Outline for Site Assessment Module

I. Introduction

A. Introduction

The U.S. Environmental Protection Agency (EPA) has defined Brownfields sites as "abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination." EPA established its Brownfields Economic redevelopment Initiative to empower states, communities, and other stakeholders involved in economic revitalization to work together to accomplish the redevelopment of such sites. Many states and local jurisdictions also help business and communities adopt environmental cleanup programs to the special needs of Brownfields sites.

Preparing Brownfields sites for productive reuse requires the integration of many elements—financial issues, community involvement, liability considerations, environmental assessment and cleanup, regulatory requirements, and more—as well as coordination among many groups of stakeholders. The assessment and cleanup of a site must be carried out in a way that integrates all those factors into the overall redevelopment process. In addition, the cleanup strategy will vary from site to site. At some sites, cleanup will be completed before the property is transferred to new owners. At other sites, cleanup may take place simultaneously with construction and redevelopment activities. Regardless of when and how cleanup is accomplished, the challenge to any Brownfields program is to clean up sites quickly and redevelop the land in ways that benefit communities and local economies. (from Road Map).

B. Purpose

The purpose of this training session is to help you understand each element of the Environmental Site Assessment process and how these components relate to brownfields redevelopment. We will review the associated federal and state laws and regulations associated with brownfields, look at the purpose for conducting each phase of the ESA process, develop standards for each component of the ESA process, examine typical environmental concerns, explore various investigation techniques, inspect how to determine what the analytical results mean as well as look at financial concerns associated with investigating a brownfield site.

These basics will help you to have a voice in the redevelopment of brownfields sites in your community. It will give municipal economic development officials the knowledge to put a proposal together for a consultant to bid on the investigation of a site and to understand the final report they will provide. A concerned citizen will be able to understand what is going on in his or her community and be able to ask appropriate questions. By developing an understanding of the ESA process, all stakeholders will be able to come up with a scope of work which will quickly and effectively determine what is at the site so they can move one step closer to redevelopment which is the ultimate goal.

C. Associated laws and regulations

The issue of conducting environmental site assessments for property has yet to be fully addressed on the federal regulatory level. The majority of ESA policy and standards have originated from lending institutions, professional organizations, company policies, and states. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA), both promulgated by the U.S. Environmental Protection Agency, have clarified the role of site assessments indirectly. Even though neither of these Acts directly requires a site assessment be performed, they indirectly necessitate the action; court rulings based on these laws also support this.

1. Federal

   A. RCRA
   Resource Conservation and Recovery Act (RCRA) of 1976 instituted regulations on the handling of hazardous wastes. It established a regulatory system to track hazardous substances from their generation to their disposal. The law requires the use of safe and secure procedures in treating, transporting, storing, and disposing of hazardous substances. RCRA's goal is to prevent future releases of hazardous substances into the environment.

   B. CERCLA/Superfund
   Even though the RCRA of 1976 addressed the current practices of handling hazardous waste in an effort to prevent additional releases to the environment, there were no laws that addressed cleaning up of releases to the environment that already occurred. Prior to the instituting of environmental regulations, there were no guidelines for the generation, transportation, storage or disposal of hazardous waste. The result was numerous releases to the environment prior to RCRA. Because of the sheer number of past releases that the federal government was left to deal, they needed a vehicle to assign liability to past or present owners/operators of sites were released had already occurred. The vehicle adopted was named the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The 1980 law created a special tax that funds a trust fund, commonly known as Superfund, to be used to investigate and clean up abandoned or uncontrolled hazardous waste sites. CERCLA also was issued to hold past and present owners or operators of contaminated sites liable for the contamination and its cleanup. This liability is boundless and can be characterized as:

   ?? STRICT - If you fall within a defined class of owner or operator (generator) of a site containing hazardous substances or you were the transporter, storer or disposer (TSD) of the hazardous substances, the government or a private party may be able to recover cleanup costs against you as a potentially responsible party (PRP), whether or not you were responsible in any way.

   ?? JOINT and SEVERAL - This means that one or a combination of PRP's is liable for the total response costs associated with a hazardous waste site. This means that the EPA can go after one solvent PRP for the entire cost unless the RPR can prove some basis for cost allocation to other PRP's.

   ?? RETROACTIVE - By its very nature, CERCLA imposes liability for past acts. This means that an owner/operator or a TSD are liable for cleanup of acts that were legal when they occurred. This permits liability to be imposed for transactions that proceed the effective date of the Act.

   ?? UNLIMITED - The PRP's potential CERCLA liability includes all costs including: investigation; remediation; restoration; health studies; public protection; and third party damages. These costs are many times greater than the value of the property in question.

   ?? INDIVIDUAL - CERCLA liability may be imposed on individuals or corporate employees if they were responsible for or arranged for the disposal of hazardous substances contrary to the law or best prevailing practices at the time of disposal.

Unless the owner/operator can effectively avoid liability by claiming to be an innocent landowner, they will be liable for cleanup. In order to be an "innocent purchaser", the landowner or purchaser must be able to demonstrate:

The property was acquired after the disposal or placement of the hazardous substances; and at the time the property was acquired, the purchaser did not know and had no reason to know that any hazardous substances were on the property.

In order to fulfill the requirement number 2, the purchaser must prove that at the time of acquisition, he or she undertook "all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice in an effort to minimize liability." This is commonly known as due diligence, and is performed through what is routinely called a Phase I Environmental Site Assessment (ESA). Under CERCLA, the following points constitute appropriate inquiry:

- ?? Any specialized knowledge or experience on the part of the purchaser;
- ?? The relationship of the purchase price to the value of the property if uncontaminated;
- ?? Commonly known or reasonably ascertainable information about the property;
- ?? The obviousness of the presence or likely presence of contamination on the property; and
- ?? The ability to detect contamination by appropriate inspection.

