Brownfields Technical Support Center: Technical Assistance for the Sloan Auto/90 Hopkins Street Site, Buffalo, New York

Prepared for:

U.S. Environmental Protection Agency
Office of Solid Waste and Emergency Response
Technology Innovation Office
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BROWNFIELDS TECHNICAL SUPPORT CENTER
TECHNICAL ASSISTANCE FOR THE SLOAN AUTO/90 HOPKINS STREET SITE, BUFFALO, NEW YORK

1.0 INTRODUCTION

This document is Tetra Tech EM Inc.'s (Tetra Tech) response to several technical issues that could impact the cleanup and ultimate development or reuse of the Sloan Auto/90 Hopkins Street site located in Buffalo, New York. The U.S. Environmental Protection Agency (EPA) Region 2 requested assistance from the Brownfields Technical Support Center (Center) regarding the site. This report (1) describes the technical issues, (2) discusses the process Tetra Tech used to obtain information about the site, and (3) provides information to assist the site owner in making decisions about potential cleanup activities at the site.

2.0 ISSUES UNDER REVIEW

EPA requested the assistance of the Center to identify potential beneficial uses for a large quantity of lime that is currently stockpiled at the Sloan Auto/90 Hopkins Street site. There are two piles of lime containing approximately 50,000 total cubic yards of material. The piles are estimated to have been on site for more than 50 years. The reason they were placed there is not known. Finding a beneficial use for the lime material would help the owner of the site prepare for future development or reuse of the site by removing the large piles from the site. Removing the lime also may eliminate potential degradation of the site and adjacent areas caused by leaching or runoff from the piles. This report also provides information on remedial technologies for the site owner to consider for the potential treatment and cleanup of shallow soils at the site.

The information provided in this report is relevant to the brownfields program for several reasons. present. First, Tetra Tech developed an approach to finding a beneficial use of the lime material that otherwise may have gone unused. That approach could be used at other sites that contain large quantities of material with a potential beneficial use. Second, it is common to find soil contamination at a brownfields site. The types of remedial technologies identified to potentially clean up the site can be considered for use at other sites at which similar contamination is present.

3.0 THE PROCESS USED BY THE CENTER

A number of activities were conducted to develop responses to the technical issues identified. Those activities included discussions with EPA, review of site information provided by EPA, coordination among Tetra Tech staff to solicit options available for beneficial use of the lime material, discussions with representatives of several companies to determine whether they believe the lime material has a beneficial use, and review of remedial technologies potentially applicable to the site.

Tetra Tech contacted EPA staff to obtain specific information about the Sloan Auto site. The primary EPA point of contact was Mr. Kevin Matheis, on-scene coordinator (OSC). Mr. Matheis provided characterization data on the lime piles located on the site, specific information about site investigations performed to date, and preliminary results of those investigations.

Tetra Tech received from Mr. Matheis two documents that provided site characterization data. The first document (undated) is a summary of the characterization of the lime piles, based on sampling performed by Malcolm Pirnie, Inc. in December 1997. The results of the analysis presented in the report indicate that the constituents of the lime pile are very consistent throughout the depth of each pile and consistent with the preliminary determination that the piles were composed of lime material. The results indicate that the material is calcitic lime (calcium carbonate) and may be suitable for all the potential uses identified in Section 4.1 of this report.

The second document, dated October 29, 1998, had been prepared by Roy F. Weston, Inc. That report provides results of sampling performed at various locations at the site, including the lime piles, surface and subsurface soils, drums, and a pile of debris. The samples had been analyzed for target compound list (TCL) volatile organic compounds (VOC), base neutral acid (BNA) extractables, target analyte list (TAL) metals, and pesticides and polychlorinated biphenyls (PCB). The Weston report also compared the levels of contamination found at the site to the New York Department of Environmental Conservation Technical and Administrative Guidance Memorandum on Determination of Soil Cleanup Objectives and Cleanup Levels (NYDEC TAGM). This comparison showed that the following types of contaminants were present in the shallow soils at levels of potential concern: VOC; polycyclic aromatic hydrocarbons (PAH) including benzo(a)pyrene; PCB; and metals, including lead and mercury. The samples obtained from the lime piles were analyzed for pH, total cyanides, pesticides and PCBs. Appendix A summarizes the types of contaminants identified in the shallow soils at the site, and the maximum concentrations measured for those types of contaminants.

4.0 OPTIONS FOR IMPLEMENTATION OF CLEANUP ACTIVITIES

4.1 BENEFICIAL USES FOR LIME MATERIAL

Staff of Tetra Tech working on this project solicited from other staff of the company information about potential beneficial uses of the lime material at the Sloan Auto site. One consideration in identifying such uses was the potential cost of transporting the material to the end user.

The following uses were identified:

- Electric power plants (flue gas desulfurization)
- Stabilization (various applications)
- Agricultural use
- Cement manufacturing
- Fertilizer manufacturing
- Wastewater treatment
- Pulp and paper industry
- Steel industry

The City of Buffalo, New York, the current owner of the site, may be able to generate revenue through the sale of this material. To determine the feasibility of the various uses of the lime, potential users in the area were identified and contacted. The limited research conducted indicates that the most practicable options for the beneficial use of the lime include use in scrubbers and stabilization in mines or of fly ash. If any of the potential users found the lime at the site to be suitable, it could be used relatively quickly because of the large volumes required for such uses. Discussed below are the results of those preliminary contacts. For a quick reference, Appendix B is a summary of the information obtained from the contacts.

Electric power plants: At coal-fired power plants, lime is used in the scrubber units to reduce emissions of sulfur dioxide. This process, called flue gas desulfurization, requires large quantities of lime. Both Niagara Mohawk and New York State Electric and Gas (NYSE&G) have power plants in the area that might have use for the lime. Niagara Mohawk's Huntley Plant is located in Tonawanda, New York, and NYSE&G has a plant in Somerset, New York. It is recommended that the two utilities be contacted to determine their interest in the lime.

Waste-to-energy plants have similar scrubber units that can use lime. Such plants also mix lime with fly ash before disposing of the fly ash. Tetra Tech contacted the Buffalo Hammer Mill Corp., in Buffalo, New York (Mr. Chris Edelsward, [716] 855-1202). Mr. Edelsward stated that a waste-to-energy plant in the area uses an average of 160 to 200 tons of lime per month.

Stabilization: Lime can be added to a natural soil material to improve one or more of its properties when used as a base material for road and airfield pavements and under floor slabs. Lime has been used as an additive to improve clay soils. The lime stabilization process requires mixing, then curing for a few days, followed by remixing and compaction. If the natural soil is considered inadequate for use as a base material, it is often less expensive to stabilize the soils with an additive (such as lime) than to excavate the "bad" soil and replace it with soil that is more acceptable. Tetra Tech contacted the New York State Department of Transportation (NYSDOT) in Buffalo, New York to determine the frequency with which lime is used as a stabilizing material. NYSDOT indicated it had not used lime because many of its projects involved soils that are low in clay content. However, NYSDOT indicated that some towns in northern Erie County and Niagara County, where clay is more prevalent, may use lime as a stabilizing material. It is possible those counties could use the lime for some projects.

