FIXED FACILITIES FOR SOIL WASHING

A REGULATORY ANALYSIS

-FINAL-

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Prepared by
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Work Group
Metals in Soils Work Team
Soil Washing Project

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EXECUTIVE SUMMARY

This document discusses issues surrounding the use of fixed facilities for the treatment of contaminated soil and sediment via soil washing technologies. The document provides technology background on soil washing, and examples of fixed facilities currently in operation around the world. The Metals in Soils Team conducted interviews with vendors, regulators and consultants to outline existing models for deployment of the technology in Europe, Canada and the United States. Through these interviews and other research, the Team was able to identify barriers that deter the use of fixed facilities for soil washing, and to generate some conclusions regarding potential future actions to further the use of the technology to treat soils contaminated with metals.

This document was produced by the ITRC Metals in Soils Team. Membership on this work team was open to all ITRC members. Participants with expertise or interest in metals treatment technologies in their states elected to join the team and contributed consistently to the development of this work product. Members of the RTDF (Remediation Technologies Development Forum) IINERT technology team (In-Place Inactivation and Natural Ecological Restoration Technologies) also participated in this team and helped to provide an industry perspective. A representative from the U.S. Army Corps of Engineers and the Department of Energy actively participated on the team. Support was also provided by the United States Environmental Protection Agency and the Department of Defense. Input regarding public and community concerns for these technologies was provided by ITRC public stakeholder representatives.

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1.0 INTRODUCTION

The legal and regulatory uncertainties surrounding the cleanup of waste sites discourages the testing and use of innovative technologies in the field. Technology developers have difficulty gaining regulatory approval for the use of new technologies. Their difficulties are compounded by the requirement for developers to demonstrate a technology's performance in each state targeted for deployment.

In response to this concern, the Interstate Technology and Regulatory Cooperation (ITRC) Working Group was formed. The ITRC is made up of representatives of approximately twenty-five state environmental agencies and includes federal, industry, tribal and public stakeholders. The ITRC is exploring and developing mechanisms to more effectively deploy innovative environmental technologies for the cleanup of contaminated sites throughout the country. One of the mechanisms under review is the development of baseline regulatory requirements and standardized protocols for verifying a technology's cost and performance.

The ITRC has established several areas of technical focus and teams have been formed to establish reporting and demonstration protocols for specific technologies. The Metals in Soils Team chose to examine those technologies which may provide a viable, cost effective alternative to landfilling or capping soils contaminated with metals. Hopefully, this effort will facilitate the future deployment of innovative technologies for the cleanup of metal-contaminated sites.

The Metals Team felt that fixed facilities for soil washing could potentially provide a cost effective method for treating metal-contaminated soils. This report explores the status of the use of fixed facilities for soil washing operations in the US. The report establishes why the fixed facility model, popular in Europe and gaining popularity in Canada, is not being actively pursued as a remedial option in the US. In addition, the report examines regulatory and market concerns, and includes suggestions for regulatory change.

The Metals Team contacted numerous commercial soil washing vendors both in the US, Canada, and

in Europe. The goal was to determine what, if any, regulatory barriers exist to the use of soil washing at centralized fixed facilities. In addition, the group attempted to determine if there were any regulatory actions taken in Europe that drove the market towards the use of fixed facilities. An attempt was made to explore several existing models for deployment of fixed facilities for soil washing in the US, and to cite those areas where regulatory change could encourage market growth.

2.0 SOIL WASHING BACKGROUND

Soil washing is a broad term used to describe a variety of separation techniques for the remediation of contaminated soil. Although it may be considered a misnomer, the term "soil washing" will be used to describe both physical and chemical separation processes for the purposes of this report. Other names for soil washing technologies include "soil processing," "physical separation," etc. The degree to which solvents or chelating agents are used may affect the nomenclature used to describe the process. Typical particle size separation techniques could be called "physical separation," whereas the use of size separation coupled with leaching and / or solvent extraction could be called "soil washing." Confusion resulting from these misnomers often contributes to the propagation of misconceptions about the technology.