With environmental liability being so strict today, the proper use of the ESA process is imperative.

C. Other Federal Environmental Regulations

Even though RCRA and CERCLA set the stage for use of an ESA in a property transfer for liability issues, there are other federal laws that may affect both liability issues and the outcome of the ESA. These laws include federal underground storage tank (UST) and aboveground storage tank (AST) regulations, the Clean Air Act (CAA), the Clean Water Act (CWA), the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the Toxic Substance Control Act (TSCA) among other. These laws and regulations can: govern what level of contaminants are allowed in the air, soil, and water at the facility; give performance standards for onsite equipment; determine the specifications of onsite equipment. The regulations affect the outcome of the ESA by determining if the facility is in compliance. Therefore, knowledge of what regulations may or may have governed previous site activities is part of completing a proper ESA.

2. State

The EPA typically gives the states a chance to manage their federal programs, such as RCRA, CERCLA, and UST/ASTs. According to the federal statutes, the state must prove that their program is AT LEAST as stringent as the federal program in order for them to be permitted to manage a state level program. In many cases, state level programs are more stringent than the federal program. It is necessary to also be aware of the state regulations that may affect any past or present operations at the site being redeveloped.

A. State Hazardous Waste
This is the equivalent of the federal RCRA program. It will determine how waste are handled onsite and during an investigation. Most states have state hazardous waste inventory which is a list of sites within the state that have a known or suspected release of a regulated substance above the reportable quantity.

B. State CERCLA/Superfund
State CERCLA programs are mirror images of the federal program. Typically, state CERCLA employees are contracted by the EPA to investigate potential National Priority List (NPL) sites in the state. Therefore, when investigating how CERCLA will affect your site, most likely you will be contacting a state employee in the Hazardous Waste Branch, Superfund Section.

C. UST/AST
State equivalent of the federal UST and AST regulations. In many cases, state laws are more stringent. The level of stringency of a state program is usually dependent on varying geologic conditions including soil type, depth to groundwater, and source of drinking water. For instance, because Florida uses its groundwater as drinking water

3. Local
Individual counties or township sometimes have their own regulations. For instance, a county can be responsible for instituting a state program. In addition, local municipalities have their own regulations for fires and building codes. It is necessary to make sure that the influence of any local program is investigated prior to project initiation.

D. Components of the ESA Process

1. Transaction Screening

2. Phase I Environmental Site Assessment
Phase I involves a preliminary environmental review including: (1) an evaluation of the site history; (2) an assessment of pertinent regulatory compliance issues; and (3) a field reconnaissance inspection. From this work, tentative conclusions or recommendations are developed. Based on the Phase I findings, usually presented in report format, the site assessment will either be terminated or continued on to a more detailed level of investigation.

3. Phase II Environmental Site Assessment
The next level of an ESA is the Phase II. This is the start of the field investigation that is needed in order to determine if the known or suspected impacts to the environment are above regulatory levels and will need corrective action. The Phase II utilizes information compiled in the Phase I to develop a detailed, site-specific sampling and analysis strategy that will target suspected or known site contamination. The goal of the sampling strategy is to identify particular hazardous or non-hazardous constituents that may be present at the site, to evaluate the extent of contamination and its risk implementation, if any, and to estimate the financial impact to parties pursuing the transaction.

The three-phase ESA process is sometimes thought to be a discrete set of steps that happens in all cases. However, the process we will talk about is just that, a process. Depending on the particular set of conditions, the user must determine what components of the ESA process should be completed. For instance, if a previous Phase I was completed and it was determined that known contamination exists onsite, the project may begin with Phase II sampling. However, for a new site where nothing is known, the general three-tiered process is usually followed.

E. ESA Protocols

In order to assure that the ESA process is completed in compliance with accepted commercial and professional standards, several companies and organizations have developed protocols for various phases of the ESA process. Among the professional organizations which have developed or are developing standards for conducting ESA are: American Society for Testing Materials (ASTM); The Association of Engineering Firms Practicing in the Geosciences (ASFE), National Groundwater Association, and the Hazardous Waste Action Coalition. However, the most widely recognized standards currently available are the ASTM standards.

1. The American Society for Testing Materials

   The American Society for Testing Materials (ASTM) has developed a complete set of standards for the ESA process. These standards were initially published in 1993 and are updated when needed. The first number of the ASTM title is the standard number, while the second number is the year the specific standard was last updated.

   A. Transaction Screening - Standard Practice for Environmental Site Assessments: Transaction Screen Process (E 1528 - 96)
   B. Phase I - Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (E 1527 - 97)
   C. Phase II - Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process (E 1903 - 97)

   In addition to the above standards, ASTM also has standards for specific investigation techniques. These standards as well as the above can be purchased from ASTM via telephone or the web. In addition, ASTM standards are usually available in the reference section of the library.

2. EPA

   A. Compliance Audits

      A Compliance Audit is an examination of a company's operations to determine whether they meet the requirements of applicable laws and regulations. It usually, but not always, covers safety as well as environmental issues. In the transactional setting, it may be conducted at a "surveillance level," focusing on only the major issues that are likely to lead to large corrective cost expenditures or fines.