Lime also can be used as a stabilization agent for various wastes. Lime is mixed with the waste to reduce the solubility and mobility of the waste. Lime is suitable for addition to industrial wastes, including metals. For example, the chemical industry generates wastes that require stabilization prior to their disposal. Two large companies in the Niagara Falls, New York area (DuPont and Occidental) were contacted to determine whether they have use for the lime. Both companies are ISO 9000 certified and employ rigorous quality assurance procedures in their stabilization processes. Therefore, either company must review the results of the testing of the lime to determine whether the lime is of adequate quality. Occidental indicated that it uses only pebble lime. DuPont indicated it uses hydrated lime and stated that, even if the lime were acceptable, completion of its approval process probably would require three months.

Similarly, lime can be used to solidify/stabilize wastes at sites undergoing corrective action under RCRA or cleanup under Superfund. Tetra Tech conducted a preliminary search for potential sites using the EPA REACH IT website, (Remediation and Characterization Innovative Technologies), at www.epareachit.org, to determine if there are any sites in the Buffalo area where there may be a potential use for the lime. Although no sites appeared on the website, EPA and NYSDEC possibly have additional information that could be used to identify potential sites.

The mining industry also uses lime for stabilization. Coal and metal mining create waste that is highly acidic. Those wastes must be neutralized to minimize their environmental effects. A number of coal mines in Pennsylvania could potentially use the lime. Tetra Tech contacted Clean Earth in Norristown, Pennsylvania.and spoke with Mr. Steve Sands ([800] 278-6902). Clean Earth is involved in mine reclamation activities in the northeastern United States. Mr. Sands indicated a possible interest in the lime for a large project scheduled to begin in the next six months. He further indicated that the lime could potentially command a price of $10 to $20 per ton. Mr. Sands offered to visit the site and obtain samples for analysis to determine if the lime is suitable for the project. If Clean Earth were to decide the material is not suitable, other companies could be contacted to determine their interest in the lime.

Agricultural use: Lime can be added to soil to raise the pH. If soil is acidic (pH less than 7), crops, plants, and grass do not grow well. Ideally, to promote growth, soil pH should be in the range of 6 to 7. Western New York is well known for its agricultural products, including corn, soybeans, milk products, and ornamental plants. Farmers in the area could apply the lime to the land as they harvest. It would be necessary to know the results of analysis of the lime piles before the lime could be used in agricultural.

Cement manufacturing: Lime is used in manufacturing cement. Companies that have offices in Buffalo, New York include the Lafarge Corporation and Independent Cement Corporation. The Lafarge Corporation expressed an interest, however, the company must review the results of analysis of the lime before it can determine whether it is of use to the company. Other companies in Niagara Falls or elsewhere may be interested, as well. However, results of the chemical analysis and any grain size analysis would assist such companies in determining whether they can use the lime.

Fertilizer manufacturing: Lime is used as an additive in manufacturing fertilizers. Lawn, garden, and other fertilizers are produced locally by Gro-Green Products, Inc. located in Buffalo, New York. Gro-Green indicated it supplies fertilizer to more than 200 stores from New York to Maine and might be interested in the lime. Currently, Gro-Green obtains its lime from a company in Ohio. Other fertilizer manufacturers in the area might be interested in the lime as well.

Wastewater treatment: Lime is used in sewage treatment, primarily for neutralizing acidic waste. Today, many treatment plants have reduced their use of lime, using materials like polymer instead. The city of Buffalo and the town of Amherst indicated they use polymer and have no need for a large quantity of lime. However, it is possible that some rural areas in the vicinity of Buffalo, New York could use the material.

Since the city of Buffalo is not interested, it is recommended that treatment plants in rural areas be contacted to determine whether they are interested in the lime.

Pulp and paper industry: In the pulp and paper industry, lime is mixed with ash generated by the incineration of waste from the pulping process. International Paper in Erie, Pennsylvania indicated it operates a pulping mill that uses lime. However, the mill recycles its lime and therefore rarely needs a new supply. If the kilns shut down, the mill acquires more lime; however, such shut downs are rare. Buffalo Paperboard Corp. in Lockport, New York indicated that no pulping is carried out at its facility, and it has no need for the lime.

Steel Industry: Lime is mixed with ore in the manufacture of steel to remove impurities including silicates. Lime is mixed with the ore then melted to combine the lime and silicates to form a liquid called slag. The slag is immiscible with molten iron and is drained to remove the silicates from the steel. Approximately 80 kilograms of lime are used in the production of one metric ton (1,000 kilograms) of steel. Tetra Tech attempted to contact a representative of Bethlehem Steel Corporation on Hamburg Turnpike in Buffalo, New York to determine if melting operations are performed at this facility and if they have any interest in the lime. The representative (Mr. Ted James [716] 689-6366) had not returned the call at the time this report was submitted.

4.2 ADDITIONAL ANALYSES OF THE LIME MATERIAL

Results of analysis indicate that the piles are not contaminated and that the material most likely is calcitic lime. Before an option for use of the lime is selected, the potential user likely will require additional information. Specifically, additional sampling and analysis may be required to assist the potential user in determining whether or not the lime material meets the user's specifications.

Each potential user may want to conduct their own sampling. As an alternative, more detailed analysis of the lime piles could be provided to each of the potential users for review in anticipation that this information would be sufficient for them to make a decision regarding their potential interest.

Listed below are recommended characterization analyses that should satisfy the requirements of most potential users of the lime. The analyses were selected based on information provided by the potential users of the line and by Tetra Tech staff with experience in the processes discussed in Section 4.1 of this report.

Parameters	Total Metals	TCLP Metals
pH	Arsenic	Arsenic
Conductivity	Cadmium	Barium
Totals solids	Chromium	Cadmium
Calcium carbonate equivalent (CCE)	Copper	Chromium
Calcium	Lead	Lead
Magnesium	Mercury	Mercury
Sodium	Molybdenum	Selenium
Phosphorus	Nickel	Silver
Potassium	Selenium	
Sulfate	Zinc	
Total sulfur		
Sieve analysis		
Free carbon		
Percent CaO		
Percent MgO		
Total carbonate		

4.3 POTENTIAL VALUE OF THE LIME

As discussed above, there are a number of potential uses for the lime, and it is possible that a user may be willing to pay the owner of the site for the material. A key factor in establishing the amount a potential user will agree to pay is the cost of transporting the material to the user's site. Transportation cost can include several components; the cost to load and unload the material, and the shipping costs. Tetra Tech contacted several vendors to try to develop a framework for those costs, and found there were wide variations. For purposes of this estimate, it is assumed the cost to load material and the cost to unload material are approximately equal, and one cubic yard of the lime material weighs approximately 1.4 tons.

Three local transportation companies in the Buffalo area responded to Tetra Tech's calls. Estimates from two of the companies were based on haul distances of no greater than 30 to 35 miles, and their estimates did not include loading costs, because they do not have loading equipment. A representative from Price Trucking ((716) 822-1414) indicated that hauling 105 tons per day (35 tons per trailer) would cost approximately $16 per ton. That company could haul only three trailers per day. A representative from Professional Carriers and Brokers ((716) 631-8486) indicated the cost to haul a ton is approximately $13.

