the landfill within the slurry wall. This means that even with the trench in place the landfill would never de-water. CEMEX would like nothing better than to have the landfill de-watered and no longer generating leachate requiring operation of a water treatment plant, but we don't think that upgrading the trench as envisioned will accomplish de-watering in three years, 10, or even 20 years. To go deeper with the trench would involve major rock excavation and implementability issues. Let us continue to operate the treatment system as it is. With that system running normally as it has for the past several years, it does keep up with leachate generation volumes. Now, the preferred plan raised that question. Even after all our heavy, recent heavy rains in the last week or so, there's only about five feet of leachate in the collection tanks. At one time we did have to meter leachate coming into the system because we were having control system problems with the treatment plant which has since been corrected.*

Two ground-water flow models have been developed for the site, one by Southdown in the feasibility study and the other by Ohio EPA. Both models show that the upgradient trench will dewater the landfill. No data has been presented, other than unsubstantiated figures purporting to represent ground-water flow, that contradicts the findings of the models.

To clarify the difference between a perimeter slurry wall and an upgradient trench, the perimeter slurry wall extends around the entire landfill, while the upgradient trench is only located on the east side of the landfill. The layout of the perimeter slurry wall allows water from the Elkhorn Formation to enter the site from the east. However, this water cannot drain since it is blocked by the slurry wall on the west side of the landfill. The landfill would then fill-up like a bathtub

8. *In summary, CEMEX is committed to a long-term remediation of this land. Even with restrictive use covenant in place, the land has significant value, has wildlife preserved, green space, and wetlands. The CEMEX desired plan is to continue operation of leachate collection and treatment system as it currently operates,*

continue maintaining the impermeable landfill cap, address remaining local stressed areas with alkali resistant plants and neutralizing agents, and evaluate surrounding surface drainage patterns that may be increasing the amount of water infiltrating the landfill. With these systems in place the landfill will continue to recover as it has over the last ten years. We would like to thank Ohio EPA for this opportunity to state our position and again, we invite anyone who might be interested to come out to see the landfill for themselves. The things that you read in the paper don't necessarily do it justice and I know that there haven't been any reporters out at the landfill since the three years I've been at CEMEX. Come and see for yourselves. Again, we have cards out at our table. If you'd like to contact us, please take a card. And that concludes our comments.

Ohio EPA evaluated the alternatives developed in the feasibility study for addressing the contamination at the site. Based on this evaluation, the alternatives selected in the preferred plan will protect human health and the environment from exposure to contaminants above cleanup goals in ground water, soil, sediment, and surface water. Plus, these goals will be achieved at a significantly lower cost than the above-mentioned actions.

Written Comments from Joseph Towarnicky of Los Alamos Technical Associates, Inc. On Behalf of CEMEX, March 28, 2006

General Comments:

CEMEX asserts that this Revised Preferred Plan should not be implemented because:

1. *The additional remedial elements included with the Preferred Plan are not needed to maintain protectiveness of human health or the environment at the Site. The implemented Interim Action has adequately secured the site and residual on-site risks are confined to small, distinct areas within the site boundaries. The site is secure, there are no current residences on-site and future land-use activities will be controlled using an environmental covenant to restrict future land (and groundwater) use.*

   Although the alternatives in the approved feasibility study include use restrictions to limit site access and to prevent excavation, none of these alternatives propose the use of an environmental covenant to restrict ground-water use. Such a proposal would have to be incorporated into the feasibility study and subjected to individual and comparative analysis against the eight remedy selection criteria under the NCP. Essentially, this would be modification of the no-action ground-water alternative to include the environmental covenant to prevent human exposure. This would delay the completion of the project since the feasibility study would have to be revised and then reviewed and approved by Ohio EPA. See response to comment 6 from the public hearing.

In deciding whether to allow this proposal to be incorporated into the feasibility study, Ohio EPA considered the likelihood of it being selected as the ground-water remedy. The proposal for solely restricting future ground water use at the site would not meet the two threshold criteria. The proposal fails to protect human health and the environment because it does not prevent the exposure of plants and animals to contaminated surface water, soil, and sediment. It does not comply with Ohio law because there will continue to be violations of Ohio's water quality standards in the wetlands downgradient from the landfill.

2. *With the exception of several small, distinct areas, the site is already cleaned up to risk based levels appropriate to current and reasonable future use scenarios. Most site media currently have concentrations of Site constituents at levels below Remedial Action Concentrations (RACs). CEMEX has also agreed to place an environmental covenant (i.e., enforceable deed restriction) on the site restricting future activities to industrial or commercial development without potable groundwater-use. The site will never be released for future unrestricted residential use; thus, clean-up to the current (residential-based) RACs is not appropriate because the RACs were calculated using residential exposure and potable groundwater use as exposure assumptions. Because no future residential use (with groundwater consumption) will occur, site conditions are already protective of human health and the environment under current and reasonable (non-residential) future use scenarios.*

In order to establish whether the remediation goals have been attained in soil and sediment, contaminant concentrations must be compared with the remediation goals. Statistical methods must be used to demonstrate attainment. For example, Ohio EPA's Closure Plan Guidance for RCRA Facilities requires that a minimum of 12 samples be collected from each contaminated area, and that the 95% upper confidence level of the arithmetic mean of the samples be less than the cleanup goal. The samples would have to be collected at the same time. See the following references:

Methodology for Evaluating Site-specific Background Concentrations of Chemicals

http://www.epa.state.oh.us/derr/rules/Methodology.pdf

Background Calculation Methodology
http://www.epa.state.oh.us/derr/rules/RR-039_public.pdf

Role of Background in the CERCLA Cleanup Program, OSWER 9285.6-07P, April 2002
http://www.epa.gov/superfund/programs/risk/bkgpol_jan01.pdf

Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites, EPA 540-R-01-003 OSWER 9285.7-41 September 2002
http://www.epa.gov/oswer/riskassessment/pdf/background.pdf

Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media, U.S. EPA, EPA 230/02-89-042, February 1989.
http://www.epa.gov/tio/download/stats/vol1soils.pdf

Methods for Evaluating the Attainment of Cleanup Standards, Volume 3: Reference-Based Standards for Soils and Solid Media, EPA 230-R-94-004, December 1992
http://www.epa.gov/tio/download/stats/vol3-refbased.pdf.

An adequate number of representative samples at any one time to conduct the necessary statistical analysis to evaluate compliance with the soil and sediment remediation goals has not been collected, and there is no way to judge whether the levels of contaminants in soil and sediment have changed since the remedial investigation. Areas of the wetlands west of the landfill continue to be barren of plants suggesting the continued presence of contaminants at harmful levels. Contaminant levels have decreased in some ground-water monitoring wells but appear to be either increasing or have reached an asymptotic level that is greater than the remediation goals in other wells.

