Previous Site Use Scenarios

Rural Community Sites

Contaminated or potentially contaminated sites, once thought to be limited to urban and suburban areas, are also present in rural areas. Rural communities considering revitalization can face many unique obstacles. These obstacles may include:

- A remote and rural geographic location often inhibits economic growth, making it difficult to recruit new businesses, retain existing businesses, and to justify funding revitalization.
- Costs associated with cleanup and revitalization often far exceed the costs of developing abundant green space.
- Absence of funds necessary to recruit expertise required to manage a revitalization project.
- Lack of a formal self-help network of other rural development practitioners involved in revitalization to share experiences and exchange information.

However, strategies for rural revitalization have been developed. Recent rural revitalization success can be attributed to focused attention from state brownfields programs, rural community development research and awareness training conducted by the National Association of Development Organizations (NADO) as well as integration of Smart Growth. The NADO research foundation provides training, information resources, and representation for regional development organizations serving small metropolitan and rural communities.

Smart Growth is a constantly evolving approach to land development and redevelopment that promotes a mix of residential, commercial, and recreational uses; preserves green space and working landscapes; and provides a variety of transportation options. Smart Growth is a network of partners including environmental groups, historic preservation organizations, professional organizations, developers, real estate interests, and local and state government entities. Typically, Smart Growth is achieved through collaborative planning, mixed-use development, downtown revitalization, and open-space conservation. However, rural communities can adapt Smart Growth strategies and modify them to revitalize small towns; link natural resource protection with development; maintain working landscapes; and coordinate regional development. Smart Growth strategies partnered with existing research and training conducted by the NADO and other organizations demonstrate how resources for rural development have become increasingly available.

Web links with further information on revitalization and rural communities are listed in the Links to Resources for Rural Community Sites Exhibit.

Exhibit: Links to Resources for Rural Community Sites

Organization	Topic
NADO	Rural Brownfields Awareness Project and Reports
NADO	Brownfields Resouces for Rural and Small Communities

Organization	Topic
Northeast-Midwest Institute	Financing Brownfield Development in Small Towns and Rural Areas
Northeast-Midwest Institute	Smart Growth at the Frontier: Strategies and Resources for Rural Communities
Rural Community Assistance Partnership	Rural Community Assistance Programs
Rural Community Assistance Corporation	Rural Community Assistance Programs
Technical Assistance to Brownfields (TAB) Communities	Hazardous Substance Research Center (HSRC) Home Page TAB General Information Brochure
USDA	Rural Development Home Page
University of Louisville Center for Environmental Policy and Management	Farmland Preservation: The Benefits of Saving Our Agricultural Land and Resources
University of Louisville Center for Environmental Policy and Management	Dealing with Growth: Alternatives to Large Lot Zoning on the Urban Fringe
University of Missouri Extension	Community Food Systems and Sustainable Agriculture Program

Mine-Scarred Land Sites

Mine-scarred lands (MSL) are defined as lands, associated waters, and surrounding watersheds where extraction or processing of ores and minerals (including coal) has occurred (EPA, 2004). Mine-scared lands have become a persistent problem in many communities due to the economic and environmental challenges of cleaning up and reusing mine-scarred lands.

As an extension of the Brownfields Federal Partnership, the Mine-Scarred Lands Working Group, co-chaired by the U.S. EPA's Office of Brownfields Cleanup and Redevelopment, and the U.S. Department of Interior's Office of Surface Mining was established to collaboratively address the challenges of mine-scarred lands cleanup and revitalization. The mission of the Working Group is to foster the cleanup and sustainable revitalization of mine-scarred lands and affected communities. Challenges of these sites include:

- Economic distress
- Acid mine drainage
- Stockpiled waste rock and tailings
- Stored chemicals and leaking containers

- Open shafts and pits and rotting support structures
- Subsidence

The MSL Working Group has recently identified six Demonstration Projects across the U.S. where the opportunity exists to collaborate with local stakeholders by providing technical assistance to clean up and reuse mine-scarred lands. In the future, it is hoped that the lessons learned from these Demonstration Projects will serve as models for success in mine-scarred lands revitalization. In fact, lessons learned by the MSL initiative can currently be viewed on the Mine-Scarred Lands Initiative Tool Kit, now available on the EPA website listed below. The Tool Kit provides information on:

- Creating a Vision for Revitalization
- Identifying and Engaging Partners and Stakeholders
- Developing a Revitalization Plan
- Technical Considerations
- Legal Considerations
- Funding Revitalization Projects

In addition to the MSL Working Group Demonstration Projects, another exciting approach to mine-scarred land reclamation has been initiated by the Harvard University Graduate School of Design. The Project for Reclamation Excellence (P-REX), promotes design as a catalyst for reclaiming and reusing post-mined landscapes through research, education, and communication.