A representative from a third local transportation company, Vince Fallone of Fallone Trucking ((716) 337-2645) indicated the cost to haul a ton of lime material is approximately $6. Mr. Fallone also estimated $3 per ton to load the material. For comparison, a representative of a mineral recycler, Mr. Kevin Sweeney, of Minerals, Metals & Solvents, Inc., in the New Orleans, Louisiana area ((504) 818-1244), indicated that if the potential user is within a 30 to 40 miles of the site, the cost per ton of transporting the material might be $1 to 2 per ton to load the material, and $3 to 4 per ton to haul it.

A potential user may be willing to pay only a fraction of the actual cost of transporting the lime to the user's location, or to pay nothing. If so, the owner of the site would have to remove the material from the site at its own expense. However, such an expenditure might be appropriate if future development of the site depends on the removal of the material. In such circumstances, the expenditure could be considered an investment necessary to redevelop or reuse the site.

4.4 POTENTIAL ENVIRONMENTAL IMPACTS OF THE LIME PILES

If the owner of the site intends to leave the lime on site, the following items should be considered in determining the potential environmental impacts of the lime piles, and whether barriers or containment systems might help to minimize or reduce potential impacts.

- The adequacy of sampling or investigations conducted to determine whether liquids (leachate) are being generated from the lime pile and the characterization of those liquids.
- The adequacy of sampling conducted on the adjacent surface-water body, Ramco Pond, and if there is an indication of any effects of the lime piles (leachate) on the pond.

4.5 POTENTIAL CLEANUP OF SHALLOW SOILS

The following discussion is provided should a need for additional remedial action be identified.

On the basis of the site characterization data provided to Tetra Tech, it is not possible to recommend a specific remedial technology for the shallow soils at the site. The data provided to Tetra Tech do not delineate the exact nature and extent of the contamination, and the volume of material that would require treatment is not defined completely. In addition, it would be important to identify the redevelopment or reuse plans for the site, the schedule for redevelopment or reuse, and the amount of effort the owner of the site is willing to invest in cleanup. This information is necessary to complete a detailed comparison of remedial technologies according to cost or other criteria.

Typical remedial options for this type of site would be containment and/or excavation followed by disposal off-site. Frequently at these sites, contaminants are relatively immobile, and there are only limited risks to human health and the environment. Therefore, containment (such as covering the contaminated soil with asphalt) can be used, with monitoring of the natural processes that attenuate the contamination. Such an approach might be performed in addition to limited excavation and off-site disposal, or institutional controls, such as a deed restrictions governing future use of the site.

In addition, there are a wide variety of other, potentially applicable remedial technologies that could be considered for use at this type of site. Those include innovative technologies such as bioremediation, soil flushing, and solvent extraction, and more established technologies such as thermal desorption and incineration. Potentially applicable remedial technologies for treatment of the shallow soils are listed in Appendix C, along with their target contaminant types (organic or inorganic contaminants), potential advantages, and limitations or concerns related to them.

In evaluating whether there is a need for cleanup of shallow soils for the site, the potential risks to human health and the environment posed by each medium (such as surface and subsurface soils and surface water) must be identified. To identify those risks, the following questions should be answered:

- What do historical records show about past operations at the site and what kinds of materials and chemicals may have been handled at the site (especially for PCB-containing materials)?
- What is the nature and extent of contamination at the site?
- What are the effects of such contamination on groundwater and surface water, such as adjacent wetlands?
- Who or what are the potential receptors?
- Which contaminants are contributing to elevated risks?
- Is remediation of some or all of the site necessary?
- Can remediation be limited to relatively small discrete areas?

APPENDIX A

SUMMARY OF TYPES OF CONTAMINANTS IDENTIFIED IN SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK

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SUMMARY OF TYPES OF CONTAMINANTS IDENTIFIED IN SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK

Type of Contaminant	Specific Contaminants Identified with Results > NYDEC TAGM Levels[1] (no. of locations[2]; maximum concentration in mg/kg)	
Volatile organic compounds	Benzene (1; 0.077) m&p-xylene (1; 1.4) o-xylene (1; 1.1)	
Semivolatile organic compounds	4-Methylphenol (1; 0.98 J)[3] Phenol (1; 0.17 J) Diethylphthalate (1; 10 J) Bis(2-ethylhexyl)phthalate (1; 66 B)[4] Phenanthrene (1; 54) Fluoranthene (1; 57) Pyrene (1; 51)	Benzo(a)anthracene (11; 28) Chrysene (11; 26) Benzo(b)fluoranthene (8; 24) Benzo(k)fluoranthene (8; 25) Benzo(a)pyrene (12; 28) Indeno(1,2,3-cd)pyrene (5; 16) Dibenzo(a,h)anthracene (6; 6.9 J)
Pesticides	None	
PCBs	Arochlor 1242 (4; 17) Arochlor 1248 (4; 8.6) Arochlor 1260 (6; 2.2)	
Metals	Arsenic (17; 170) Barium (4; 880) Beryllium (6; 3.4) Cadmium (14; 16) Calcium (16; 320,000) Chromium (11; 920) Copper (14; 510)	Lead (11; 7,800) Magnesium (11; 30,000) Manganese (1; 26,000) Mercury (18; 60) Nickel (9; 88) Vanadium (1; 420) Zinc (21; 3,300)

1. NYDEC TAGM is the New York Department of Environmental Conservation Technical and Administrative Guidance Memorandum on Determination of Soil Cleanup Objectives and Cleanup Levels
2. Shallow soils were analyzed at a total of 23 locations
3. J - The value is below the method detection limit and is estimated
4. B - The analyte was found in the blank

Source: Roy F. Weston report, October 29, 1998.

APPENDIX B

SUMMARY OF POTENTIAL BENEFICIAL USES FOR LIME MATERIAL AT SLOAN AUTO SITE, BUFFALO, NEW YORK

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SUMMARY OF POTENTIAL BENEFICIAL USES FOR LIME MATERIAL AT SLOAN AUTO SITE, BUFFALO, NEW YORK

Potential Use	How Lime is Used in the Process	Potential Contacts
Electric Power Plants	In scrubber units to reduce emissions at coal-fired power plants and waste-to-energy plants	Niagra Mohawk Tonawanda, New York New York State Electric and Gas Somerset, New York Buffalo Hammer Mill Corp. Buffalo, New York Mr. Chris Edelsward (716) 855-1202
Stabilization	Add to natural soil material to improve its properties when used as a base material Mixed with waste to reduce the solubility and mobility of the waste Solidify/stabilize wastes at sites undergoing corrective action Neutralize waste from the coal and metal mining industries	Towns in Northern Erie County and Niagara County Niagra Falls, New York DuPont and Occidental EPA and NYSDEC Clean Earth Norristown, Pennsylvania Mr. Steve Sands (800) 278-6902
Agricultural Use	Add to soil to raise pH	Farmers in Western New York
Cement Manufacturing	An additive in the manufacturing process	Lafarge Corporation Buffalo, New York Independent Cement Corporation Buffalo, New York
Fertilizer Manufacturing	An additive in the manufacturing process	Gro-Green Products, Inc. Buffalo, New York
Wastewater Treatment	In sewage treatment, primarily for neutralizing acidic waste	Rural areas in the vicinity of Buffalo, New York
Pulp and Paper Industry	Mixed with ash generated by the incineration of waste from the pulping process	International Paper Erie, Pennsylvania
Steel Industry	Mixed with ore to remove impurities	Bethlehem Steel Corporation Buffalo, New York Mr. Ted James (716) 689-6366