The feasibility study does not contain an alternative that includes an environmental covenant to restrict future land and ground-water use.

CEMEX's predecessor, Southdown, included the residential future use scenario for the site in the baseline risk assessment. The inclusion of this scenario is consistent with the NCP and U.S. EPA's risk assessment guidance.

3. *Soil, sediment, and groundwater conditions have improved dramatically over the past 10 years. Those wells whose concentrations are most affected by landfill leachate (e.g., MW-3, landfill wells) have shown the most improvement.*

As stated in the response to general comment 2, a sufficient number of soil and sediment samples have not been collected at any one time to conduct the necessary statistical analysis to evaluate compliance with the soil and sediment remediation goals, and there is no way to judge whether the levels of contaminants in soil and sediment have changed since the remedial investigation. Contaminant levels have decreased in some ground-water monitoring wells but appear to be either increasing or have reached an asymptotic level that is greater than the remediation goals in monitoring wells MW-4, MW-6, and MW-14.

4. *The Preferred Plan remedial elements have significant cost, limited effectiveness, and problems with implementation. The Preferred Plan elements do not significantly*

reduce overall risks to human health and the environment at the site under current or reasonable future use scenarios when compared to the actions already taken in the Interim Action. Thus, with no significant additional risk reduction associated with the Preferred Plan elements, the Preferred Plan is not as consistent with the NCP as continuing the Interim Action. Maintaining the current Interim Action activities supplemented with a few additional targeted remedial activities in areas of concern will be more effective at addressing current site conditions, can be easily implemented without undue disturbance of the site or its surroundings, and will do so at a lower total cost than the Preferred Plan.

Ohio EPA disagrees with what is stated above. Ohio EPA's selected alternatives should be effective, can be implemented, and should significantly reduce risk based on information provided by Southdown (now owned by CEMEX) in the feasibility study. Ohio EPA's selected alternatives are also less expensive than the remedial alternatives suggested above.

5. *The groundwater remedial element will not perform as assumed in the Preferred Plan: the upgradient trench will not dewater the landfill within 3 years (or ever) due to underflow beneath the trench and cross-flow around the trench. Thus, the existing surface water leachate collection and treatment system will have to be operated for an extended period of time and well beyond that assumed in the Preferred Plan.*

Two ground-water flow models have been developed for the site: one by Southdown in the feasibility study and the other by Ohio EPA. Both models show that the upgradient trench will dewater the landfill. No evidence has been presented, other than unsubstantiated figures purporting to represent ground-water flow, that contradicts the findings of the models. See response to comment 7 from the public hearing.

6. *The Preferred Plan's cost assumptions are not valid because they assume discontinuing the leachate treatment. Thus, because this assumption is not valid, the selected alternative becomes significantly more costly and would not be the preferred remedial element if an accurate evaluation was performed.*

The wastewater treatment plant will not be needed after the landfill is essentially dewatered. Therefore, it is appropriate to reduce the operation and maintenance costs for the wastewater treatment plant.

7. *The Preferred Plan is based upon addressing Site conditions as they existed more than 10 years ago. Site soil, sediment, and groundwater conditions have since improved as demonstrated by the data collected since the original RI. Thus, the amount of site soil/sediment requiring remediation is much less than previously estimated. Any evaluation of candidate remedial alternatives against the NCP*

criteria will not be appropriate to address conditions as they exist today. A remedy that may be appropriate for addressing thousands of cubic yards of contaminated soil and sediment may not be appropriate for addressing a few dozen cubic yards.

The only evidence that is available for evaluating the nature and extent of soil and sediment contamination comes from the remedial investigation. The scope of the soil and sediment investigation conducted by Southdown aka CEMEX since the remedial investigation does not allow for an updated estimate of the nature and extent of contamination (see response to general comment 2). Ohio EPA will require that additional sampling be conducted during the remedial design. If the volume of soil and sediment requiring remediation has changed, it may be necessary to revisit and possibly modify the scope of the soil and sediment remedy.

8. *The Revised Preferred Plan does not differ significantly from the previous Preferred Plan for which CEMEX provided comments to the OEPA on June 15, 2003. In that letter, CEMEX also proposed an alternative, contingent, remedy to better address conditions noted at that time.*

Ohio EPA changed the 2001 preferred plan by modifying two of the ground-water alternatives by reducing the amount of time required for the operation of the wastewater treatment plant from 30 years to 4 years. The reduction in operation and maintenance costs due to the decreased time of operation for the wastewater treatment plant reduced the present-worth costs for the upgradient trench and upgradient slurry wall alternatives. These changes are significant and resulted in the revised preferred plan.

Ohio EPA and CEMEX have discussed the possibility of a contingent remedy. Ohio EPA was willing to monitor the effectiveness of the existing landfill cap on ground-water quality provided that CEMEX defined clear action points that would trigger the contingency in case progress towards complying with the ground-water cleanup goals was not being achieved. CEMEX failed to define appropriate action points. In addition, CEMEX did not want to implement the selected remedy for soil and sediment. Therefore, Ohio EPA rejected the contingent remedy proposal.

Specific Comments

1. *The Interim Action activities have sufficiently addressed off-site risks and the majority of on-site risks under current and reasonable future-use activity conditions.*

CEMEX operated a landfill at the Site that accepted wastes from the cement-making process, including Cement Kiln Dust(CKD). Cement-making wastes have affected Site media, in part by dissolving into Site waters and causing the pH to rise. To address Site conditions, CEMEX completed an Interim Action that included the following activities:

- *securing the site,*
- *capping the landfill,*
- *constructing a surface-water diversion system,*
- *constructing a leachate-collection system, and*
- *constructing a leachate treatment system and blending operation.*

Since May 1995, CEMEX has operated the leachate collection/neutralization system and discharged treated leachate (blended with diverted surface water) to the on-site wetlands. Although there have been intermittent operational problems, the collection/neutralization is now operating continuously and automatically with a microprocessor system. As currently operated, leachate is effectively collected, treated, and controlled.

The majority of affected soils were impounded beneath the landfill cap during the Interim Action. Residual soils and sediments have constituent concentrations below RACs. Thus, risks to human health and the environment from exposure to site media under current conditions are controlled by engineering and administrative controls. No additional remedial actions are needed to control site risks under current conditions. The unacceptable site risk levels identified in Revised Preferred Plan were calculated using concentrations found at the site more than 10 years ago - prior to implementation of the Interim Action.

Despite the implementation of the interim action, monitoring data demonstrate that the levels of contaminants in surface water and ground water present an unacceptable risk to human health and the environment. As stated in the response to general comment 2, a sufficient number of soil and sediment samples have not been collected at any one time to conduct the necessary statistical analysis to evaluate compliance with the soil and sediment remediation goals, and there is no way to judge whether the levels of contaminants in soil and sediment have changed since the remedial investigation. Contaminant levels have decreased in some ground-water monitoring wells but appear to be either increasing or have reached an asymptotic level that is greater than the remediation goals in monitoring wells MW-4, MW-6, and MW-14. See response to comment 5 under public hearing.