3. State specific

   In contrast to federal directives regarding site assessment protocols, many states have begun to implement stringent regulations addressing the sale or purchase of contaminated property. An expanding number of states have existing or proposed requirements for site investigations and cleanup prior to the sale of commercial, industrial, and in some cases residential property. According to a 1989 publication of The Association of Engineering Firms Practicing the Geosciences (ASFE), approximately 11 states have existing or proposed requirements for site investigations and cleanup prior to sale of commercial property while approximately 30 states had detailed or general investigation result disclosure requirements. Many states are concerned with recovering costs of state-financed cleanups. At least 16 states have some variation of a lien enforcement capability where the state will recover costs before any other party in a case where the owner or operator of a contaminated site declares bankruptcy. In an effort to increase redevelopment of impacted sites, many states have begun loan and grant programs in order to provide an economic incentive to perspective purchasers. By providing a state standard for the ESA process, the state will ensure that the funds are going to a property that it will be feasible to redevelop.

4. Company Specific
   In addition to ASTM, EPA, and state specific ESA protocol, many companies have developed their own. Each company has a different perspective on how environmental conditions affect their purchase, development, or financing of a project. One company may view asbestos containing material as insignificant while it is another's main concern. This has lead to individual companies developing their own ESA protocol or standards. This is especially true of banks that finance redevelopment projects. It may be you that has the specific protocol or you who must provide a report that meets someone else's standards. Therefore, before you start the ESA process know what standards you or your consultant will use and make sure that all elements are completed in the appropriate manner.

II. Phase I Environmental Site Assessment

A. Site Reconnaissance - What do you look for?

The objective of the site reconnaissance is to visually and physically observe the property and any structure(s) located on the property in order to determine the likelihood of environmental impact to the property. The entire site must be observed, both inside and outside. If there are any areas that are not accessed, they must be specifically identified in the report. A contaminant is any physical, chemical, biological or radiological substance or matter present in any media at concentrations that may results in adverse effects on air, water, or soil (EPA). A release is any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, leaching, dumping, or disposing into the environment of a hazardous or toxic chemical or extremely hazardous substances, as defined under RCRA.

1. General Site Setting/Site Overview

A sketch showing the site layout is helpful to complete right away. That way, when any evidence of environmental concern is noted, it can be immediately located. Other items to be noted on the map are locations of various owners, operators, or tenants, improvements, land cover, topography, adjacent neighbors, and site utilities.

A description of the structures or other improvements on the property must be noted during the site visit including number of buildings, number of stories each, approximate age of buildings, and construction type of each building.

The topography of the site and the surrounding area should be noted at the site of the site visit. If any information shows there are likely to be hazardous substances or petroleum products onsite or that may migrate from offsite, the topographic observations must be analyzed in connection with the geologic, hydrogeologic, hydrologic, and topographic information obtained from record reviews, interviews, or site observations. This analysis will evaluate whether hazardous substances or petroleum products are likely to migrate to the property, or within or from the property, into soil and groundwater.

Public thoroughfares (roads) adjoining the property should be identified during the site visit. In addition, note any roads, streets or parking facility on the subject property should be described. The source of potable water for the property must be identified during the site walk through. The sewage disposal system for the site must also be determined during the site reconnaissance. If the sewage disposal system is an onsite septic system, an inquiry into the age of the system, and its maintenance should be completed. The means of heating and cooling the buildings on the property, including the fuel source, must be identified during the site reconnaissance. These systems can include but are not limited to heating oil, gas, electric, or radiators from steam boiler fueled by gas.

2. Site Conditions - Operations and/or maintenance practices
   One of the main determinants of whether potential environmental impact will be present is the present and past usage of the site and the surrounding properties. The present use of the property as noted during the site visit should focus on the likely use, treatment, storage, disposal or generation of hazardous substances or petroleum products. During the site reconnaissance it is also imperative to observe adjacent properties in an attempt to determine if any potential environmental conditions exist on the site which could ultimately impact the subject property. The observations about the adjacent properties and the surrounding area should be made from the subject site or from a public right-of-way. Due to legal issues, no entry onto another person's piece of property is advisable. Past uses of the subject site, adjacent properties and the surrounding area can be determined either via historical document review, interviews or visual observations.

Common areas of concern to be identified during the site walk through include the following list. The purpose of going over these common occurrences it to explain what they are, how they are identified, and briefly state what issues are usually associated with them.

3. USTs
   An underground storage tank, usually referred to as a UST, is a tank and any underground piping connected to the tank that has at least 10% of its combined volume underground. Requirements and definitions of USTs are found in Code of Federal Regulations, 40 CFR Part 280. These federal regulations apply only to USTs storing either petroleum or certain hazardous substances. Some kinds of tanks are not covered by these regulations: farm or residential tanks of 1,100 gallons or less capacity holding motor fuel used for noncommercial purposes; tanks storing heating oil used on the premises where it is stored; tanks on or above the floor of underground areas, such as basements or tunnels; septic tanks and systems for collecting storm water and wastewater; flow-through process tanks; and emergency spill and overfill tanks. However, just because these USTs are not covered by Federal 40 CFR Part 280, they may be covered under state or local regulations. In addition, unregulated USTs can cause contamination that would be regulated.