APPENDIX C

SUMMARY OF POTENTIAL TECHNOLOGIES FOR TREATMENT OF SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK

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SUMMARY OF POTENTIAL TECHNOLOGIES FOR TREATMENT OF SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK[1]

Technology	Target Contaminant Types	Potential Advantages*	Potential Limitations/ Concerns[2]
Bioremediation: a process (in situ or ex situ) in which microorganisms (for example, fungi, bacteria, and other microbes) degrade (metabolize) organic contaminants in soil or groundwater; nutrients, oxygen, or other amendments may be used to enhance bioremediation.	Organic	- Innovative technology - Several potential configurations (in situ and ex situ) - Intrinsic bioremediation may be adequate for treatment of some contaminants - Rate may be enhanced by addition of oxygen or nutrients - Typically costs less than incineration	- Rate may be relatively low in cold, northern climate - Likely will not reduce concentrations of metals
Soil flushing: an in situ process that uses water or other suitable aqueous solutions to extract contaminants from soil, typically accomplished by passing an extraction fluid through soils with an injection or infiltration process.	Organic and Inorganic	- Innovative technology - May be operated without excavation (in situ soil flushing) - Could be effective for both organic and inorganic contaminants - Typically costs less than incineration	- May require additional extraction or treatment of groundwater - As with many in situ technologies, proper design may require development of an accurate conceptual model of the site - May increase mobility of some relatively immobile contaminants (such as some metals)

APPENDIX C

SUMMARY OF POTENTIAL TECHNOLOGIES FOR TREATMENT OF SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK (continued)

Technology	Target Contaminant Types	Potential Advantages*	Potential Limitations/ Concerns[2]
Soil vapor extraction (SVE): an in situ process that uses application of a vacuum to soil to induce the controlled flow of air and remove volatile and semivolatile contaminants; typically requires control of off-gases.	Organic	- Established technology - May be operated without excavation (in situ SVE) - Several potential configurations (vertical or horizontal wells) - Rate may be enhanced by thermal processes - Typically costs less than incineration	- Operation is sensitive to site characteristics (for example, soil permeability and moisture content) - Typically requires air emission control and stack discharge permit - May not be effective for metals and lower volatility organics (such as some PAHs) - As with many in situ technologies, proper design may require development of accurate conceptual model of the site
Soil washing: an ex situ process that uses water to separate contaminants sorbed onto fine soil particles from those in bulk soil on the basis of particle size; wash water may be augmented with a basic leaching agent, surfactant, or chelating agent, or by pH adjustment, to help remove organics and heavy metals.	Organic and Inorganic	- Innovative technology - Could be effective for both organic and inorganic contaminants - Typically costs less than incineration	- Does not destroy contaminants and creates a concentrated residue that requires further treatment or disposal - Operation is sensitive to site characteristics (for example, soil types) - May increase mobility of some relatively immobile contaminants (such as some metals)

APPENDIX C

SUMMARY OF POTENTIAL TECHNOLOGIES FOR TREATMENT OF SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK (continued)

Technology	Target Contaminant Types	Potential Advantages*	Potential Limitations/ Concerns[2]
Solvent extraction: an ex situ chemical extraction process that uses an organic solvent to extract contaminants sorbed to soil; solvent extraction differs from soil washing in its choice of an organic solvent instead of an aqueous-based solvent.	Organic and Inorganic	- Innovative technology - Could be effective for both organic and inorganic contaminants; demonstrated effectiveness for PCBs - Typically costs less than incineration - May be able to remove contaminants not amenable to other technologies	- Does not destroy contaminants and creates a concentrated residue that requires further treatment or disposal - Operation is sensitive to site characteristics (for example, soil types and moisture content)
Thermal desorption: a physical separation process designed to volatilize and strip water and organic contaminants, but to not destroy organic contaminants; a carrier gas or vacuum system transports volatilized water and organic contaminants to a gas treatment system; may be conducted ex situ (requiring disposal) or in situ.	Organic	- Established technology - Easier to permit than incineration - Several potential configurations (indirect- and direct-heated) - Demonstrated effectiveness for organics including PCBs - Typically costs less than incineration	- Typically requires excavation and disposal of residues - Typically requires air emission control and stack discharge permit - Likely will not reduce concentrations of metals
Incineration: an ex situ thermal destruction process operated at relatively high temperatures (870 to 1,200° C, or 1,400 to 2,200° F), to volatilize and combust (in the presence of oxygen) organic contaminants; often requires use of auxiliary fuels to initiate and sustain combustion; off gases and residues of combustion generally require treatment.	Organic	- Established technology - Demonstrated effectiveness for organic contaminants - Off-site incineration is available from several commercial firms	- On-site incineration requires extensive permitting process - Typically has relatively high cost - Likely will not reduce concentrations of metals

APPENDIX C

SUMMARY OF POTENTIAL TECHNOLOGIES FOR TREATMENT OF SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK (continued)

Technology	Target Contaminant Types	Potential Advantages*	Potential Limitations/ Concerns[2]
Solidification and stabilization: a process of physically binding or enclosing contaminated material within a stabilized mass (solidification) or inducing chemical reactions between a stabilizing agent and contaminants to reduce the mobility of the contaminants (stabilization); may be conducted ex situ (requiring disposal) or in situ.	Inorganic	- Established technology - Demonstrated effectiveness for inorganic contaminants - May be used as part of a treatment train - Solidification and stabilization technologies are available from several commercial firms	- Does not destroy contaminants and may be sensitive to future use of site and environmental conditions - May be limited to treatment of relatively shallow soil - Likely will not be effective for treatment of organics

1. Tetra Tech identified these potentially applicable technologies assuming typical remedial options for this site would be containment and/or excavation followed by disposal off-site. Frequently, contaminants are relatively immobile, and there are only limited risks to human health and the environment from sites similar to this one. Therefore, containment (such as covering the contaminated soil with asphalt) can be used, with monitoring of the natural processes that attenuate the contamination. Such an approach might be performed in addition to limited excavation and off-site disposal, or institutional controls, such as a deed restriction governing future use of the site.

2. Comparisons of potential advantages and limitations and concerns are relative to those for incineration (organic contaminants) and solidification and stabilization (inorganic contaminants) because these are two commonly used processes for treating contaminated soils.