The baseline risk assessment performed by Southdown complied with U.S. EPA's Risk Assessment Guidance for Superfund Volume 1 Human Health Evaluation Manual (RAGS Part A). RAGS Part A states that there must be an exposure point where contact can occur, such as the future use of ground water at the site. RAGS Part A also states that "if ground water is not currently used in the area of the site as a source of drinking water but is of potable quality, future use of ground water as drinking water would be possible.... if the site is currently industrial but is located near residential areas in an urban area, future residential land use may be a reasonable possibility." For the purpose of assessing future risk, the ground water at the site would be potable, if it was not contaminated, and there are residences next to the site. Therefore, the future use of ground water from the site was considered in the baseline risk assessment.

The statement "the majority of affected soils were impounded beneath the landfill cap during the Interim Action" appears to be speculative. CEMEX has not cited any evidence to for this assertion.

2. *Site conditions continue to improve; thus, the remedies evaluated in the Preferred Plan are not needed to address Site risks under reasonable future use scenarios.*

Since the completion of the Interim Action, constituent concentrations in groundwater, surface water, shallow soils, and sediments have been monitored at the Site. Results demonstrate that the site conditions in all media continue to improve; constituent concentrations continue to decrease to near/below Remedial Action Concentrations (RACs) for all media (see Table 1 from Revised Preferred Plan).

RACs were developed to be protective under future unrestricted residential use of the site. Because CEMEX has agreed to restrict the site to industrial or commercial development with no groundwater use using the Universal Environmental Covenants Act, no additional improvement in groundwater condition is needed to protect human health or the environment under current or future non-residential uses. Therefore, the additional activities targeted to address leachate/groundwater are not needed.

For a response to the assertions regarding improvement in site media, please see the responses to general comments 2 and 3.

Ohio EPA is not aware of any agreement with CEMEX regarding restricting the site using the Universal Environmental Covenants Act.

2a. *Groundwater conditions are improving. Those wells with groundwater most affected by leachate are improving the most. Wells that are not improving are those that are not as directly affected by landfill leachate. Current data demonstrate that off-site groundwater does not exceed the RACs in any well sampled.*

As a part of the Remedial Investigation (RI), completed in September 1994, 64 wells were installed and sampled both on- and off-Site. Thirty-one of these wells never had any constituents exceeding the RACs. Since the completion of the RI, 19 wells located outside and downgradient of the landfill (15 of the 19) and wells located inside the landfill (4 of the 19) have been sampled (see Figure 1). Concentrations of most constituents in most of these wells continue to show decreasing trends. Only 7 wells (2 inside the footprint of the landfill) have been sampled through 2005. Figures 2-7 show graphs of constituent trends for the 7 wells currently sampled at *the site. Constituent concentrations in the other wells located outside the footprint of the landfill are all below RACs.*

As shown in Figures 2-7, most constituent concentrations are decreasing over time. Of the 13 well-constituent pairs with historic concentrations above RACs, eight of them show statistically significant decreasing trends at the 95% confidence interval. See Mann-Kendall Intra-Well summaries presented in Appendix A.

Figure 8 presents a cross-section of the landfill with certain elements (including the location of MW-3) identified.

Well MW-3 is located immediately downgradient of the leachate collection trench. Thus, any impacts associated with eliminating leachate would be most obvious in this well. Figures 9-13 show decreasing trends in concentration to below RACs for all constituents. This demonstrates the effectiveness of the leachate collection trench in controlling impacts to groundwater from landfill leachate.

Other wells located farther from the leachate source have similar but less pronounced trends. There are a few constituents in a few wells that do not show apparently decreasing trends. For example, well (MW-6) does not show an apparently decreasing trend for ammonia. In fact, Figure 14 shows ammonia concentrations in MW-6 that are greater than those in MW-3 (closer to the landfill) and greater than LW-3 (installed through the landfill).

The ammonia in MW-6 does not appear to be related to migration of leachate but perhaps to local (to the well) historic impacts. This finding implies that further changes to landfill leachate production will not result in any improvement in ammonia concentrations in MW-6. Based on this evaluation, the installation of an upgradient trench, as proposed by Ohio EPA will not address the ammonia problem remaining in MW-6.

In addition to significant improvements in groundwater quality in site monitoring wells, wells completed through the landfill leachate also show significant improvement in pH and constituent concentrations. Thus, the current collection of landfill leachate and treatment continues to extract residual alkali values and thus reduce the toxicity of the landfilled contents.

Contaminant levels have decreased in some ground-water monitoring wells but appear to be either increasing or have reached an asymptotic level that is greater than the remediation goals in monitoring wells MW-4, MW-6, and MW-14. It appears that the landfill cap and leachate collection system have reached their limits of effectiveness.

It is has not been determined why some areas of the site have higher concentrations of contaminants than others. There are many factors that could contribute to this including ground-water flow direction, the heterogeneity and anisotropy of the hydraulic conductivity of the aquifer, the elevation of the leachate collection trench, the volume of cement kiln dust that comes in contact with ground water before it moves beyond the landfill, and how long it takes for ground water to pass through the cement kiln dust. MW-6 is located closer to the wetlands that are contaminated with leachate than MW-3; therefore, it is not surprising that it has higher concentrations of leachate than found in MW-3.

No evidence is cited to back the assertion that "wells that are not improving are those that are not as directly affected by landfill leachate."

Ammonia is a chemical of concern for the site. The highest concentration of ammonia found in ground water at the site is found in the landfill wells. The average concentration in landfill well LW-4 between 2001 and 2005 was 204 mg/l. The highest concentration found in MW-6 between 1993 and 2006 was 9.5 ug/l. The background upper tolerance limit for ammonia in ground water is 2.3 mg/l. It is apparent that (1) the concentration of ammonia in ground water increases as ground water moves through the landfill (2) the ammonia found in MW-6 and other downgradient wells comes from the landfill.

2b. *Sediment conditions are improving. None of the Interim Action activities have directly affected sediments at the site (i.e., no removal actions have been taken). However, by eliminating the impacts of the uncontrolled sources and allowing natural attenuation, the historically-sampled sediment locations now meet RACs.*

Figures 15 and 16 show trends in sediment concentrations relative to RACs for arsenic and vanadium. The decreasing trends are all statistically significant at the 95% confidence level (see Appendix A) except for arsenic in SS-15, which has always had an arsenic concentration below the RAC.

Some additional sediment sampling/delineation may be required to evaluate the need for further, targeted remedial activities to address constituents found with concentrations above the RACs.