   A UST is designed as a holding structure. It total volume can range anywhere from 250 gallons to 100,000 gallons. An UST can be located either inside or outside and under pavement or grass. USTs are usually used to hold petroleum products, raw chemical materials, or waste products. UST can be identified in the field by visually looking for a dispensing system, a man-way to the tank, or an aboveground fill port (usually located running vertically up a building or canopy). A surface spill occurring during the filling of the UST or during the dispensing of fuel can be evidenced by stained soil or pavement or stressed vegetation in the area of the UST dispensing equipment or fill port. A subsurface release to the soil or groundwater from a leaking UST (LUST) can not be determined without screening subsurface soils or analytical testing of subsurface soil or groundwater. The location, content, capacity, age, and structure of all USTs onsite shall be determine either at the time of the site visit or from historical data reviews.

   USTs can cause of the following environmental conditions: surficial soil contamination due to overfilling or sloppy housekeeping; subsurface soil contamination due to a leak from the UST; and groundwater contamination due to a release from UST migrating into the site groundwater. The resulting impact depends on the site geologic and topographic conditions, the type of contaminant, and the age of the release. Typical constituents of a release from an UST include:

volatile organic compounds (VOCs); semi-volatile compounds (SVOCs); chlorinated compounds; polycyclic aromatic hydrocarbons (PAHs); and lead (from leaded gasoline).

4. ASTs
   An aboveground storage tank (AST) is a holding tank that has less than 10% of its volume underground. ASTs perform the same function as USTs, storage. An AST's total volume usually ranges from 250 gallons to 60,000 gallons. However, because the AST is aboveground taking up useable space at a property, their sizes are usually limited to 10,000 gallons or less. Similar to an UST, ASTs can be located either outside or inside a building. By their nature, ASTs have a greater likelihood for surface spillage and therefore are usually located on a paved surface and sometimes within a diked area for secondary containment. The location, content, capacity, age, and structure of all ASTs onsite shall be determine either at the time of the site visit or from historical data reviews.

   Because ASTs are an aboveground structure they can easily be identified visually onsite. Typical ASTs look similar to a cylinder that is oriented horizontally. Some new ASTs look like a cube as all their safety features are housed internally. A surface spill occurring during the filling of the AST, during the dispensing of fuel, or by a leak can be evidenced by stained soil or pavement or stressed vegetation in the area of the AST and its dispensing equipment. You would be unable to tell if a surface release caused impact to the subsurface soil or groundwater unless screening of subsurface soils or analytical testing of subsurface soil or groundwater was conducted.

   If an AST's structure fails or the dispensing hose leaks, a surface spill can be caused. This could result in surface soil contamination, deeper soil contamination depending on history of spillage, contamination of storm water, surface water or groundwater. Typical constituents of a release from an UST include: volatile organic compounds (VOCs); semi-volatile compounds (SVOCs); chlorinated compounds; polycyclic aromatic hydrocarbons (PAHs commonly found in petroleum fuels, coal products, and tar); and lead (from leaded gasoline).

5. Hazardous or non-hazardous waste storage
   Any storage of hazardous waste, non-hazardous waste, or petroleum products must be noted to the extent visually or physically observed or identified. Storage can be in drums, tanks, or other containers. Drums often hold 55 gallons, but containers as small as 5 gallons should be noted during the site inspection. For any storage, the location, material stored, type of container, storage conditions (i.e. on pallet, near drain), and container conditions (i.e. leaking, rusted, etc.) should be noted. If the material stored is unidentifiable or unknown, it shall be noted in the report.

   When completing the site inspection, drums or other storage container can visually be seen. In addition, evidence of historical waste storage including stained soil or pavement, stressed vegetation, or pallets can be physically observed during the site inspection. A historical review of aerial photographs, operational reports, and databases can help determine if the facility has ever stored hazardous or non-hazardous waste or had a release from the storage area.

   Current or historical waste storage can cause soil and groundwater contamination if improper handling or leaks have caused the release of hazardous, non-hazardous, or petroleum products onto the ground.

6. Hazardous or non-hazardous waste disposal
   Disposal is defined as the final placement or destruction of toxic, radioactive or other wastes, surplus or banned pesticides or other chemicals, polluted soils, and drums containing hazardous

materials from removal actions or accidental release. Disposal can be accomplished through the use of approved secure landfills, surface impoundments, land farming, deep well injection, ocean dumping, or incineration.

Because waste disposal can Evidence Pools of liquid... stains or corrosion... pits, ponds, or lagoons... stained soil or pavement... stressed vegetation

7. Solid Waste
   Solid waste can be normal refuse, bulky items, fill material or anything else defined by RCRA.

   Both present and prior solid waste disposal should be noted during the site reconnaissance. At the time of the site visit, current solid waste disposal practices can be evidenced by ******. Areas that are apparently filled or graded by non-natural causes or filled by fill from an unknown origin suggest trash or other solid waste disposal. In addition, mounds or depressions in the site topography can suggest areas of solid waste disposal.

   Solid wastes can contain many physical and chemical materials. When solid wastes are disposed of they begin to decompose,

8. Wastewater
   Wastewater is spent or unused water from an individual home, a community, a farm, or an industry that contains dissolved or suspended matter.

9. Wells

10. Drains and Sumps

11. Odors

12. PCBs
    Polychlorinated Biphenyls (PCBs) are a group of toxic, persistent chemicals, produced by chlorination of biphenyl. PCBs were previously used in high voltage electrical transformers because of they are good electrical insulators, conduct heat well, and are fire resistant. PCBs are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes. Further legal sale or use of PCBs was banned in 1979. This ban caused most electrical companies to slowly replace PCB contaminated transformers with non-PCB contaminated transformers. Therefore, PCBs are typically a concern at older sites.

    Because PCB are typically housed within another structure, their presence or previous presence usually is known from signs or other documentation such as historical site plans.