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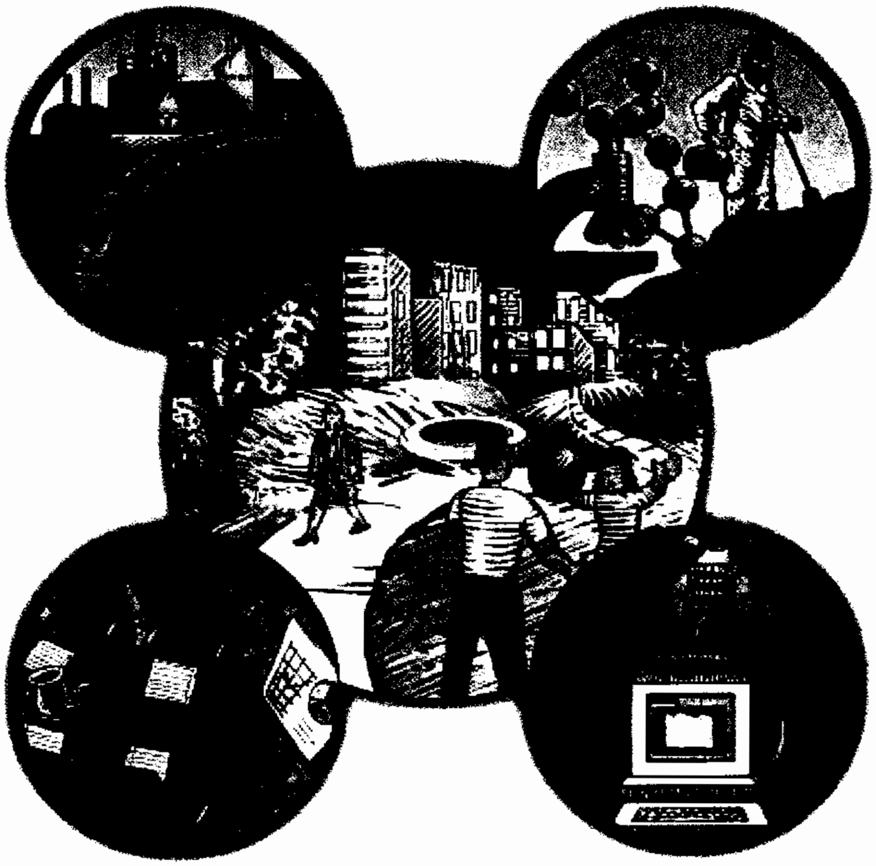
Erie Co.

Technical Assistance for the Sloan Auto/ 90 Hopkins Street Site, Buffalo, New York



Brownfields Technology Support Center

March 1999

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1.0 INTRODUCTION

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The information provided in this report is relevant to the brownfields program for several reasons. present. First, Tetra Tech developed an approach to finding a beneficial use of the lime material that otherwise may have gone unused. That approach could be used at other sites that contain large quantities of material with a potential beneficial use. Second, it is common to find soil contamination at a brownfields site. The types of remedial technologies identified to potentially clean up the site can be considered for use at other sites at which similar contamination is present.

3.0 THE PROCESS USED BY THE CENTER

A number of activities were conducted to develop responses to the technical issues identified. Those activities included discussions with EPA, review of site information provided by EPA, coordination among Tetra Tech staff to solicit options available for beneficial use of the lime material, discussions with representatives of several companies to determine whether they believe the lime material has a beneficial use, and review of remedial technologies potentially applicable to the site.

Tetra Tech contacted EPA staff to obtain specific information about the Sloan Auto site. The primary EPA point of contact was Mr. Kevin Matheis, on-scene coordinator (OSC). Mr. Matheis provided characterization data on the lime piles located on the site, specific information about site investigations performed to date, and preliminary results of those investigations.

Tetra Tech received from Mr. Matheis two documents that provided site characterization data. The first document (undated) is a summary of the characterization of the lime piles, based on sampling performed by Malcolm Pirnie, Inc. in December 1997. The results of the analysis presented in the report indicate that the constituents of the lime pile are very consistent throughout the depth of each pile and consistent with the preliminary determination that the piles were composed of lime material. The results indicate that the material is calcitic lime (calcium carbonate) and may be suitable for all the potential uses identified in Section 4.1 of this report.

The second document, dated October 29, 1998, had been prepared by Roy F. Weston, Inc. That report provides results of sampling performed at various locations at the site, including the lime piles, surface and subsurface soils, drums, and a pile of debris. The samples had been analyzed for target compound list (TCL) volatile organic compounds (VOC), base neutral acid (BNA) extractables, target analyte list (TAL) metals, and pesticides and polychlorinated biphenyls (PCB). The Weston report also compared the levels of contamination found at the site to the New York Department of Environmental Conservation Technical and Administrative Guidance Memorandum on Determination of Soil Cleanup Objectives and Cleanup Levels (NYDEC TAGM). This comparison showed that the following types of contaminants were present in the shallow soils at levels of potential concern: VOC; polycyclic aromatic hydrocarbons (PAH) including benzo(a)pyrene; PCB; and metals, including lead and mercury. The samples obtained from the lime piles were analyzed for pH, total cyanides, pesticides and PCBs. Appendix A summarizes the types of contaminants identified in the shallow soils at the site, and the maximum concentrations measured for those types of contaminants.

4.0 OPTIONS FOR IMPLEMENTATION OF CLEANUP ACTIVITIES

4.1 BENEFICIAL USES FOR LIME MATERIAL

Staff of Tetra Tech working on this project solicited from other staff of the company information about potential beneficial uses of the lime material at the Sloan Auto site. One consideration in identifying such uses was the potential cost of transporting the material to the end user.

The following uses were identified:

- Electric power plants (flue gas desulfurization)
- Stabilization (various applications)
- Agricultural use
- Cement manufacturing
- Fertilizer manufacturing
- Wastewater treatment
- Pulp and paper industry
- Steel industry

The City of Buffalo, New York, the current owner of the site, may be able to generate revenue through the sale of this material. To determine the feasibility of the various uses of the lime, potential users in the area were identified and contacted. The limited research conducted indicates that the most practicable options for the beneficial use of the lime include use in scrubbers and stabilization in mines or of fly ash. If any of the potential users found the lime at the site to be suitable, it could be used relatively quickly because of the large volumes required for such uses. Discussed below are the results of those preliminary contacts. For a quick reference, Appendix B is a summary of the information obtained from the contacts.

Electric power plants: At coal-fired power plants, lime is used in the scrubber units to reduce emissions of sulfur dioxide. This process, called flue gas desulfurization, requires large quantities of lime. Both Niagara Mohawk and New York State Electric and Gas (NYSE&G) have power plants in the area that might have use for the lime. Niagara Mohawk's Huntley Plant is located in Tonawanda, New York, and NYSE&G has a plant in Somerset, New York. It is recommended that the two utilities be contacted to determine their interest in the lime.

Waste-to-energy plants have similar scrubber units that can use lime. Such plants also mix lime with fly ash before disposing of the fly ash. Tetra Tech contacted the Buffalo Hammer Mill Corp., in Buffalo, New York (Mr. Chris Edelsward, [716] 855-1202). Mr. Edelsward stated that a waste-to-energy plant in the area uses an average of 160 to 200 tons of lime per month.