As stated previously, a sufficient number of sediment samples have not been collected at any one time to conduct the necessary statistical analysis to evaluate compliance with the sediment remediation goals, and there is no way to judge whether the levels of contaminants in sediment have changed since the remedial investigation. In addition, Ohio EPA has observed the sediment sampling locations and has determined that the sampling methods are biased and unacceptable. The same location has been sampled repeatedly resulting in a depression in the ground. It appears that all of the contaminated sediment has been removed from the sampling locations. The surrounding areas appear to be contaminated based on the lack of vegetation.

Ohio EPA agrees that additional sampling is needed to verify the area of contaminated sediment that requires remediation. See response to comment 2 under public hearing.

2c. *Surface soil barren areas are improving. None of the Interim Action activities have directly affected the barren areas at the site (i.e., no removal actions have been taken). However, by eliminating the impacts of the uncontrolled sources and allowing natural attenuation, the barren areas have been greatly reduced in number and extent.*

The photos shown in Appendix B show the dramatic improvements at the site. The remaining barren areas persist due to continuing high pH levels that resulted from historic impacts that have not yet been mitigated by natural attenuation. Although they would eventually re-vegetate, CEMEX proposes to more-actively address these areas by one-time neutralization with agricultural acidulants and/or by planting of alkali-tolerant vegetation.

Because the residual barren areas and affected sediments are already greatly reduced in area in volume compared to the levels assumed by the Preferred Plan; and because these levels may be further reduced by in-situ treatment with an acidulant, there may be few soils or sediments at the site that require excavation. Thus, the Preferred Plan remedial approach to soil (excavation and creation of additional landfill cell) will pose unnecessary cost and problems with implementation. In addition, adding to the landfill will increase volume of entombed soils in a manner contrary to the NCP. In-place treatment (if needed) will reduce toxicity and volume at lower cost and without implementability and cost issues.

As stated previously, a sufficient number of soil samples have not been collected at any one time to conduct the necessary statistical analysis to evaluate compliance with the soil remediation goals, and there is no way to judge whether the levels of contaminants in soil have changed since the remedial investigation. In addition, Ohio EPA has observed the soil sampling procedures and has determined that the sampling methods are biased and unacceptable. The same location has been sampled repeatedly resulting in a depression in the ground. It appears that all of the contaminated soil has been removed from the sampling locations. The surrounding areas appear to be contaminated based on the lack of vegetation. See response to comment 2 under public hearing.

None of the alternatives in the feasibility study propose the treatment of contaminated soil by neutralizing with agricultural acidulants and/or by planting of alkali-tolerant vegetation. Such a proposal would have to be incorporated into the feasibility study and subjected to individual and comparative analysis against the eight remedy selection criteria.

The NCP does not prohibit increasing the volume of materials in a landfill.

The assertion that in-place treatment will reduce toxicity and volume at a lower cost without implementability and cost issues is contradicted by the feasibility study which found that alternative S-5 (stabilize soil and sediment in place) was less technically implementable and more expensive than alternative S-4, (excavate soil and sediment and cap on-site).

3. *The upgradient trench will not be effective at dewatering the landfill. Unless the landfill is completely dewatered, the leachate collection system will have to operate. Thus, the incremental cost of the upgradient trench will provide no reduction in site risk or cost.*

Figure 8 presents a cross-section of the site that shows that the upgradient trench will not be effective at dewatering the landfill. There will be significant underflow beneath the trench through the Elkhorn Formation. Appendix C evaluates the groundwater model used to assert that the upgradient trench will dewater the landfill. The model does not completely account for the boundary conditions and the amount of relief present at the site. Decreasing groundwater elevations at the top of the hill by 4' will not necessarily translate to a 4' decrease in groundwater elevations at the bottom of the hill, especially when the trench does not extend around the perimeter of the landfill. The groundwater model has not been adjusted to incorporate the fact that this system is located along the side of the hill.

OEPA also asserts that water collected in the upgradient trench would not require treatment. CEMEX disputes this finding. As the OEPA noted, some upgradient wells have high pH conditions. The relative proportions of affected water to unaffected water that will be collected by the trench and the buffering capacity of the upgradient groundwater cannot be predicted prior to installation. Thus, if the 50/50 blend assumed by the Preferred Plan does not match the actual blend of waters intercepted by the trench, the upgradient water may require treatment -- significantly altering the cost evaluations in the Preferred Plan.

Two ground-water flow models have been developed for the site: one by Southdown in the feasibility study and the other by Ohio EPA. Both models show that the upgradient trench will de-water the landfill. No evidence has been presented, other than unsubstantiated figures purporting to represent ground-water flow, that contradicts the findings of the models. See response to comment 7 under public hearing.

Ohio EPA has updated its ground-water flow model to include more accurate water level information based on a 2006 survey of the site. The model continues to predict that after the installation of the upgradient trench, substantial dewatering should occur within four years and the residual leachate production should be practically negligible.

Prior to conducting the mixing study in 2003, Ohio EPA evaluated ground-water data from the remedial investigation in eight upgradient wells close to the proposed location for the upgradient trench. Of the wells evaluated, only one well, BRW-8, contained water that would require treatment before being discharged to surface water. Thus, it appears that only a small portion (12.5%) of the upgradient ground water that would be captured by the upgradient trench is impacted. Ohio EPA mixed BRW-8's water with the other well waters at various ratios up to a 50/50 blend (50% BRW-8) and found that the pH of all of the blends fell into the requirements for surface water in Ohio, 6.5 - 9.0 S.U. The 50/50 blend is a much higher ratio of contaminated to uncontaminated ground water than indicated by existing data.

4. *The Revised Preferred Plan is based upon addressing Site conditions as they existed more than 10 years ago. As noted above, site soil, sediment, and groundwater conditions have improved since the RI/FS and risk assessment were conducted. Thus, the amount of site soil/sediment requiring remediation is much less than previously estimated. Any evaluation of candidate remedial alternatives against the NCP criteria will not be appropriate to address conditions as they exist today. A remedy that may be appropriate for addressing thousands of cubic yards of contaminated soil and sediment may not be appropriate for addressing a few dozen cubic yards.*

   Similarly, any evaluation of candidate groundwater alternatives that does not take into account the new baseline groundwater conditions that now exist at the site is not consistent with the NCP. 40 CFR 300.430 (e) requires the "development and evaluation of alternatives [that] shall reflect the scope and complexity of the remedial action under consideration and the site problems being addressed." Thus, it is inconsistent with the NCP to use a proposed remedial action to address site problems that haven't existed at the site for more than 10 years.

   The Preferred Plan states that unacceptable health risks exist to human health and the environment that are a result from exposure to soils, sediments, surface water and groundwater at the CKD Landfill #6 site. The plan then evaluates the remedial alternatives in a manner to mitigate these risks. While this methodology is consistent with guidance, the conclusions from this process are only sound if the information on which they are based was conducted properly and updated to take currently available data into account. The guidance assumes the RI/FS and risk assessment are based upon current (or near-current) data.