    PCBs are a cause of soil contamination. By their structural nature, PCBs do not migrate quickly from the source area nor do they degrade quickly. This makes PCBs are older sites a main concern.

13. Wetlands
    What is a wetland?

How can we identify a wetland? There are published maps of wetland data

What are the issues with wetlands?

14. Groundwater quality

15. Surface water quality

16. Radon

    Radon is a colorless, naturally occurring, radioactive, inert gaseous element formed by radioactive decay of radium atoms. Radionuclides are designated as hazardous substances under § 9602(a) of CERCLA and as a hazardous air pollutant under § 112 of the Clean Air Act. Radon and its daughter products are considered radionuclides, therefore radon is a CERCLS hazardous substance. However, radon can be naturally present in soil; the amount in the soil depends on the geology. When radon is naturally occurring, there is no liability under CERCLA because remedial actions of a naturally occurring substances is except under 42 USC § 9604(a)(3)(A). Because ASTM Phase I standards are focused on identifying potential contaminants as defined by CERCLA in order to use the innocent purchaser defense under Superfund, investigation into radon at a site is considered a non-scope issue. However, its qualification is usually required by financial institutions. It is also becoming a standard to test for radon in residential property transactions.

    Because of its gaseous properties, radon usually collects in basements. Radon is a concern because of its potential cancer causing effects. Radon is a colorless gas and therefore can not be detected in the field without the use of detection devices or analytical testing. For the purposes of the Phase I process, it is necessary to note all low lying site features or building structures were radon could collect. Also, published radon data is readily available that provides a good baseline to determine whether radon is likely to be an issue and if analytical testing should be recommended.

17. Asbestos

    Material is considered asbestos if it contains more than one-percent asbestos. Asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite asbestos and any of these minerals which have been chemically treated and/or altered. Asbestos that is used in building materials are referred to as asbestos containing building materials (ACBM).

    Section 9604(a)(3)(B) of CERCLA prohibits response actions involving a release or threat of release "from products which are part of the structure of, and result in exposure within, residential buildings or business or community structures." Per Appendix X1.6.4.5 of the ASTM Standard E 1527, if the asbestos is part of the structure of the building it is excluded from CERCLA liability, and should not be investigated pursuant to the party's innocent purchaser appropriate inquiry requirements. If asbestos-containing material is investigated the information should be placed in the non-scope issue of the report. Note, that is asbestos is disposed of on a site and, therefore, is no longer part of the structure of the building, the cleanup of the disposed asbestos is subject to Superfund response actions. According to the same ASTM standard, if a building is sold with the knowledge that it will be demolished, the sale may constitute a disposal falling under CERCLA's liability provisions. Because investigation of suspect asbestos-containing material is considered non-ASTM, you must determine prior to initiation of the Phase I whether you want an investigation of this type performed. If you tell your consultant you want a Phase I ESA performed by the ASTM standards, they will not identify potentially asbestos-containing material.

Suspect ACBMs potentially include:
asbestos containing material can be identified How to identify asbestos?

Asbestos: What are the issues with asbestos?

18. Lead in Drinking Water and Lead-Based Paint
    Lead is a heavy metal that is hazardous to the health if breathed or swallowed. The hazardous of lead in drinking water and lead-based paint can be evaluated in terms of exclusions of 42 USC § 9604(a)(3)(B) and (C), in an analysis similar to radon and asbestos. The environmental hazards are not encompasses by Superfund's appropriate inquiry responsibilities. However, similar to asbestos, if there is a disposal of these substances on the site or in a facility, CERCLA liability may arise.

    Leads use in gasoline, paints, and plumbing compounds has been restricted or eliminated by Federal laws and regulations. Prior to the government's intervention, lead used to be an ingredient in paint. Older buildings may still have lead-based paint in them. As the paint peals or is stripped, harmful particles can be released into the air where they can be breathed or swallowed. In addition, lead is also a concern in soil and groundwater due to prior releases from USTs or ASTs that contained leaded gasoline.

    There is no way to identify lead-based paint or lead in drinking water during a Phase I ESA without using screening equipment or analytical testing. In older buildings were lead-based paint is suspected, it is important to note the location, condition, and approximate square footage of the material. The report can also note whether leaded gasoline was stored onsite.

19. Pesticides/herbicides
    A pesticide is a substance or mixture of substances intended to prevent or mitigate infestation by, or destroy or repel, any pest. A herbicide is a chemical pesticide designed to control or destroy plants, weeds, or grasses. Because of their chemical structure, pesticides and herbicides accumulate in fat cells and therefore can lead to poisoning of animals and/or humans if levels become too high. The past or present use of pesticides or herbicides on a property usually can be determined from the type of site usage and from historical documentation, such as process methods. Constituents associated with pesticides and herbicides include: alochlor, *****

20. Explosives

A. Common contaminants - can be arranged numerous ways......APPENDIX?
   1. Volatile organic compounds (VOCs) - A VOC is one of a group of carbon-containing compounds that evaporate readily at room temperature. Examples of VOCs include trichloroethane, trichloroethylene, benzene, toluene, ethylbenzene, and xylenes (BTEX). These contaminants are typically generated from metals degreasing, printed circuit board cleaning, gasoline, and wood preserving processes.
   2. Semi-volatile organic compounds (SVOCs) - SVOCs are composed primarily of carbon and hydrogen atoms, have boiling points greater than 200? C. Common SVOCs include

pentachlorophenol (PCP) and phenols. These are commonly used in feed stock material and chemical manufacturing.