Stabilization: Lime can be added to a natural soil material to improve one or more of its properties when used as a base material for road and airfield pavements and under floor slabs. Lime has been used as an additive to improve clay soils. The lime stabilization process requires mixing, then curing for a few days, followed by remixing and compaction. If the natural soil is considered inadequate for use as a base material, it is often less expensive to stabilize the soils with an additive (such as lime) than to excavate the "bad" soil and replace it with soil that is more acceptable. Tetra Tech contacted the New York State Department of Transportation (NYSDOT) in Buffalo, New York to determine the frequency with which lime is used as a stabilizing material. NYSDOT indicated it had not used lime because many of its projects involved soils that are low in clay content. However, NYSDOT indicated that some towns in northern Erie County and Niagara County, where clay is more prevalent, may use lime as a stabilizing material. It is possible those counties could use the lime for some projects.

Lime also can be used as a stabilization agent for various wastes. Lime is mixed with the waste to reduce the solubility and mobility of the waste. Lime is suitable for addition to industrial wastes, including metals. For example, the chemical industry generates wastes that require stabilization prior to their disposal. Two large companies in the Niagara Falls, New York area (DuPont and Occidental) were contacted to determine whether they have use for the lime. Both companies are ISO 9000 certified and employ rigorous quality assurance procedures in their stabilization processes. Therefore, either company must review the results of the testing of the lime to determine whether the lime is of adequate quality. Occidental indicated that it uses only pebble lime. DuPont indicated it uses hydrated lime and stated that, even if the lime were acceptable, completion of its approval process probably would require three months.

Similarly, lime can be used to solidify/stabilize wastes at sites undergoing corrective action under RCRA or cleanup under Superfund. Tetra Tech conducted a preliminary search for potential sites using the EPA REACH IT website, (Remediation and Characterization Innovative Technologies), at www.epareachit.org, to determine if there are any sites in the Buffalo area where there may be a potential use for the lime. Although no sites appeared on the website, EPA and NYSDEC possibly have additional information that could be used to identify potential sites.

The mining industry also uses lime for stabilization. Coal and metal mining create waste that is highly acidic. Those wastes must be neutralized to minimize their environmental effects. A number of coal mines in Pennsylvania could potentially use the lime. Tetra Tech contacted Clean Earth in Norristown, Pennsylvania.and spoke with Mr. Steve Sands ([800] 278-6902). Clean Earth is involved in mine reclamation activities in the northeastern United States. Mr. Sands indicated a possible interest in the lime for a large project scheduled to begin in the next six months. He further indicated that the lime could potentially command a price of $10 to $20 per ton. Mr. Sands offered to visit the site and obtain samples for analysis to determine if the lime is suitable for the project. If Clean Earth were to decide the material is not suitable, other companies could be contacted to determine their interest in the lime.

Agricultural use: Lime can be added to soil to raise the pH. If soil is acidic (pH less than 7), crops, plants, and grass do not grow well. Ideally, to promote growth, soil pH should be in the range of 6 to 7. Western New York is well known for its agricultural products, including corn, soybeans, milk products, and ornamental plants. Farmers in the area could apply the lime to the land as they harvest. It would be necessary to know the results of analysis of the lime piles before the lime could be used in agricultural.

Cement manufacturing: Lime is used in manufacturing cement. Companies that have offices in Buffalo, New York include the Lafarge Corporation and Independent Cement Corporation. The Lafarge Corporation expressed an interest, however, the company must review the results of analysis of the lime before it can determine whether it is of use to the company. Other companies in Niagara Falls or elsewhere may be interested, as well. However, results of the chemical analysis and any grain size analysis would assist such companies in determining whether they can use the lime.

Fertilizer manufacturing: Lime is used as an additive in manufacturing fertilizers. Lawn, garden, and other fertilizers are produced locally by Gro-Green Products, Inc. located in Buffalo, New York. Gro-Green indicated it supplies fertilizer to more than 200 stores from New York to Maine and might be interested in the lime. Currently, Gro-Green obtains its lime from a company in Ohio. Other fertilizer manufacturers in the area might be interested in the lime as well.

Wastewater treatment: Lime is used in sewage treatment, primarily for neutralizing acidic waste. Today, many treatment plants have reduced their use of lime, using materials like polymer instead. The city of Buffalo and the town of Amherst indicated they use polymer and have no need for a large quantity of lime. However, it is possible that some rural areas in the vicinity of Buffalo, New York could use the material. Since the city of Buffalo is not interested, it is recommended that treatment plants in rural areas be contacted to determine whether they are interested in the lime.

Pulp and paper industry: In the pulp and paper industry, lime is mixed with ash generated by the incineration of waste from the pulping process. International Paper in Erie, Pennsylvania indicated it operates a pulping mill that uses lime. However, the mill recycles its lime and therefore rarely needs a new supply. If the kilns shut down, the mill acquires more lime; however, such shut downs are rare. Buffalo Paperboard Corp. in Lockport, New York indicated that no pulping is carried out at its facility, and it has no need for the lime.

Steel Industry: Lime is mixed with ore in the manufacture of steel to remove impurities including silicates. Lime is mixed with the ore then melted to combine the lime and silicates to form a liquid called slag. The slag is immiscible with molten iron and is drained to remove the silicates from the steel. Approximately 80 kilograms of lime are used in the production of one metric ton (1,000 kilograms) of steel. Tetra Tech attempted to contact a representative of Bethlehem Steel Corporation on Hamburg Turnpike in Buffalo, New York to determine if melting operations are performed at this facility and if they have any interest in the lime. The representative (Mr. Ted James [716] 689-6366) had not returned the call at the time this report was submitted.

4.2 ADDITIONAL ANALYSES OF THE LIME MATERIAL

Results of analysis indicate that the piles are not contaminated and that the material most likely is calcitic lime. Before an option for use of the lime is selected, the potential user likely will require additional information. Specifically, additional sampling and analysis may be required to assist the potential user in determining whether or not the lime material meets the user's specifications.

Each potential user may want to conduct their own sampling. As an alternative, more detailed analysis of the lime piles could be provided to each of the potential users for review in anticipation that this information would be sufficient for them to make a decision regarding their potential interest.

Listed below are recommended characterization analyses that should satisfy the requirements of most potential users of the lime. The analyses were selected based on information provided by the potential users of the line and by Tetra Tech staff with experience in the processes discussed in Section 4.1 of this report.

Parameters	Total Metals	TCLP Metals
pH	Arsenic	Arsenic
Conductivity	Cadmium	Barium
Totals solids	Chromium	Cadmium
Calcium carbonate equivalent (CCE)	Copper	Chromium
Calcium	Lead	Lead
Magnesium	Mercury	Mercury
Sodium	Molybdenum	Selenium
Phosphorus	Nickel	Silver
Potassium	Selenium	
Sulfate	Zinc	
Total sulfur		
Sieve analysis		
Free carbon		
Percent CaO		
Percent MgO		
Total carbonate		

4.3 POTENTIAL VALUE OF THE LIME

As discussed above, there are a number of potential uses for the lime, and it is possible that a user may be willing to pay the owner of the site for the material. A key factor in establishing the amount a potential user will agree to pay is the cost of transporting the material to the user's site. Transportation cost can include several components; the cost to load and unload the material, and the shipping costs. Tetra Tech contacted several vendors to try to develop a framework for those costs, and found there were wide variations. For purposes of this estimate, it is assumed the cost to load material and the cost to unload material are approximately equal, and one cubic yard of the lime material weighs approximately 1.4 tons.