Soil washing can be applied to both organic and inorganic contaminants, including heavy metals and radionuclides. Many of the unit operations typically used for soil washing have been used in the mining industry for many years, but have failed to gain widespread acceptance in the US remediation field. Although there are several pilot scale projects completed or ongoing in the US, the ITRC Metals Team felt that considering the number of sites requiring metals removal, the number of soil washing applications was disproportionately low. Today, nearly all operations that do incorporate some form of soil washing are carried out with mobile units constructed for a particular site; the few exceptions will be discussed later in this report. A mobile soil washing process was used at the King of Prussia site in New Jersey in 1993, the first full scale demonstration of the technology in the US.

The most appropriate remedial strategy for a site contaminated with metals will often employ a combination of two or more remedies; optimum remedy selection is very site-specific. The numerous remedies for metals in soils, both demonstrated and emerging, coexist and compete on an "economic continuum." There is no single solution or combination of solutions so superior as to be applicable in a majority of situations. There are no known "silver bullets."

For a given remediation project, site and contamination characteristics and site specific cleanup

objectives dictate which technology, or combination of technologies, will be optimum in terms of cost, performance, and level of protection afforded. Detailed comparisons of multiple technology suites are always appropriate for large projects. Soil washing technologies can be used independently or in conjunction with other treatment technologies to remediate metal-contaminated soils.

Soil washing has been largely developed on the principle that contaminants in soil, including metals, tend to congregate on soil surfaces and are subsequently concentrated in the smaller size fractions of soils. Separating the fine fraction from the coarse fraction of site soils will often greatly reduce the total volume of soil requiring additional treatment. The clean coarse fraction from soil washing can often be returned directly to the site at very low cost.

Soil washing nearly always produces a more highly contaminated fraction of fine material which must be dealt with through stabilization or chemical treatment. Ideally, the contaminants in the fine fraction could be concentrated sufficiently to allow recycling at a smelter or other metal processing facility. In some cases, landfilling of fine fractions may be acceptable. Soil washing is generally favored by low overall fines content in a soil, and may be considered impractical if the fines (typically defined as less than 74 microns or 200 mesh) exceed 30 to 50 percent of the bulk soil (Mann et al., 1993). This is not always the case, however. The Ashtabula project, discussed later in this report, utilized physical and chemical processing to achieve acceptable removal of radionuclides from soils in excess of 75 percent fines. Project budgets will often dictate the extent to which soils with high percentages of fines can be remediated.

3.0 FIXED FACILITIES FOR SOIL WASHING

A “fixed facility” for soil washing is a centralized facility that accepts wastes from a number of sites. Also referred to as “regional,” these facilities are widespread in Europe, and have also been used to some extent in Canada. There are a variety of advantages and some limitations imposed by the use of fixed facilities for waste treatment. The Metals Team evaluated regulatory and market factors to assess the following:

1) Current developments in the deployment of fixed facilities for soil washing, and
2) Regulatory barriers which could potentially be modified.

In addition to addressing these issues, the group made preliminary attempts to facilitate the siting of a fixed facility for soil washing in New Jersey. The results are discussed below.

In today’s mature environmental market, perceived costs dictate the selection of remedial alternatives. Obviously, alternatives that may limit or remove future liability associated with contaminated media

have an advantage over those that do not. Soils contaminated with metals present a dilemma for the regulated community. There are limited options for remediation, due to the fact that unless the metals are removed from the soil and recycled, some "waste" will remain. The remediation of metal-contaminated soils which are hazardous wastes is regulated under RCRA, the Resource Conservation and Recovery Act. RCRA also includes provisions for recycling, and recycling facilities. To achieve the status of a RCRA part B facility, the applicant must undergo a rigorous permitting process. Approval of applications may or may not be granted, and the cost of applying for these permits is high. Besides gaining the endorsement of the EPA, potential recycling facilities must gain approval on local and state levels. This process can be difficult, time intensive, and costly. Recycling status however, results in many exemptions from hazardous waste regulations.

3.1 European Model for Fixed Facilities for Soil Washing

The group interviewed regulators in the US, the Netherlands, and Germany to gain a perspective on the European model for the deployment of fixed facilities for soil washing. In the Netherlands, generally acknowledged as the leader in the field of soil washing, the regulatory entity is a government owned subsidiary, SCG. This "company" is responsible for the oversight of all remediation projects in the Netherlands. SCG decides whether soils are treatable, what cleanup levels must be achieved, and in some cases what technology should be used to meet those levels. If SCG determines that a site can be remediated, the responsible party (RP) must remediate that site. If the RP claims that the job cannot be done, SCG will perform the work at a cost deemed appropriate by them. To summarize, SCG acts as a consultant, regulatory body, and remediation firm.