   The risk assessment relies on concentrations of constituents in site media that existed prior to implementation of the interim action and used residential exposure scenarios for soils and groundwater (including ingestion). These are unreasonable assumptions for the current and reasonably anticipated or controllable future site conditions and result in incorrect conclusions about the need for further actions at *the site. This is not to say that no further actions are, ordo not present remedies that will have any appreciable impact on the actual risks that are potentially present from likely exposures to site media.*

A risk-based evaluation of the site, and thus, any consideration of needed remedies, should be bifurcated to consider the on-site risks and off-site risks separately.

This comment contains several allegations including: (1) soil and sediment conditions have improved, (2) a remedy that is appropriate for a large volume of sediments may not be appropriate for a small volume, (3) ground-water conditions have changed and it is inappropriate to propose remedial actions to address problems that haven't existed in 10 years, (4) it is inappropriate to base a preferred plan on old data, (5) the residential exposure scenarios used in the risk assessment are inappropriate and result in incorrect conclusions about the need for remedial action, and (6) the consideration of remedies should consider on-site risks and off-site risks separately.

In responding to this comment, two preliminary points need to be made. First, the commenter is criticizing its own work. The respondent to the RI/FS order is Southdown, Inc. which is now owned by CEMEX, Inc. The respondent conducted the remedial investigation, baseline risk assessment, and the feasibility study and developed the remedial alternatives that were evaluated in the preferred plan. It is unclear as to why the respondent has decided that the work it conducted, as required by the orders, is now wrong. Second, Ohio EPA must base its decision on the data that is available at the time of its evaluation of the alternatives. That includes the RI, baseline risk assessment, FS, and the data collected between the approval of the FS and the present.

As stated previously, the allegation that soil and sediment conditions have improved cannot be verified because a sufficient number of soil and sediment samples have not been collected at any one time to conduct the necessary statistical analysis to evaluate compliance with the soil and sediment remediation goals. Ohio EPA will require CEMEX to conduct additional soil and sediment sampling during the remedial design phase. If the volume of soil and sediment requiring remediation has changed, it may be necessary to revisit and possibly modify the scope of the soil and sediment remedy.

Ohio EPA agrees that ground-water conditions have changed; however, the level of contaminants in ground water still exceeds the risk-based cleanup goals developed by the respondent. The problems that exist today are similar to those that existed 10 years ago.

There is no rule-of-thumb for the age of the data used in developing a preferred plan. In this case, Ohio EPA used data from the RI as well as the on-going monitoring data.

The residential exposure scenarios used in the risk assessment were appropriate at the time the risk assessment was conducted and are appropriate today. The guidance on assessment of human health risk has not changed.

It is unclear as to what point the commenter is trying to make regarding considering on-site versus off-site risks. Site is defined in the order as Landfill #6 and "any other area contaminated or threatened to be contaminated by hazardous waste and/or industrial waste and/or other waste migrating therefrom." Off-site means areas that are not impacted by Landfill #6. It therefore makes no sense to consider risk for areas that are not contaminated and may never be contaminated.

4a. *On-site Risk Evaluation. Basing a risk assessment on residential exposure to soils and groundwater at the CKD Landfill #6 is unreasonable under current-use conditions (no residents or groundwater use currently exist at the site). The only potential current on-site receptors would be an industrial/construction worker who would be on-site to perform maintenance or grounds keeping duties, or an on-site trespasser (with insignificant exposures when compared to other receptors at the site). A review of the currently available data indicates that there are no unacceptable risks to industrial/construction workers from exposure to soils or sediments at the site or from the incidental groundwater exposures that could be expected (potable groundwater use at the site was not considered a completed exposure pathway). These risk-based standards are calculated in a similar manner to those calculated in the base-line risk assessment conducted for the site.*

Exposure to site media can be limited for future receptors through the use of the Uniform Environmental Covenants Act that would limit future development of the site to industrial or commercial uses without potable groundwater use. The Uniform Environmental Covenants Act became effective on December 31, 2004, and is used to create traceable and enforceable activity and use restrictions on properties within Ohio.

The approved baseline risk assessment complied with U.S. EPA's Risk Assessment Guidance for Superfund Volume 1 Human Health Evaluation Manual (RAGS Part A). RAGS Part A states that there must be an exposure point where contact can occur, such as the future use of ground water at the site. RAGS Part A also states that "if ground water is not currently used in the area of the site as a source of drinking water but is of potable quality, future use of ground water as drinking water would be possible.... if the site is currently industrial but is located near residential areas in an urban area, future residential land use may be a reasonable possibility." The ground water at the site would be potable, if it was not contaminated, and there are residences next to the site. Therefore, the future use of ground water from the site was considered in the risk assessment.

The feasibility study does not contain an alternative that includes an environmental covenant to restrict future land and ground-water use. See response to general comment 1.

4b. *Off-site Evaluation. There are no available data to indicate that off-site groundwater is being impacted from sources on the CKD Landfill #6 site. Current data indicate some RAC exceedances (molybdenum) at dispersed locations on-site but there does not appear to be off-site transport; wells located between those with exceedances and the perimeter do not exceed RACs.*

The above statement is self evident given that site is defined in the orders as Landfill #6 and "any other area contaminated or threatened to be contaminated by hazardous waste and/or industrial waste and/or other waste migrating therefrom." If off-site ground water was contaminated or threatened it would be part of the site.

Summary. *The Interim Action continues to be effective at controlling continuing impacts from the CKD landfill under current use conditions and has allowed historic impacts to be mitigated. Limited additional work is needed to address any residual historic impacts.*

The interim action's effectiveness is limited. Leachate continues to be discharged to surface water at the site and poses a threat to human health and the environment.

Currently available data indicate that there are no persistent off-site exceedances of sediment or surface water RACs. Data collected from soils, sediments, surface water and groundwater, and observations from the site photos demonstrate that Site conditions continue to improve; constituent concentrations continue to decrease to near/below RACs. Only a few groundwater RACs issues are present near the landfill. The decreasing concentrations are statistically significant. Thus, no additional actions of the scope of those presented in the Preferred Plan are needed and should not be implemented.

As stated previously, a sufficient number of soil and sediment samples have not been collected at any one time to conduct the necessary statistical analysis to evaluate compliance with the soil and sediment remediation goals, and there is no way to judge whether the levels of contaminants in soil and sediment have changed since the remedial investigation. Contaminant levels have decreased in some ground-water monitoring wells but appear to be either increasing or have reached an asymptotic level that is greater than the remediation goals in monitoring wells MW-4, MW-6, and MW-14. The site continues to have unacceptable risk to human health and the environment and does not meet ARARs. See response to general comment 1 and comment 5 under public hearing.