Three local transportation companies in the Buffalo area responded to Tetra Tech's calls. Estimates from two of the companies were based on haul distances of no greater than 30 to 35 miles, and their estimates did not include loading costs, because they do not have loading equipment. A representative from Price Trucking ((716) 822-1414) indicated that hauling 105 tons per day (35 tons per trailer) would cost approximately $16 per ton. That company could haul only three trailers per day. A representative from Professional Carriers and Brokers ((716) 631-8486) indicated the cost to haul a ton is approximately $13. A representative from a third local transportation company, Vince Fallone of Fallone Trucking ((716) 337-2645) indicated the cost to haul a ton of lime material is approximately $6. Mr. Fallone also estimated $3 per ton to load the material. For comparison, a representative of a mineral recycler, Mr. Kevin Sweeney, of Minerals, Metals & Solvents, Inc., in the New Orleans, Louisiana area ((504) 818-

1244), indicated that if the potential user is within a 30 to 40 miles of the site, the cost per ton of transporting the material might be $1 to 2 per ton to load the material, and $3 to 4 per ton to haul it.

A potential user may be willing to pay only a fraction of the actual cost of transporting the lime to the user's location, or to pay nothing. If so, the owner of the site would have to remove the material from the site at its own expense. However, such an expenditure might be appropriate if future development of the site depends on the removal of the material. In such circumstances, the expenditure could be considered an investment necessary to redevelop or reuse the site.

4.4 POTENTIAL ENVIRONMENTAL IMPACTS OF THE LIME PILES

If the owner of the site intends to leave the lime on site, the following items should be considered in determining the potential environmental impacts of the lime piles, and whether barriers or containment systems might help to minimize or reduce potential impacts.

- The adequacy of sampling or investigations conducted to determine whether liquids (leachate) are being generated from the lime pile and the characterization of those liquids.
- The adequacy of sampling conducted on the adjacent surface-water body, Ramco Pond, and if there is an indication of any effects of the lime piles (leachate) on the pond.

4.5 POTENTIAL CLEANUP OF SHALLOW SOILS

The following discussion is provided should a need for additional remedial action be identified.

On the basis of the site characterization data provided to Tetra Tech, it is not possible to recommend a specific remedial technology for the shallow soils at the site. The data provided to Tetra Tech do not delineate the exact nature and extent of the contamination, and the volume of material that would require treatment is not defined completely. In addition, it would be important to identify the redevelopment or reuse plans for the site, the schedule for redevelopment or reuse, and the amount of effort the owner of the site is willing to invest in cleanup. This information is necessary to complete a detailed comparison of remedial technologies according to cost or other criteria.

Typical remedial options for this type of site would be containment and/or excavation followed by disposal off-site. Frequently at these sites, contaminants are relatively immobile, and there are only limited risks to human health and the environment. Therefore, containment (such as covering the contaminated soil with asphalt) can be used, with monitoring of the natural processes that attenuate the contamination. Such an approach might be performed in addition to limited excavation and off-site disposal, or institutional controls, such as a deed restrictions governing future use of the site.

In addition, there are a wide variety of other, potentially applicable remedial technologies that could be considered for use at this type of site. Those include innovative technologies such as bioremediation, soil flushing, and solvent extraction, and more established technologies such as thermal desorption and incineration. Potentially applicable remedial technologies for treatment of the shallow soils are listed in Appendix C, along with their target contaminant types (organic or inorganic contaminants), potential advantages, and limitations or concerns related to them.

In evaluating whether there is a need for cleanup of shallow soils for the site, the potential risks to human health and the environment posed by each medium (such as surface and subsurface soils and surface water) must be identified. To identify those risks, the following questions should be answered:

- What do historical records show about past operations at the site and what kinds of materials and chemicals may have been handled at the site (especially for PCB-containing materials)?
- What is the nature and extent of contamination at the site?
- What are the effects of such contamination on groundwater and surface water, such as adjacent wetlands?
- Who or what are the potential receptors?
- Which contaminants are contributing to elevated risks?
- Is remediation of some or all of the site necessary?
- Can remediation be limited to relatively small discrete areas?

APPENDIX A

SUMMARY OF TYPES OF CONTAMINANTS IDENTIFIED IN SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK

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SUMMARY OF TYPES OF CONTAMINANTS IDENTIFIED IN SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK

Type of Contaminant	Specific Contaminants Identified with Results > NYDEC TAGM Levels[1] (no. of locations[2]; maximum concentration in mg/kg)	
Volatile organic compounds	Benzene (1; 0.077) m&p-xylene (1; 1.4) o-xylene (1; 1.1)	
Semivolatile organic compounds	4-Methylphenol (1; 0.98 J)[3] Phenol (1; 0.17 J) Diethylphthalate (1; 10 J) Bis(2-ethylhexyl)phthalate (1; 66 B)[4] Phenanthrene (1; 54) Fluoranthene (1; 57) Pyrene (1; 51)	Benzo(a)anthracene (11; 28) Chrysene (11; 26) Benzo(b)fluoranthene (8; 24) Benzo(k)fluoranthene (8; 25) Benzo(a)pyrene (12; 28) Indeno(1,2,3-cd)pyrene (5; 16) Dibenzo(a,h)anthracene (6; 6.9 J)
Pesticides	None	
PCBs	Arochlor 1242 (4; 17) Arochlor 1248 (4; 8.6) Arochlor 1260 (6; 2.2)	
Metals	Arsenic (17; 170) Barium (4; 880) Beryllium (6; 3.4) Cadmium (14; 16) Calcium (16; 320,000) Chromium (11; 920) Copper (14; 510)	Lead (11; 7,800) Magnesium (11; 30,000) Manganese (1; 26,000) Mercury (18; 60) Nickel (9; 88) Vanadium (1; 420) Zinc (21; 3,300)

1. NYDEC TAGM is the New York Department of Environmental Conservation Technical and Administrative Guidance Memorandum on Determination of Soil Cleanup Objectives and Cleanup Levels
2. Shallow soils were analyzed at a total of 23 locations
3. J - The value is below the method detection limit and is estimated
4. B - The analyte was found in the blank

Source: Roy F. Weston report, October 29, 1998.