3. Polycyclic aromatic hydrocarbons (PAHs) - A PAH is a chemical compound that contains more than one fused benzene ring. They are commonly found in petroleum fuels, coal products, and tar.
4. Metals
5. Pentachlorophenol (PCP) - PCP, a chemical compound containing carbon, chlorine, oxygen, and hydrogen, is a contaminant used in feed stock material and chemical manufacturing.
6. PCBs
7. Pesticides/herbicides
8. Explosives
9. Lead
10. Asbestos

III. Phase II Site Investigations

A. Technologies - Can be arranged numerous ways.....APPENDIX

Numerous technology options are available to assist those involved in Brownfields cleanup. EPA's Technology Innovation Office (TIO) encourages the use of innovative and cost-effective technologies to characterize and clean up contaminated sites. Innovative technologies for evaluating the nature and extent of contamination and for addressing the cleanup of Brownfields sites hold promise for reducing the cost of cleanup and accelerating the cleanup schedule—potentially producing significant benefits to Brownfields stakeholders by reducing barriers to redevelopment that add to costs, or time schedules, or create uncertainties. When such factors as lower cost, increased environmental protection, and improved effectiveness are considered, innovative technologies frequently are more cost-effective and provide better and more efficient cleanup than established treatment technologies. Often, they also are more acceptable to communities.

Innovative does not mean unproven. EPA defines an innovative technology as one that has been used in the field but that is not yet considered routinely for use. In addition, cost and performance data on the technologies may be insufficient to encourage managers of cleanup projects to select those technologies over established methods. Nevertheless, innovative technologies are being used in many cleanup programs to assess contamination and to treat a variety of hazardous substances and petroleum products that have been released into the environment. For example, approximately 43 percent of Superfund sites that have contaminated soil are using "innovative" technologies (Innovative Treatment Technologies: Annual Status Report, Eighth Edition).

An Emerging Technology is an innovative technology that currently is undergoing bench-scale testing, in which a small version of the technology is tested in a laboratory.

An Innovative Technology is a technology that has been field-tested and applied to a hazardous waste problem at a site, but lacks a long history of full-scale use. Information about its cost and how well it works may be insufficient to support prediction of its performance under a wide variety of operating conditions.

An Established Technology is a technology for which cost and performance information is readily available. Only after a technology has been used at many different sites and the results fully documented is that technology considered established.

1. Buried Objects

   a) Ground penetrating radar (GPR)
      GPR is a technology that emits pulses of electromagnetic energy into the ground to measure its reflection and refraction by subsurface layers and other features, such as buried debris.

   b) Electromagnetic (EM) Induction
      EM induction is a geophysical technology used to induce a magnetic field beneath the earth's surface, which in turn causes a secondary magnetic field to form around nearby objects that have conductive properties, such as ferrous and nonferrous metals. The secondary magnetic field is then used to detect and measure buried debris.

   c) Infrared Monitor (IR)
      An infrared monitor is a device used to monitor the heat signature of an object and therefore detect buried objects in soil.

   d) Seismic Reflection and Refraction
      Seismic reflection and refraction is a technology used to examine the geophysical features of soil and bedrock, including geophysical profiles as well as debris, buried channels, and other features

2. Geophysical profiles

   a) Seismic reflection and refraction
      Seismic reflection and refraction is a technology used to examine the geophysical features of soil and bedrock, including geophysical profiles as well as debris, buried channels, and other features.

   b) Direct push sampling
      Direct push sampling is a technique in which a sampling tube is hydraulic pushed or banged into the subsurface and collects material as it advances. The sampling tubes are usually 2 or 4 feet in length and can provide a continuous sample of the subsurface material. By visually analyzing the material within the sampling tubes an environmental specialist or geologist can provide a derive a subsurface geophysical profile consistent with the depth the samples were collected. Direct push sampling can only occur in unconsolidated sediments where bedrock is not present. Direct push sampling can not penetrate bedrock.

3. Soil

   a) Soil screening
      1. Flame Ionization Detector (FID)
         A flame ionization detector (FID) measures the change of signal as analytes are ionized by a hydrogen-air flame. A FID can be used alone to give a total reading of ionized contaminants in parts per million (ppm). When used in this setting, the FID is a screening tool for soil contamination. It can give you a general idea whether soil is slightly or grossly impacted based on the total ppm reading. However, not that there is not a direct relationship between the contaminant levels identified with a FID and those obtained during laboratory analysis of the soil. In addition, when a FID is used alone the contaminant is unknown because it can not identify the individual contaminants causing the ionization. Because a FID can detect phenols, phthalates, PAHs, VOCs, and petroleum hydrocarbons, the ppm reading can could any one of these individual contaminants or a combination of them.

A FID can also be used in conjunction with a gas chromatograph to identify and quantify the individual constituents causing the soil contamination.

2. Photoionization Detector (PID)
Similar to a FID, a photoionization detector (PID) measures the change of signal as analytes are ionized by an ultraviolet lamp. It can be alone to give a general idea of levels of soil contamination, but can not identify the individual constituents that are present. The PID can detect VOCs and petroleum hydrocarbons.

A PID can also be used in conjunction with a gas chromatograph to identify and quantify the individual constituents causing the soil contamination.

1. Direct push
Direct push sampling is a technique in which a sampling tube is hydraulic pushed or banged into the subsurface and collects material as it advances. The sampling tubes are usually 2 or 4 feet in length and can provide a continuous sample of the subsurface material. The environmental specialist or geologist will log the type of material (i.e. clay, course sand, etc.) collected at each sampling interval and collect a representative sample from the material for laboratory analysis. The volume of soil and the sampling jars needed will depend on the laboratory analysis to be completed. The type of laboratory analysis conducted is contingent on the suspected type of contaminants. Direct push sampling can occur only in unconsolidated sediments where bedrock is not present. Direct push sampling can not penetrate bedrock. This technique can be used when sampling for any constituent (VOCs, SVOCs, PCBs, PAHs, etc.)