The remedial elements included with the Revised Preferred Plan will not work as claimed. Groundwater will continue to flow under the landfill cap and contribute to the formation of landfill leachate. This continuing contribution will not pose a threat because the produced leachate is reliably collected and treated. Implementation of an upgradient trench will not eliminate landfill leachate and thus will not mitigate the long term leachate system operational costs. Nevertheless, the quality of the leachate produced over the years continues to improve.

As previously stated, two ground-water flow models have been developed for the site: one by Southdown in the feasibility study and the other by Ohio EPA. Both models show that the upgradient trench will de-water the landfill. No evidence has been presented, other than unsubstantiated figures purporting to represent ground-water flow, that contradicts the findings of the models. Once the flow of leachate has stopped, the wastewater treatment system can be shut down resulting in considerable cost savings. See response to general comment 5.

Finally, the Preferred Plan actions were designed to address conditions that have not existed at the site for more than 10 years. Thus, any evaluation of their suitability to address current conditions will be flawed. The Preferred Plan is not consistent with the NCP in that it does not properly consider the actual current conditions the remedy is designed to address.

There is no rule-of-thumb for the age of the data used in developing a preferred plan. In this case, Ohio EPA used data from the RI as well as the most recent on-going monitoring data. Current conditions require that remedial actions be taken. Ohio EPA's Revised Preferred Plan is not inconsistent with the NCP.

For these reasons, CEMEX asserts that the Preferred Plan should not be implemented and Ohio EPA should not proceed to preparing a Decision Document.

Ohio EPA is charged with the responsibility to protect public health and the environment from threats caused by air, water, or soil contamination. The preferred plan must be implemented to protect human health and the environment from exposure to contaminants above acceptable limits in ground water, soil, sediment, and surface water.

Written Comments from Dawn Falleur & Suzanne Patterson, Green Environmental Coalition, March 29, 2006

1. *According to Michael Henry, Cemex, the company continually monitors groundwater contaminants by frequent sampling. What is the schedule and for how many years will they continue to monitor the wells?*

   Cemex's current ground-water sampling program is voluntary. They sample the monitoring wells four times a year. After they implement the remedial action, they will be required to monitor ground water according to a plan to be approved by Ohio EPA until they demonstrate they have cleaned up the ground water at the site which is projected to take approximately15 years.

2. *Describe the satellite landfill. Is it a lined site with cap that will need to be monitored? In ten years will the satellite landfill be a leachate problem for human health and the environment?*

   Ohio EPA will require that the satellite landfill be constructed according to the current relevant and appropriate standards for solid waste landfills. This will include a cap and a liner. If the satellite landfill is properly constructed and maintained, it will not create a leachate problem. In addition, operation and maintenance of the satellite landfill cap will continue as long as there is waste in place.

3. *Under what conditions will the OEPA "sign-off" in three years?*

   Ohio EPA is not aware of any three year sign-off procedure.

4. *Who will inspect the wetlands both east and west of I-675 for contaminants, and how often? We suggest that sediment and water be analyzed annually. The results of the testing should be made public.*

   CEMEX will be required to collect soil and sediment samples following the excavation of soil and sediment in order to verify that all of the contaminated material has been removed. Periodic inspections will also be conducted by CEMEX and Ohio EPA to verify that the discharges of leachate have ceased. Any data obtained by Ohio EPA is public information and will be available to anyone.

Written Comment from Dawn Falleur,Green Environmental Coalition, March 31, 2006

The Green Environmental Coalition would like to add a comment about the wetland on the west side of I-675. It is very important to have accurate and current testing on the water and the sediment or soils in the affected areas. Protective fencing should be maintained at the western edge of the property to keep trespassers away. And, with more residences being added nearby, the public must be protected from contaminants leaching into their properties. As a plan is developed this area should be carefully considered and taken care of.

CEMEX will be required to maintain the fence around the landfill. As part of the remedial action, CEMEX will collect soil and sediment samples to verify the current nature and extent of contamination and to delineate the areas required to be removed to the satellite landfill. This will include sampling of the wetlands on both sides of I-675. Additional verification sampling will be required following the removal.

Evaluation of Ohio EPA Groundwater Model

CEMEX attached an appendix to their written comments that evaluated Ohio EPA's ground-water flow model for the site. This appendix plus a response by Dr. Timothy Christman, P.E., of Ohio EPA, follows.

Page numbers referenced in this response refer to the original appendix submitted by CEMEX.

Evaluation of Groundwater Flow Model Results

LATA's review of the groundwater modeling indicates that the proposed upgradient interceptor trench will reduce the flow requirement at the existing downgradient interceptor trench, but not cut off the leachate source entirely. As a result, the net effect is that the upgradient interceptor trench will not be a cost-effective nor permanent solution to eliminate ongoing leachate treatment. Based on this evaluation, the upgradient interceptor trench should not be installed.

The critical feature affecting the model is the relative contribution from the Elkhorn formation. Installation of an interceptor trench may intercept contribution through the Brassfield formation and the overburden but not the Elkhom. Fundamentally, the proposed upgradient trench will not eliminate leachate, but just reduce it.

A simple calculation can be performed to determine the relative contribution per unit width of flow between the Brassfield and the Elkhorn. The flux is determined by Darcy's law.

$$Q=K\ B\ W\ i$$

Where Q = flux
K = hydraulic conductivity of the unit
B = unit saturated thickness
i - groundwater gradient of the unit

Formation	*Hydraulic conductivity (ft/da)*	*Saturated thickness*	*Potentiometric gradient (ft/ft)*	*Flux per unit width (ft^3/day–ft)*
Brassfield (unmined)	*0.5*	*12*	*8.8 e-3*	*0.05*
Brassfield (mined)	*100*	*12*	*11.5 e-3*	*13.8*
Elkhorn	*0.2*	*30*	*49 e-3*	*0.29*

The conductivity of the mined Brassfield is quite high. Thus, eliminating the mined Brassfield contribution would greatly reduce the volume of leachate that migrates to the leachate collection trench. However, just eliminating the mined Brassfield would not completely eliminate the leachate volume and would induce underflow and cross-flow under the cap in the lower elevations of the landfill.

Once the mined Brassfield contribution is eliminated, the much-lower-volume but still significant contribution from the Elkhorn would remain. As long as the groundwater nows under the trench and into the landfill, it will percolate to the trench, requiring collection and treatment.

The model also did not factor in the hydraulic conductivity of the sandy unit bounded by a constant head boundary being the wetlands. Active pumping downgradient of the trench likely yields more water from the wetlands than from the landfill. This is likely a sensitive parameter in the model which is not mentioned.

Further details of the modeling construction are discussed below. Individual documents reviewed are listed below with specific comments on each.