Throughout Europe, Heidemij and several other vendors operate both fixed and mobile soil washing facilities for the treatment of metals and other contaminants in soils. Heidemij is the market leader in the Netherlands and has been soil washing since 1983. Heidemij's fixed facilities accept soil samples for treatability studies at their plant. If deemed treatable, the facility will accept the remaining site soils for treatment. Clean soil is returned to the original site, and the treatment residue is transported to a waste facility for land disposal. Costs for soil washing of highly contaminated soils is often between 30 and 70 dollars per ton. To date, soil washing operations in Europe have had little success with the recycling of residues. They have, however, had great success in dramatically reducing the total volume of soils and wastes placed in landfills.

As noted above, several successful fixed facilities incorporating soil washing are currently in operation in Europe. The following factors appear to have led to their success:

1. The mind set in Europe is substantially different from that in the US. Since land is a much more valuable commodity in many of the smaller European countries, laws deter the use of landfills as a remedial alternative. In the Netherlands, contaminated soil cannot be

landfilled unless it is deemed untreatable by the regulatory oversight body (SCG).

2. European soil washing facilities operate on a level playing field with landfills and on-site disposal due to the use of true life-cycle costing (taking into account future land use)

to evaluate remedial options. Obviously, a clean site has a greater future land value than a contaminated site that has been capped. Taking property value into account lowers the relative cost of remediation and increases the cost of on-site disposal and capping.

3. The small size of many European countries allows for easy shipping of contaminated media within national (and jurisdictional) boundaries. In addition, regulators have eased rules regarding the shipping of waste materials for treatment.

4. In Europe, soil washing technology is relatively well-established. Vendors have incorporated a number of mining and hydrometallurgical techniques and have had a great degree of success remediating soils. The use of fixed facilities enables operators to adjust their systems to meet the needs of a variety of waste streams. For soil washing, a technology that relies on variable process flows, this is extremely beneficial.

5. Fixed facilities were established in the Netherlands at a time when the permitting of mobile units was not yet possible. Currently, while regulations do allow the use of mobile units, the cost and difficulty of permitting them continues to preclude their economic feasibility as a remedial alternative. Local, provincial, and state permits are needed to operate a treatment unit for remediation. The permitting process to gain approval takes over a year and is extremely expensive. As a result, it is nearly impossible for a mobile plant to be profitable with throughput less than 25,000 tons per year. Mobile plants are used almost exclusively for feasibility testing, or at sites where there are no other alternatives.

6. Fixed facilities in Europe are regulated on performance based standards (specifying outcome requirements rather than operational ones). Vendors may choose technologies and adjust process variables to meet cleanup goals. The final product is sampled and verified by the governing body (SCG in the Netherlands) to ensure compliance. This reduces the oversight work load on the governing body and places the engineering responsibility on the vendor, who is most familiar with the process anyway.

7. Consistent performance standards within entire countries enable vendors to maintain clear performance goals for all of their projects. This increases their ability to successfully bid jobs and remain profitable. The use of consistent standards makes it easier to benchmark

project successes and transfer data and operating parameters between projects. Inconsistent standards in the US often force technology vendors to modify system designs for multiple applications. This requires that a larger and more complicated data base be developed for innovative technologies seeking to gain approval for use.

8. In Europe, liability for waste is removed if soil is treated, even if the residue is land-disposed. This makes treatment a much more desirable option, as it raises the relative life-cycle cost of on-site disposal while emphasizing the benefits of remediation.

3.2 Canadian Model for Fixed Facilities for Soil Washing

In Canada, the US soil washing company ART formed a joint venture with Cintec Environment, Inc. to establish a fixed soil washing facility for the remediation of soils contaminated with metals, PAHs and petroleum hydrocarbons at a number of government-owned sites in Montreal. Cintec already owned and operated a permitted contaminated soil landfill in the city. In cooperation with the Quebec Ministry of the Environment, Montreal set aside funds for the remediation of government-owned sites throughout the city. The joint venture was contracted to excavate the soils from the individual sites, transport soils slated for treatment to the facility, and dispose of residue not treated. A building was set up at the soil processing site to contain the 30 ton/hr processing plant and to house treated and untreated soils. The success of this project can be attributed to the fact that the government worked with industry to promote remediation as an alternative to capping or landfilling.