2. Drilling - sample collection

3. Soil gas survey - VOCs, BTEX
Soil gas consists of gaseous elements and compounds that occur in small spaces between particles of the earth and soil. Such gases can move through or leave the soil or rock, depending on changes in pressure. During a soil gas survey a small hole (less than 1-inch) is advanced in the soil to a depth the investigator is interested in. A small tube from the PID or FID is placed into the hole so the soil gas can travel up the tube to the ionization device. After ionization, the gas enters into a portable gas chromatograph (GC) which identifies and quantifies the individual organic compounds on the basis of molecular weight, characteristic fragmentation patterns, and retention times. The results of a soil gas survey give a general quantification and location of the constituents of soil contamination at the site. Soil gas surveys are applicable when the suspected contaminants is a VOCs and SVOCs.

4. Immunoassay test kits
Immunoassay is an innovative technology used to measure compound-specific reactions to individual compounds or classes of compounds. The reactions are used to detect and quantify contaminants. In field portable test kits using this method are available for the following compounds or groups of compounds: benzene, toluene, ethylbenzene, and xylene (BTEX), PCPs, PCBs, PAHs, pesticides, explosives, and metals. In order to use immunoassay testing effectively, one must know or have a strong suspicion what contaminant is in the soil, as well as where it is.

5. Colorimetric kits

Colorimetric refers to chemical reaction-based indicators that are used to produce compound reactions to individual compounds, or classes of compounds. The reactions, such as visible color changes or other easily noted indications, are used to detect and quantify contaminants. In order to use colorimetric kits effectively as a testing method, one must know or have a strong suspicion what contaminant is in the soil, as well as where it is. Colorimetric kits can be used to analysis for organic and explosive contaminants.

6. Fluorescence analyzers - petroleum

7. Laser induced fluorescence/cone penetrometry
   Laser-induced fluorescence/cone penetrometer is a field screening method that couples a fiber optic-based chemical sensor system to a cone penetrometer mounted on a truck. It is most effectively used when petroleum contamination is present.

8. X-ray fluorescence (XRF)
   A x-ray fluorescence analyzer is a self-contained, field-portable instrument, consisting of an energy dispersive x-ray source, a detector, and a data processing system that detects and quantifies individual metals or groups of metals.

9. Long path FTIR - organics

4. Groundwater
   a) Direct push
      Direct push sampling is a technique in which a sampling tube is hydraulic pushed or banged into the subsurface coring a hole. After the hole reaches the groundwater table, a groundwater sampling tube can be drop down to collect a sample. The volume of groundwater and the sampling jars needed will depend on the laboratory analysis to be completed. The type of laboratory analysis conducted is contingent on the suspected type of contaminants. Direct push sampling can only be used when the groundwater table is in the unconsolidated sediments because it can not penetrate bedrock. This technique can be used when sampling for any constituent (VOCs, SVOCs, PCBs, PAHs, etc.)

   b) Drilling - well installation

   c) Immunoassay test kits
      Immunoassay is an innovative technology used to measure compound-specific reactions to individual compounds or classes of compounds. The reactions are used to detect and quantify contaminants. In field portable test kits using this method are available for the following compounds or groups of compounds: benzene, toluene, ethylbenzene, and xylene (BTEX), PCPs, PCBs, PAHs, pesticides, explosives, and metals. In order to use immunoassay testing effectively, one must know or have a strong suspicion what contaminant is in the soil, as well as where it is.

   d) Colormetric kits - organics, explosives
      Colorimetric refers to chemical reaction-based indicators that are used to produce compound reactions to individual compounds, or classes of compounds. The reactions, such as visible color changes or other easily noted indications, are used to detect and quantify contaminants. In order to use colorimetric kits effectively as a testing method, one must know or have a strong suspicion

what contaminant is in the soil, as well as where it is. Colorimetric kits can be used to analysis for organic and explosive contaminants.

e) Laser induced fluorescence/cone penetrometry
Laser-induced fluorescence/cone penetrometer is a field screening method that couples a fiber optic-based chemical sensor system to a cone penetrometer mounted on a truck. It is most effectively used when petroleum contamination is present.

5. Air
   a) Long path FTIR - organics
   b) Infrared Monitor (IR)
      An infrared monitor is a device used to monitor the heat signature of an object, as well as sample air.

6. Asbestos
   a) PLM

7. Lead
   a) X-ray fluorescence (XRF)
      A x-ray fluorescence analyzer is a self-contained, field-portable instrument, consisting of an energy dispersive x-ray source, a detector, and a data processing system that detects and quantifies individual metals or groups of metals.

IV. Data Interpretation - What do the results mean?

Where do we go after we have received the results of the Phase II?