Exhibit: Links to Resources for Mine-Scarred Land Sites

Organization	Topic
U.S. EPA	Abandoned Mine Lands Program
U.S. EPA	Mine-Scarred Lands Initiative Tool Kit
The Brownfields and Land Revitalization Technology Support Center	Brownfields Roadmap: Mining Site Redevelopment Program
U.S. Department of Interior, Bureau of Land Management	Abandoned Mine Lands Program
U.S. Office of Surface Mining	Abandoned Mine Land Inventory Tool
U.S. Office of Surface Mining	Abandoned Mine Land Reclamation Program

Organization	Topic
National Association of Abandoned Mine Land Programs (NAAMLP)	NAAMLP state and tribal partnership for Abandoned Mine Land Reclamation
Harvard University Graduate School of Design	Project for Reclamation Excellence (P-REX) Program

Methamphetamine Sites

Clandestine drug labs are an increasing problem in the United States. Once seen as only a rural issue in western states, drug labs are multiplying throughout the nation and becoming a major social, economic, and public health concern.

The most prevalent illegal drug manufactured in clandestine laboratories is methamphetamine (meth). A variety of chemicals are used to make meth. Various meth recipes include combinations of volatile organic compounds, corrosives, metals, solvents and salts. Some of these chemicals include acetone, starter fluid, freon, hexane (Coleman fuel), methanol, toluene, white gas, xylene, anhydrous ammonia, hydriodic acid, hydrochloric acid (muriatic acid), phosphine, sodium hydroxide (lye), sulfuric acid (drain cleaner), iodine, lithium metal, red phosphorus, yellow phosphorus, and sodium metal. Making meth with these chemicals poses a variety of health and safety problems and environmental concerns as they can result in explosions, chemical fires, and the release of toxic gases.

Meth labs are usually discovered in houses, apartments, motel rooms, sheds, or even motor vehicles, as most meth ingredients consist of easily obtainable over-the-counter items. These lab sites are considered hazardous waste sites by EPA and are costly to assess and clean up. The cost of cleaning up a clandestine meth lab site can range from $3,000 to $5,000 for a relatively small operation to as much as $50,000 to $100,000 for a large site. There are usually over five pounds of waste generated for every one pound of meth product and this waste is often dumped in backyards, rural areas, in rivers, or fields. Due to this growing national concern, Congress made properties contaminated by controlled substances, such as meth, eligible for Brownfields funding. Although Brownfields redevelopment is not the primary solution to the emerging drug lab issue, the Brownfields Program can provide funding and technical assistance in addressing the growing problem.

Exhibit: Links to Resources for Methamphetamine Sites

Organization	Topic
U.S. Drug Enforcement Administration	Guidelines for Law Enforcement for the Cleanup of Clandestine Drug Laboratories

Organization	Topic
White House Office of National Drug Control Policy, The Department of Justice, The Department of Health and Human Services	Methamphetamine General Resource
White House Office of National Drug Control Policy, The Department of Justice, The Department of Health and Human Services	Methamphetamine Site Cleanup Funding
U.S. EPA	Brownfields funding in use, MethFields brochure
U.S. EPA	Methfields - EPA Community Initiative
California Department of Toxic Substances Control	Clandestine Drug Lab Remediation Programs and Methamphetamine Resources

Landfills and Junkyards

Contamination from landfills, junkyards and scrapyards can pose a very real danger to human and environmental health. The contaminants released span the full spectrum of toxicity and carcinogenicity. Remediation of landfill, junkyard and scrapyard sites can be costly and time consuming, but it can be done. Technical Approaches to Characterizing and Redeveloping Municipal Landfills and Illegal Dump Brownfield Sites provides an overview of the contaminants and remediation technologies typically used at landfills and illegal dump brownfields, yet every site is unique, and developers will need to develop a remediation plan based upon the contamination actually present on-site.