Although fixed facilities for soil remediation are not common in Canada, many recycling plants exist for removing heavy metals from industrial waste streams. Fixed facilities are governed by regulations that resemble those in Europe; once a material is received at a facility the original generator's liability is removed. Regulators and lawmakers have recognized recycling as both good stewardship and good technology for a sustainable future. As a result, policies and regulations in Canada make it cheaper to recycle than to landfill. Because of the lower cost and reduced liability, many US firms ship soil and other wastes to large treatment facilities like Noranda in Canada. In the US, disposal lobbyists are often blamed for stunting the growth of the recycling industry to promote landfills. In Canada, this does not exist.

4.0 EXISTING MODELS FOR DEPLOYMENT OF FIXED FACILITIES FOR SOIL WASHING IN THE UNITED STATES

4.1 Doe Run

One model for siting a fixed facility in the US is currently under development in Boss, Missouri. The

Doe Run company has mined and smelted lead in Missouri for over 100 years. The Boss plant recycles lead from automotive and industrial batteries and scrap, producing viable lead products for reuse. The plant produces 85,000 tons of lead per year and is the largest fully integrated producer of refined lead metal in the US. In the beginning of 1997, the Doe Run company purchased the TERRAMET technology and equipment for soil washing from Cognis. This process enables them to leach lead and other heavy metals from contaminated soils, and to utilize the extracted lead in their existing operations. The clean fraction of the recycled soils can be returned to a site as fill, or be used by Doe Run in their mining operations. Doe Run began operating as a fixed facility for soil washing in the summer of 1997.

The facility operates under a revised RCRA part B permit. Under RCRA exemptions for reclamation of "useful products" from hazardous wastes, some metal bearing soils can be shipped as non-hazardous to a recycling facility. Doe Run is sometimes able to take advantage of this exemption, although the shipping conditions often change depending on the state, or vicinity of a state, in which the soil is generated. Although the soil washing plant operates as a fixed facility, Doe Run also has the capability to transport the soil washing technology off-site for mobile treatment as needed.

Several lessons can be learned from the Doe Run model. The company had an existing facility with an exemplary operational and environmental record. The facility had been operating under a RCRA part B permit since 1991, and had established credibility with both state and federal regulators. Local stakeholders had been incorporated into the company's marketing program for years, establishing the perception of the company as a positive influence in the region. Doe Run's recycling division had provided reports to the community stressing the positive aspects of their operation and safety record. Because of these public outreach efforts, the addition of soil washing was viewed by many as a positive action bringing new jobs to the community.

Another factor leading to the successful deployment of the fixed facility was the company's ability to reuse most of the end products of its primary operations. Doe Run can reuse separated metals from the soil remediation process as feedstock for it's smelting process. Because it is recycling metals from contaminated media, the facility is eligible for exemptions in operational and transportation regulations under RCRA. These regulatory exemptions are vital to the success of fixed facilities. Transportation costs and hazardous waste shipping issues are often determining factors for either treating a waste or capping it on-site. The Doe Run model demonstrates that a fixed facility for soil washing can be deployed within the current regulatory and economic environment.

4.2 Ashtabula

Alternative Remedial Technologies, Inc. (ART) and RMI Environmental Services (RMIES) have joined in an effort to site a fixed facility for soil washing in Ohio. The US Department of Energy

(DOE) Ashtabula site has been used for the demonstration of soil washing to remove radionuclides from soils. This project has been in design and testing stages for over a year, and the facility expects to be fully operational by early 1998. RMI plans to process 80,000 cubic yards of contaminated soil for DOE both from Ashtabula and other DOE sites. The soil washing plant will continue to operate as a fixed facility for the treatment of soils from both Federal and private sector sites within a 300 mile radius.

The RMI Ashtabula location includes pilot scale plants for treatability testing and a full-scale plant for remediation. The operation will also have the capability to mobilize the plant to off-site locations. There were several factors contributing to the success of this project:

1. The RMI/ART joint venture operated under the oversite of the DOE throughout its initial testing phases.

- Through the Innovative Treatment Remediation Demonstration (ITRD) program under DOE at Sandia National Labs, state officials, federal representatives, industry and stakeholders were brought together to discuss project objectives and progress.