10/13/05 memorandum from Tim Christman to Steve Martin, titled Analysis of Aquifer Pump Test Data from SWPC Site.

This memorandum is of limited use as it is unclear whether the testing was pumping tests or slug tests. The evaluation should note the flow rate, which it does not. The test duration appears to be 90 minutes in some cases, but the flow rate is not shown.

10/28/04 memorandum from Tim Christman to Steve Martin titled "3D groundwater modeling for SWPCS Site"

This memorandum summarizes the setup of the groundwater model prepared by Tim. His major claim is a 72% reduction in leachate production based on operation of the proposed upgradient trench (reduction from 660 gpd to 142 gpd). Current leachate production is ~8,000 gallons per day [averaged over the last 2 years]. Thus, his model does not accurately reflect actual conditions at the site.

An additional question is whether this reduction is sufficient to prevent treatment on the downgradient side or not. If this does not change the remedy implementation, then the expense is not likely to be beneficial. Specific issues that the model setup raises are as follows:

1. *The boundary conditions for the model are not specified and drive the flow through the model matrix. The gradient will be proportional to the calculated flow through the system. The model has fixed heads on the edges of the model. The wetlands are likely a reasonable fixed head. The heads on the upgradient side need to be*

checked. This difference in heads from opposite model boundaries sets up the flow and should be reviewed.

2. *One model run shows a liner on the downgradient side of the trench to provide an impermeable barrier to make the trench more effective. This may make the model look better, but is not realistic as we know that the liners do not effectively seal. This assumption will make the trench to appear more effective in the model than it would be in actuality.*

3. *The fundamental question is the setup of the layers. The Elkhorn and Whitewater formations discharge into the landfill and a removal within the Brassfield will not affect these natural flows. The question is what portion the flow contribution from the Elkhorn and Whitewater are relative to the entire flow regime. The hydraulic conductivities of the Brassfield and Elkhorn are similar (0.2 ft/day vs 0.5 ft/day, respectively). However, the silty-clay connected to the wetlands is an order of magnitude greater (7 ft/day). The net effect is that pumping near the wetland will yield lots of water, most of which is coming from the wetlands and not from the landfill. This feature may mask the calibration effort that the modeler conducted.*

4. *The model flow comes from the Brassfield through a layer called fractured surface zone to discharge at the downgradient edge of the landfill. The fractured surface layer with a 10 ft/day is where the majority of transport is coming from. The thickness of this layer and whether it was removed or filled in during construction of the landfill is a question. I would expect that the cement kiln dust that was deposited makes this layer much less permeable than outside the landfill. A reduction of this layer by ½ would decrease the underflow through the landfill by ½. This parameter needs to be reviewed in the model review.*

5. *The input parameter and layer geometry for the Elkhorn formation are unclear. Once I have a copy of the actual model this will become more evident.*

6. *There are some issues with Table 2 of the report. The revised table below adds actual water levels, the bottom of waste and comments. The predicted elevations with no trench yield water levels below the bottom of waste for LW-2, LW-3 and LW-4. If the model is believed, then the waste is not saturated except at the most upgradient location. Additionally, the water levels in the model are lower than actual by from 2.1 to 6.1 feet which calls into question the calibration. With this large of a prediction error, it calls into the ability of the model to predict the contribution from upgradient with much accuracy.*

Well	*Predicted Elevation, no trench*	*Predicted elevation with trench*	*Actual water levels 10/19/94*	*Bottom of waste*	*Comment*
LW-1	*907.8*	*903.7*	*909.99*	*904.7*	*Model predicts waste saturated 3.1 feet, actual levels 5.2 feet*
LW-2	*882.9*	*880.3*	*889.0*	*885.7*	*Model predicts waste not saturated, actual is 3.3 feet saturated*
LW-3	*870.8*	*867.6*	*875.31*	*874.3*	*Model predicts waste not saturated, actual is 1 foot saturated*
LW-4	*873.6*	*870.2*	*877.18*	*877.5*	*Model predicts not saturated, actual is not saturated*

C. 6/15/05 memorandum from Tim Christman to Steve Martin titled "Advanced Modeling, SWPC Remedial Options"

In this run he has revised the model to more closely address the stable potentiometric surface. Perhaps this addresses the issue raised in item 6 above. He concludes that 19,500 gpd is the starting point for the downgradient interceptor trench and predicts 2600 gpd is contaminated with leachate. Note that his initial prediction in item B was 660 gpd and now has grown to 2600 gpd. Perhaps this is because the water levels are higher than in his prior run.

This model predicts that after operation of the upgradient interceptor trench, the rate of the downgradient trench will stabilize at 9,000 gpd and have less leachate contribution from upgradient source. Fundamentally, the model does not predict that the downgradient trench can ever be shut down.

D. 7/13/05 memorandum from Tim Christman to Steve Martin titled "Latest Modeling, SWPC Site"

This iteration he changed the hydraulic conductivity of the waste from 4 ft/day to 0.5 ft/day. This change should reduce the predicted flow through the landfill. He simulates the existing downgradient interceptor trench operating at 12,700 gpd. The model predicts 7500 gpd of leachate passes under the trench to the wetland. This assumption is essential to his argument and is fundamentally flawed because the downgradient trench is installed in a low permeability unit that collects leachate and conveys it due to gravity discharge. This *model result may be due to his cell width in the model making the cells too wide to actually model the trench. In addition, there is another assumption that water that flows under the waste will not have the same characteristics as leachate. This is an assumption that has not been verified. Further conclusions from this write-up are in question.*

E. 10/28/05 memorandum from Tim Christman to Steve Martin titled "Slurry Wall modeling for SWPC"

A slurry wall is simulated in this run. The slurry wall is determined to be ineffective due to underflow beneath the wall. ***Any underflow that makes this alternative ineffective would also be the same underflow that would make an upgradient trench ineffective.***

INTEROFFICE COMMUNICATION

6/12/2006

To: Steve Martin, DERR/SWDO

From: Tim Christman, DERR/CO

Subject: Response to Appendix C of LATA's Comments on the Preferred Plan

General Comment:

Based on a review of maps and well logs for the site, the Ohio EPA concluded in the spring of 2006 that a new survey was needed to accurately determine the locations and elevations of the monitoring wells. In conjunction with a professional surveyor, OEPA and CEMEX conducted a new survey, which indicated that the elevations of the wells used in earlier modeling were off by an average of 1.7 feet. With the new survey data, the ground water model for the landfill was revised. That model supersedes earlier models discussed in the LATA comments.

Specific Comments:

Page 1, Discussion of role of mined and unmined Brassfield.

The model incorporates both the mined and unmined Brassfield units. The simulated upgradient trench intercepts the flow from both. The result is a significant reduction in ground water flow from the side of the hill, resulting in effective dewatering of the CKD waste. The table provided by LATA indicates that most of the flow comes from unmined Brassfield, rather than from the Elkhorn. Thus, intercepting the Brassfield flow would be expected to significantly reduce the flow through the waste.