Appendices
1. Acronyms

2. Glossary

3. Typical contaminants
   a) By group type - VOC, SVOCs, PAHs, metals, etc.
   b) By media type - soil, groundwater, air
   c) By type of property

4. Characterization Techniques
   a) By type of contaminants
   b) By media type
   c) By type of property

5. List of sources of information
   A. Publications
      1. General Information
         a) *Terminology Relating to Soil, Rock, and Contained Fluids* (ASTM D 653)

2. Brownfields Information
   a) *Road Map to Understanding Innovative Technology Options for Brownfields Investigation and Cleanup* (EPA OSWER, EPA 542-B-97-002)
   b) *Tool Kit of Information Resources for Brownfields Investigation and Cleanup* (EPA OSWER, EPA 542-B-97-001)

3. Investigation Techniques
   1. *Field Analytical and Site Characterization Technologies Summary of Applications* (EPA OSWER, EPA 542-R-97-011)
   2. *Cone Penetrometer/Laser Induced Fluorescence (LIF)*
      1. *Rapid Optical Screening Tool (ROST)* (EPA 600-R-97-020)
      2. *Site Characterization and Analysis Penetrometer System (SCAPS)* (EPA 600-R-97-019)
   3. *Field-Portable X-Ray Fluorescence (FPXRF)*
   4. *Portable Gas Chromatograph/Mass Spectrometers (GC/MS)*

   *Note a, b, and c are from the Consortium for Site Characterization Technology - Innovative Technology Verification Reports.
   5. Vendor Field Analytical and Characterization Technologies System (Vendor FACTS),Version 2.0 (Vendor Facts Bulletin EPA 542-N-97-007)
   6. *Guide to Site Characteristics for Environmental Purposes With Emphasis on Soil, Rock, The Vadose Zone, and Ground Water* (ASTM D 5730)
   7. *Test Methods for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well* (ASTM D 4750)

4. Remediation Information
   a) *Contaminants and Remedial Options at Pesticide Sites* (EPA 600-R-94-202, PB95-103869).
   b) *Contaminants and Remedial Options at Selected Metal-Contaminated Sites* (EPA 540-R-95-512, PB95-271961)
   c) *Contaminants and Remedial Options at Solvent-Contaminated Sites* (EPA 600-R-94-203, PB95-177200)
   d) *Contaminants and Remedial Options at Wood Preserving Sites* (EPA 600-R-92-182, PB92-232222)
   e) *Expedited Site Assessment Tools for Underground Storage Tank Sites: A Guide for Regulators* (EPA 510-B-97-001)
   f) *A Citizen's Guide to Understanding Presumptive Remedies* (EPA OSWER, EPA 540-F--97-019, PB97-963303, October 1997)
   g) *A Citizen's Guide to Innovative Treatment Technologies for Contaminated Soils, Sludges, Sediments, and Debris* (EPA OSWER, EPA 542-F-96-001, April 1996)
   h) *A Citizen's Guide to Soil Washing* (EPA OSWER, EPA 542-F-96-002, April 1996)
   i) *A Citizen's Guide to Solvent Extraction* (EPA OSWER, EPA 542-F-96-003, April 1996)
   j) *A Citizen's Guide to Chemical Dehalogenation* (EPA OSWER, EPA 542-F-96-004, April 1996)
   k) *A Citizen's Guide to Thermal Desorption* (EPA OSWER, EPA 542-F-96-005, April 1996)
   l) *A Citizen's Guide to In Situ Soil Flushing* (EPA OSWER, EPA 542-F-96-006, April 1996)
   m) *A Citizen's Guide to Bioremediation* (EPA OSWER, EPA 542-F-96-007, April 1996)
   n) *A Citizen's Guide to Soil Vapor Extraction and Air Sparging* (EPA OSWER, EPA 542-F-96-008, April 1996)

o) *A Citizen's Guide to Phytoremediation* (EPA OSWER, EPA 542-F-96-014, April 1996)
p) *A Citizen's Guide to Natural Attenuation* (EPA OSWER, EPA 542-F-96-015, April 1996)
q) *A Citizen's Guide to Treatment Walls* (EPA OSWER, EPA 542-F-96-016, April 1996)

5. Standard Protocol Information
   a) American Society for Testing and Materials
      1. *Transaction Screening - Standard Practice for Environmental Site Assessments: Transaction Screen Process* (E 1528 - 96)
      2. *Phase I - Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process* (E 1527 - 97)
      3. *Phase II - Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process* (E 1903 - 97)
      4. *Guide to Site Characteristics for Environmental Purposes With Emphasis on Soil, Rock, The Vadose Zone, and Ground Water* (ASTM D 5730)
      5. *Test Methods for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well* (ASTM D 4750)

B. Agency, contact name and phone number
   1. General Information
      a)

   2. Brownfields Information
      a)

C. Web sources
   1. General information
      a) http://www.epa.gov

   2. Brownfields information
      a) http://www.epa.gov/brownfields

   3. Investigation Techniques
      a) http://www.epa.gov
      b) http://clu-in.com
      c) http://www.ttemi.com/visitt

   4. Remediation information
      a) www.epa.gov
      b) http://clu-in.com

6. Recommended Report Outlines (per ASTM)

   A. Transaction Screening
      1.

B. Phase I ESA
   1. Summary
   2. Introduction
   3. Site Description
   4. Records Review
   5. Information from Site Reconnaissance and Interviews
   6. Findings and Conclusions
   7. Signatures of Environmental Professionals
   8. Qualifications of Environmental Professionals
   9. Appendices
      a) Maps, figures, photographs
      b) Ownership/historical documentation
      c) Regulatory documentation
      d) Interview documentation

C. Phase II ESA
   1. Executive Summary
   2. Introduction
   3. Background
   4. Phase II Activities
   5. Evaluation and Presentation of Results
   6. Discussion of findings and conclusions
   7. Recommendations
   8. Appendices
      a) Subsurface exploration logs and monitoring well construction details
      b) Laboratory report with quality control information
      c) Any other information to support the report