APPENDIX B

SUMMARY OF POTENTIAL BENEFICIAL USES FOR LIME MATERIAL AT SLOAN AUTO SITE, BUFFALO, NEW YORK

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SUMMARY OF POTENTIAL BENEFICIAL USES FOR LIME MATERIAL AT SLOAN AUTO SITE, BUFFALO, NEW YORK

Potential Use	How Lime is Used in the Process	Potential Contacts
Electric Power Plants	In scrubber units to reduce emissions at coal-fired power plants and waste-to-energy plants	Niagra Mohawk Tonawanda, New York New York State Electric and Gas Somerset, New York Buffalo Hammer Mill Corp. Buffalo, New York Mr. Chris Edelsward (716) 855-1202
Stabilization	Add to natural soil material to improve its properties when used as a base material Mixed with waste to reduce the solubility and mobility of the waste Solidify/stabilize wastes at sites undergoing corrective action Neutralize waste from the coal and metal mining industries	Towns in Northern Erie County and Niagara County Niagra Falls, New York DuPont and Occidental EPA and NYSDEC Clean Earth Norristown, Pennsylvania Mr. Steve Sands (800) 278-6902
Agricultural Use	Add to soil to raise pH	Farmers in Western New York
Cement Manufacturing	An additive in the manufacturing process	Lafarge Corporation Buffalo, New York Independent Cement Corporation Buffalo, New York
Fertilizer Manufacturing	An additive in the manufacturing process	Gro-Green Products, Inc. Buffalo, New York
Wastewater Treatment	In sewage treatment, primarily for neutralizing acidic waste	Rural areas in the vicinity of Buffalo, New York
Pulp and Paper Industry	Mixed with ash generated by the incineration of waste from the pulping process	International Paper Erie, Pennsylvania
Steel Industry	Mixed with ore to remove impurities	Bethlehem Steel Corporation Buffalo, New York Mr. Ted James (716) 689-6366

APPENDIX C

SUMMARY OF POTENTIAL TECHNOLOGIES FOR TREATMENT OF SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK

APPENDIX C

SUMMARY OF POTENTIAL TECHNOLOGIES FOR TREATMENT OF SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK[1]

Technology	Target Contaminant Types	Potential Advantages*	Potential Limitations/ Concerns[2]
Bioremediation: a process (in situ or ex situ) in which microorganisms (for example, fungi, bacteria, and other microbes) degrade (metabolize) organic contaminants in soil or groundwater; nutrients, oxygen, or other amendments may be used to enhance bioremediation.	Organic	- Innovative technology - Several potential configurations (in situ and ex situ) - Intrinsic bioremediation may be adequate for treatment of some contaminants - Rate may be enhanced by addition of oxygen or nutrients - Typically costs less than incineration	- Rate may be relatively low in cold, northern climate - Likely will not reduce concentrations of metals
Soil flushing: an in situ process that uses water or other suitable aqueous solutions to extract contaminants from soil, typically accomplished by passing an extraction fluid through soils with an injection or infiltration process.	Organic and Inorganic	- Innovative technology - May be operated without excavation (in situ soil flushing) - Could be effective for both organic and inorganic contaminants - Typically costs less than incineration	- May require additional extraction or treatment of groundwater - As with many in situ technologies, proper design may require development of an accurate conceptual model of the site - May increase mobility of some relatively immobile contaminants (such as some metals)

APPENDIX C

SUMMARY OF POTENTIAL TECHNOLOGIES FOR TREATMENT OF SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK (continued)

Technology	Target Contaminant Types	Potential Advantages*	Potential Limitations/ Concerns[2]
Soil vapor extraction (SVE): an in situ process that uses application of a vacuum to soil to induce the controlled flow of air and remove volatile and semivolatile contaminants; typically requires control of off-gases.	Organic	- Established technology - May be operated without excavation (in situ SVE) - Several potential configurations (vertical or horizontal wells) - Rate may be enhanced by thermal processes - Typically costs less than incineration	- Operation is sensitive to site characteristics (for example, soil permeability and moisture content) - Typically requires air emission control and stack discharge permit - May not be effective for metals and lower volatility organics (such as some PAHs) - As with many in situ technologies, proper design may require development of accurate conceptual model of the site
Soil washing: an ex situ process that uses water to separate contaminants sorbed onto fine soil particles from those in bulk soil on the basis of particle size; wash water may be augmented with a basic leaching agent, surfactant, or chelating agent, or by pH adjustment, to help remove organics and heavy metals.	Organic and Inorganic	- Innovative technology - Could be effective for both organic and inorganic contaminants - Typically costs less than incineration	- Does not destroy contaminants and creates a concentrated residue that requires further treatment or disposal - Operation is sensitive to site characteristics (for example, soil types) - May increase mobility of some relatively immobile contaminants (such as some metals)

APPENDIX C

SUMMARY OF POTENTIAL TECHNOLOGIES FOR TREATMENT OF SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK (continued)

Technology	Target Contaminant Types	Potential Advantages*	Potential Limitations/ Concerns[2]
Solvent extraction: an ex situ chemical extraction process that uses an organic solvent to extract contaminants sorbed to soil; solvent extraction differs from soil washing in its choice of an organic solvent instead of an aqueous-based solvent.	Organic and Inorganic	- Innovative technology - Could be effective for both organic and inorganic contaminants; demonstrated effectiveness for PCBs - Typically costs less than incineration - May be able to remove contaminants not amenable to other technologies	- Does not destroy contaminants and creates a concentrated residue that requires further treatment or disposal - Operation is sensitive to site characteristics (for example, soil types and moisture content)
Thermal desorption: a physical separation process designed to volatilize and strip water and organic contaminants, but to not destroy organic contaminants; a carrier gas or vacuum system transports volatilized water and organic contaminants to a gas treatment system; may be conducted ex situ (requiring disposal) or in situ.	Organic	- Established technology - Easier to permit than incineration - Several potential configurations (indirect- and direct-heated) - Demonstrated effectiveness for organics including PCBs - Typically costs less than incineration	- Typically requires excavation and disposal of residues - Typically requires air emission control and stack discharge permit - Likely will not reduce concentrations of metals
Incineration: an ex situ thermal destruction process operated at relatively high temperatures (870 to 1,200° C, or 1,400 to 2,200° F), to volatilize and combust (in the presence of oxygen) organic contaminants; often requires use of auxiliary fuels to initiate and sustain combustion; off gases and residues of combustion generally require treatment.	Organic	- Established technology - Demonstrated effectiveness for organic contaminants - Off-site incineration is available from several commercial firms	- On-site incineration requires extensive permitting process - Typically has relatively high cost - Likely will not reduce concentrations of metals

APPENDIX C

SUMMARY OF POTENTIAL TECHNOLOGIES FOR TREATMENT OF SHALLOW SOILS AT SLOAN AUTO SITE, BUFFALO, NEW YORK (continued)

Technology	Target Contaminant Types	Potential Advantages*	Potential Limitations/ Concerns[2]
Solidification and stabilization: a process of physically binding or enclosing contaminated material within a stabilized mass (solidification) or inducing chemical reactions between a stabilizing agent and contaminants to reduce the mobility of the contaminants (stabilization); may be conducted ex situ (requiring disposal) or in situ.	Inorganic	- Established technology - Demonstrated effectiveness for inorganic contaminants - May be used as part of a treatment train - Solidification and stabilization technologies are available from several commercial firms	- Does not destroy contaminants and may be sensitive to future use of site and environmental conditions - May be limited to treatment of relatively shallow soil - Likely will not be effective for treatment of organics

1. Tetra Tech identified these potentially applicable technologies assuming typical remedial options for this site would be containment and/or excavation followed by disposal off-site. Frequently, contaminants are relatively immobile, and there are only limited risks to human health and the environment from sites similar to this one. Therefore, containment (such as covering the contaminated soil with asphalt) can be used, with monitoring of the natural processes that attenuate the contamination. Such an approach might be performed in addition to limited excavation and off-site disposal, or institutional controls, such as a deed restriction governing future use of the site.

2. Comparisons of potential advantages and limitations and concerns are relative to those for incineration (organic contaminants) and solidification and stabilization (inorganic contaminants) because these are two commonly used processes for treating contaminated soils.