- Because state officials were already knowledgeable about the site and the process, the steps from internal testing, to DOE operation, to commercial application were made much easier.

2. The facility is licensed by the Nuclear Regulatory Commission (NRC) and has a RCRA permit for the treatment and storage of hazardous wastes.

3. The facility has access to a large volume of treatable soil within a relatively small area.

4. The use of innovative sampling and engineering techniques has enabled operators to achieve optimum results at competitive costs, and on schedule.

5. The combination of experience, new technology and innovative thinking from a regulatory compliance standpoint enabled project developers to come up with ideas and strategies “outside the box.” DOE’s ITRD and TechCon programs helped to provide this link.

4.3 Mt. Hope Rock Products and Recycling

The Metals in Soils group explored options for siting a fixed facility at an existing soil treatment plant in New Jersey. The group was able to define the level of effort required, as well as potential

regulatory and process changes that could facilitate this type of operation.

Mt. Hope Rock Products Company is the parent company of Mt. Hope Recycling. The New Jersey facility has the ability to process petroleum contaminated soil, produce granite and bituminous concrete, and ship materials to and from selected sites. Both the rock products and the recycling facilities are located on 560 acres in northern New Jersey at the site of a historic iron ore mine. While secluded, the site is within 20 miles of a major industrial area, with easy access to several major highways. The facility consists of a crushing plant, six asphalt plants, two soil remediation plants and a granite quarry. The site is the largest producer of granite, and the highest volume, single location, producer of bituminous concrete in the US.

Currently, the soil remediation system uses low temperature thermal technology for the treatment of organic contaminants. During an interview with members of the Metals in Soils team, a facility manager expressed interest in incorporating inorganic remediation techniques into his process. Through the course of numerous interviews and a site visit, the group identified several issues applicable to siting a fixed facility:

- Mt. Hope is having difficulty re-using its treated soil due to specifications set by the New Jersey Department of Transportation (DOT). Although the state has approved the soil treatment operation and soil can be placed back on a site as clean fill, it cannot be used in concrete and asphalt products for public road construction. This facility is currently permitted for the treatment of "non-hazardous" soils. For the treatment of metal contaminated soils which are hazardous, this barrier may be even more difficult to overcome.

- The facility has experienced difficulty competing with less costly remedial alternatives, including capping on-site, landfilling, and soil stabilization.

- There is a strong market for the treatment of inorganic contaminants in soils. The Mt. Hope facility has been contacted on numerous occasions in regards to soils contaminated with a variety of metals. If fixed facilities were used to expand treatment options, lower the overall cost of treatment and provide clients with relief from further liability, the advantages of treatment over capping and landfilling would become more apparent.

5.0 BARRIERS TO THE USE OF FIXED FACILITIES FOR SOIL WASHING

A distinction must be made when discussing barriers to the use of fixed facilities for soil washing. There are several barriers that inhibit the use of soil washing technologies in the US. There are also barriers that inhibit the use of fixed facilities for soil washing in the US. Finally, there are barriers that inhibit the use of any remediation technologies in the US; circumstances which preclude any action being taken at a contaminated site. There is a large degree of overlap between these areas, as is to be expected.

In its various forms, soil washing is being deployed at numerous sites across the country, mostly for on-site treatment using mobile units. There are several misconceptions, or perceived barriers, that are currently limiting the widespread use of soil washing. These are discussed below.

5.1 NIMBY ("Not In My Back Yard")

The NIMBY syndrome is an issue everywhere. The negative long term impacts imposed by many other remedial options must be taken into account by communities and stakeholders considering fixed facilities for soil washing. Most municipalities would oppose the siting of a treatment facility near residential areas. Landfills and recycling centers, however, are currently operating in many towns and cities. Fixed facilities for low temperature thermal desorption have been successfully deployed in many states due to a combination of a low-risk perception and favorable market forces. It could be helpful to present fixed based soil washing plants as recycling facilities for soil, as recycling is a well regarded enterprise. The main difference is the perception of the degree of risk that a facility poses to a community. Although a limiting factor, the NIMBY issue need not preclude the existence of centralized soil washing facilities in the US, as proven by the success of the Doe Run company. By starting with a non-hazardous or low-risk application, a fixed facility may segue into soil washing as a logical process expansion.