Page 2, First paragraph.

The conductivity of the soil unit in the wetlands at the base of the landfill is irrelevant to the volume of water passing through the waste from the hillside.

Page 2, Analysis of Aquifer Pump Tests.

These were pump tests, not slug tests. They were observed by a consultant retained by CEMEX, who has all of the original test data.

Model predictions mentioned in that comments have been replaced by those of the new model.

1. Control heads have been reassigned for the top and bottom of the hill, based on the most recent survey of monitoring well elevations.

2. The liner for the downgradient side of the trench wold probably be made of thick polyethylene, the same material used for lining landfills. That material has been shown to be very waterproof when correctly installed.

3. I fail to see how the conductivity of the wetland can affect the flow of water from the hillside through the waste.

4. The thickness of the fractured surface layer was estimated from drilling logs of wells that penetrate it. The conductivity was estimated from pump tests on wells that are partially screened in the surface layer.

6. The table included in the comments is properly replaced by the following tables, which are based on the newest survey of well elevations.

TABLE 1. WELL ELEVATION DATA.

Well ID	Datum May Survey	Dist to Bottom	Bottom Elevation	Dist base of well to waste	Base of waste	Model base of waste	Diff
LW1	927.66	25.49	902.17	1	903.2	904.2	-1.0
LW2	938.44	56.11	882.33	1	883.3	880.8	2.5
LW3	930.12	59.00	871.12	1.3	872.4	871.6	0.8
LW4	934.45	64.50	869.95	3.3	873.3	871.4	1.9
						avg	1.0

TABLE 2. PREDICTED AND ACTUAL WATER TABLE ELEVATIONS.

Well ID	Model Elev.	Ave. Elev.	Diff.
LW1	910.00	909.96	0.04
LW2	886.00	886.90	-0.90
LW3	873.40	874.12	-0.72
LW4	873.90	874.57	-0.67
		average	-0.56

The values given for actual water table elevations are based on the averages since 1996, after the cap was installed. The use of 1994 data by LATA is inappropriate since that data was collected around the time the cap was installed and reflects neither the drops in water levels that followed capping nor the apparent errors in the original well surveys.

Page 4. 7/13/05 Memo

The model, in its revised form, predicts an average of 8.8 gpm of leachate collection, as opposed to a reported value of about 6 gpm being collected and treated. It is not clear to OEPA that all of the water being collected in the trench is being treated, especially in periods of high flow. Also, the trench may not be collecting all of the water that passes through it.

Page 4, 10/28/05 Memo

Ground water probably deflects around or under the slurry wall while it would be captured by the trench and transported through a pipe to the base of the hill. Thus a slurry wall would bring about substantial dewatering of the landfill, but a collection trench would be even more effective.

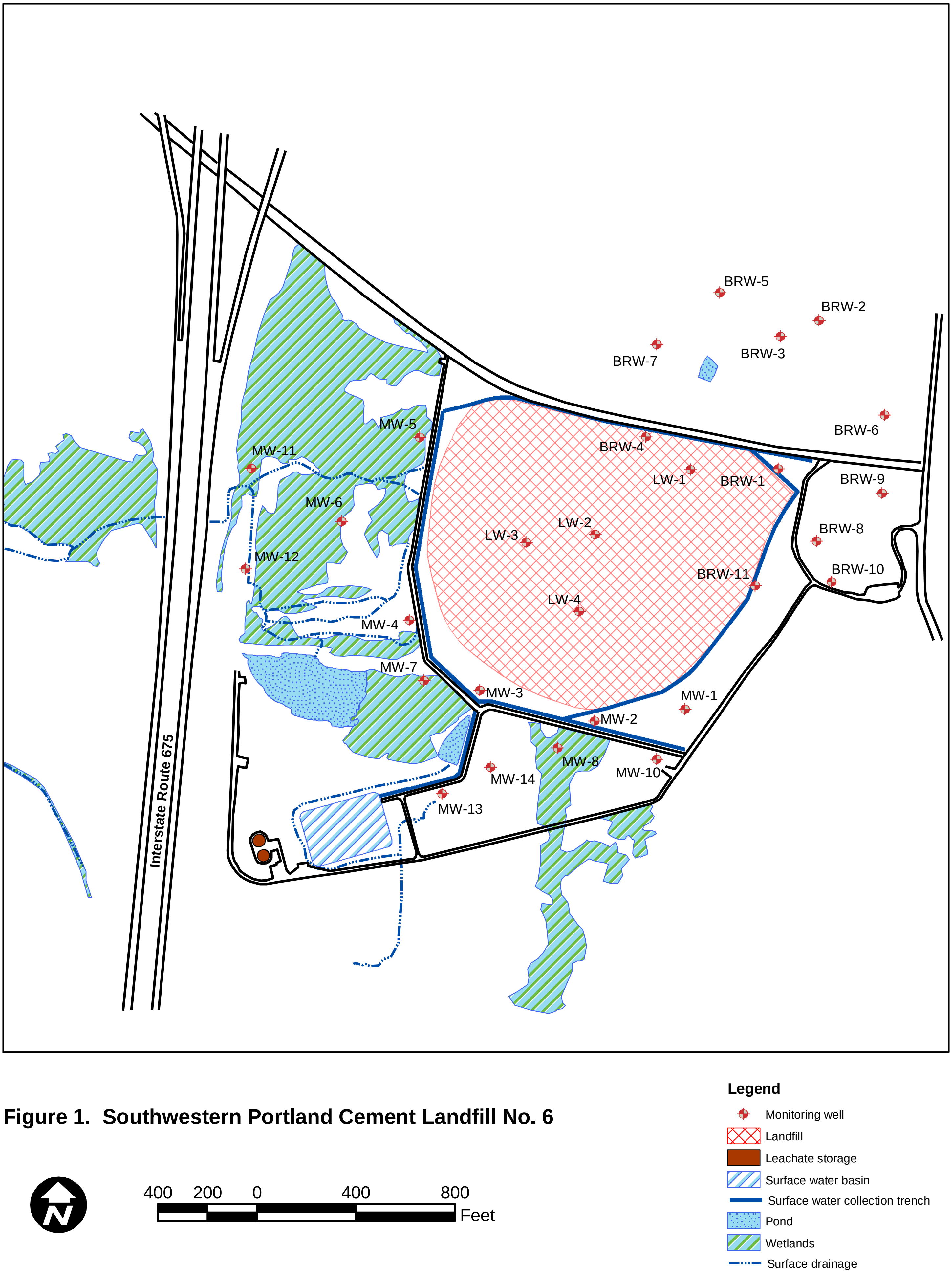

Figure 1. Southwestern Portland Cement Landfill No. 6