5.2 Transportation

The group initially felt that transportation issues were presenting significant barriers to the use of fixed facilities. Upon consulting with industry, however, this does not appear to be the case. In spite of several disincentives, transportation may not be the biggest barrier to deployment. The established waste disposal and treatment industry has been dealing with transportation issues for years. For a facility that is currently accepting wastes for landfilling or other forms of treatment, these costs were factored in long ago. Fixed facilities for metals recycling and processing incorporate freight charges into their rates and profit margins. The use of soil washing at a centralized location would not add significantly to the existing transportation burden.

If a new facility were to be sited, transportation issues would arise concerning truck traffic and noise.

In this case, site selection would be critical. One industry representative quoted 50 tons/hr as a maximum for receipt and processing of soil; anything greater would present a traffic problem in and out of the plant. This number is well within the feasible range of operation for a fixed facility. A potential impediment could be the need to transport contaminated soil as a hazardous waste. A possible regulatory recommendation could be to exempt soils from hazardous waste transportation requirements if they were being sent to a facility for recycling.

5.3 RCRA

Several issues regarding RCRA and associated permitting requirements may provide a disincentive to the use of fixed facilities for soil washing. If a material is considered hazardous only after the waste has been recycled, wastes which will be recycled could obtain non-hazardous designations as soon as a sample has been received from the recycling facility and certification that the waste is acceptable for recycling occurs. A final receipt from the recycling facility could be required to document that the waste did, in fact, get recycled. Requiring the receipt would address situations where the waste was accepted for recycling, but was subsequently disposed as a non-hazardous waste, when, in fact, the waste was hazardous.

Currently, under RCRA, if a material previously classified as a hazardous waste can be reclaimed to become a useful product, the material may no longer be regulated, and future liability may be removed as the material is no longer a hazardous waste. This consideration could provide an advantage for transporting materials as well. To facilitate the use of fixed facilities for soil washing, several amendments to RCRA may be needed.

5.4 Regulation

One of the objectives of this work group was to determine if regulatory barriers were impeding fixed facilities in the US and, if so, to develop recommendations for overcoming those barriers. A perception in industry is not that intensive regulations are discouraging market growth. Most soil washing vendors felt that increased regulation of landfills and on-site capping disposal alternatives would be good for the soil treatment industry. A similar phenomena exists in the heavy metals recycling industry. When a market is driven by regulation rather than economics, the more stringent the regulations the greater the profit margin. Soil washing is a remediation technology that inherently involves some cost for treatment. The market share leader in this industry, however, is the landfill, which involves no cost for treatment. If lawmakers and regulators continue to enable it to be more cost effective for wastes to be landfilled or capped in-place, that is the option the regulated community will take. Facilities incorporating any treatment at all cannot compete on an economic basis with landfills or cap in-place remedies, especially where total life cycle costs are not used to compare alternatives.

Most treatment technology vendors and potential fixed facility operators would welcome more regulatory involvement to level the playing field between treatment and disposal options. If true life cycle costs are used along with strict differentiation between questionable and short term stabilization techniques and actual treatment, most soil washing vendors felt that they could compete effectively with other options. This is exactly how fixed facilities became prevalent in Europe. Regulators and lawmakers incorporated strict requirements for treatment along with performance based assessment systems to achieve results. The use of more regulations, however, should not be used for verification of engineering processes. For operational issues, performance based systems stressing verification of end products encourage the use of innovative technologies and the growth of the treatment market.

5.5 Recycling

One area where technology developers felt regulators could be more proactive concerned the reuse of recycled products. Many states currently place restrictions on the reuse of products. In some states, strict department of transportation specifications preclude the use of many recycled wastes in road products. Recently, California has developed policies to allow the treatment and incorporation of treated residual materials into asphaltic and construction-grade materials. Whether it is the transportation department or the environmental department, all state agencies must cooperate to develop a market for recycled products. When making policy decisions, the regulatory community must evaluate factors that affect a market. For soil washing, a process that results in a potentially recyclable waste stream, vendors must have access to profitable markets for end products. These and other issues surrounding recycling must be discussed in relation to fixed facilities.

An important part of the recycling issue involves RCRA part B and Treatment, Storage and Disposal (TSD) designations. Recycling concentrated treatment residue which is produced during soil washing is desirable from both an economic and environmental perspective. However, smelters are not usually interested in concentrated treatment residue containing, for example, less than eight percent lead; much of the material they receive is closer to 70 percent lead. Furthermore, smelters may need to obtain a RCRA TSD permit to “treat” the waste in certain states. One recommendation for change is to waive the need for a TSD permit if the waste is less hazardous than the ore which is routinely handled by the smelter. Many smelters currently combine less concentrated waste streams to form composite streams with higher metals content. By working with the mining and heavy metal recycling facilities already in operation, soil washing vendors may be able to provide waste streams feasible for recycling at low costs.

Most remediation wastes containing metals (excluding scrap metal from equipment, etc.) require some type of processing to concentrate and purify the metallic component of the material for reuse. The definition of a solid waste can be very case specific for complex matrices such as remediation wastes that are partially treated to make them good candidates for recycling. Many times the waste

is categorized as a "spent material" to be "reclaimed." The EPA waste codes associated with the material result in the need for a permit to process the material on-site. This requirement creates a barrier to recycling as it increases project time and costs.

Due to the thermal processing performed by most metal recycling vendors, many smelters establish criteria for the type of materials they can accept, and the characteristics or constituents of the waste that may impact processing. Some of the factors which may cause a waste to be unacceptable to smelters include:

- constituent concentration (should be at least six to eight percent by weight for most metals),
- presence of other metals or constituents which can interfere with the process and reduce product quality,
- debris content (causes materials handling problems),
- moisture content.

The requirements for feed materials will vary depending upon the metal to be recovered and how much the owner of the waste material is willing to pay for smelting. Less desirable material can be recycled, but at an increased cost.

Guidelines for feedstock for lead smelting include the following:

- Lead concentrations of at least 6-8% by weight
- The soil heating value should be less than 5000 BTU
- Moisture content of the soil should be less than 10% by weight
- The soil should not contain RCRA Appendix VIII organics in quantities greater than or equal to 500 ppm

The cost of recycling contaminated treatment residue from soil washing is dependent upon the concentrations and physical characteristics of the material. In addition, the cost of transporting the material can be a significant factor, as noted above. An average cost range for the smelting of lead containing waste is approximately $150-350 per ton of material processed. In many cases, a credit for the recovered metal value may be returned to the customer. This credit, however, generally will not exceed the treatment cost.

6.0 CONCLUSION

Fixed facilities for soil washing may provide a viable option for treating metal contaminated soils in the US. To date, few of these facilities exist in the US. There are many variables that contribute to

the success of a particular technology or treatment scheme. Important factors such as cost, regulatory and stakeholder acceptance, technical soundness and site-specific constraints all play a part in technology deployment. This report outlined examples of successful fixed facilities in other countries and attempted to identify those areas where regulatory barriers were impeding market growth in the US. Fixed facilities for soil washing have been successful in Europe, due in part to regulatory actions taken to restrict other forms of disposal. In the US, there are still barriers that inhibit their use. To enter the US market, fixed facilities will need:

- Regulatory acceptance,
- Stakeholder/Community acceptance,
- Competitive pricing,
- Access to roads,
- Effective partnering with other industries (recycling, disposal, etc.),
- Aggressive marketing strategies.

Whether or not fixed facilities will become accepted in the US remains to be seen. There are some areas where regulatory change could facilitate growth. Rather than basing a decision on treatability, many US states base their remedial decisions on cost. In the free market economic continuum, remedial options that cannot compete on that basis are the first to be passed over in favor of the "low cost" alternative.

7.0 REFERENCES

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APPENDIX A

Acronyms

ACRONYMS

ART	Alternative Remedial Technologies, Inc.
BTU	British Thermal Unit
EPA	United States Environmental Protection Agency
IINERT	In-Place Inactivation and Natural Ecological Restoration Technologies
ITRC	Interstate Technology and Regulatory Cooperation Working Group
ITRD	Innovative Treatment Remediation Demonstration Working Group
NIMBY	“Not In My Backyard"
NRC	United States Nuclear Regulatory Commission
PPM	Parts per million
RCRA	Resource Conservation and Recovery Act
RMIES	RMI Environmental Services, Inc.
RTDF	Remediation Technologies Development Forum
TSD	Treatment, Storage and Disposal designations under RCRA part B

APPENDIX B

ITRC Work Team Contacts
ITRC Fact Sheet
Product Information
User Survey

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