By definition, a municipal solid waste landfill is a discrete area of land or an excavation that receives household waste, and that is not a land application unit, surface impoundment, injection well, or waste pile, as those terms are defined by law. Landfills/Junkyards/Scrapyards come in all shapes and sizes and can impact the environment in many different ways. Some dump sites may as be as small as a few barrels of waste oil, while the largest industrial waste landfill may cover 100 acres or more. The range of effects that dump sites and landfills can manifest upon the environment are just as diverse as the various forms the sites may take. If conditions are right, i.e. water and bacteria are present, which is the case with most lanfills and dumps, leachate and landfill gases (mostly methane)may be generated. Both may be composed of different contaminants and each represents a challenge for site revitalization. Taken together, they can affect the soils, ground and surface waters, and air in and around dumps and landfills, many times years after they have been closed. Because of unregulated use prior to 1970, or

illegal dumping practices, landfills may contain volatile organic compounds, pesticides, PCBs, polynuclear aromatic hydrocarbons, cyanides, heavy metals, and other contamination. Even household waste can contain small quantities of oil and grease, paint, corrosives, solvents and other miscellaneous consumer chemicals (EPA, 2002).

Waste decomposition in a landfill occurs first under aerobic and then under unaerobic conditions, generating first carbon dioxide and finally methane gas. Methane combined with air, may form an explosive combination. Methane and hydrogen sulfide, another landfill gas, are toxic. Leachate produced by water moving through deposited refuse represents a potential hazard to soils as well as surface and groundwater.Remediation of former landfill sites is somewhat different from remediation at other contaminated sites. For one, landfills often differ from other contaminated sites in the sheer volume and area of contamination. Also, site contamination is almost always spread throughout the entire site and cannot be remediated economically with most treatment technologies. The final remediation strategy for a site will depend mostly on the size of the landfill or dump site and the costs of the proposed remediation strategies.

Landfills and illegal dump sites pose a significant risk to human and environmental health. Yet as pressure for new land rises, especially in urban and suburban areas, these landfills, junkyards, and scrapyards are becoming valuable parcels of land and cost-effective and safe remediation of any contaminants on-site becomes a first priority.

Exhibit: Links to Resources for Landfills/Junkyards/Scrapyards Sites

Organization	Topic
U.S. EPA	Municipal Solid Waste Disposal
U.S. EPA	Land Disposal Restrictions
U.S. EPA	Closure and Post-Closure Care Requirements for Municipal Solid Waste Landfills (MSWLFs)
U.S. EPA	Scrap Tire Cleanup Guidance
U.S. EPA	Office of Solid Waste and Emergency Response (OSWER)

Gas Stations

It is estimated that there are more than 450,000 brownfields across the U.S., and that up to half of those sites are thought to be impacted by underground storage tanks or some type of petroleum contamination, mostly from abandoned gas station sites. These sites can have a negative impact on the environmental and economic health of the communities where they are located. However, revitalization of petroleum brownfields can have an immensely positive impact on communities. The revitalization process improves and protects the local environment, by ensuring remediation of sites to clean up standards, and takes development pressures off of undeveloped open land by utilizing existing infrastructure for prospective site use. Community development is further strengthened as clean up and reuse of old gas station sites increases local tax bases and facilitates job growth.

In 2002, the Brownfields program was expanded to include relatively low-risk petroleum sites as eligible sites for Brownfields assessment and cleanup grant funding. By law, EPA must now make available 25 percent of the total Brownfields grant funds each year for the assessment and/or cleanup of relatively low-risk petroleum-contaminated sites. These brownfield funds can also be combined with state-based UST cleanup funds to further promote the revitalization of blighted sites that are commonly located on desirable properties such as high traffic streets and corner lots.

For a site to be eligible for Brownfields Grants, the state,or, if necessary, EPA, must make the determination that a petroleum contaminated site:

- Is "relatively low risk" compared to other petroleum-contaminated sites in the state
- Has "no viable responsible party"
- Will be assessed, investigated, or cleaned up by a person not potentially liable for the contamination
- Is not subject to a corrective action under RCRA §9003(h)

Since 2003, EPA has awarded a total of over $89.8 million for the assessment and cleanup of petroleum brownfield sites.

With so many UST sites requiring remediation, EPA is promoting faster, more effective, and less costly alternatives to established cleanup methods. An innovative tool, the "Ready for Reuse" determination developed by EPA Region 6, encourages timely cleanups that will support redevelopment opportunities protective of human health and the environment. The Ready for Reuse Program is a certification process that recognizes when contamination has been evaluated and, if necessary, cleaned up to the extent that a property is safe for its current use or planned future use. The primary purpose of the Ready for Reuse determination is to document, in a straightforward manner, specific information about the current environmental conditions on a property, the work performed at the site to address risks, and to identify that the entire facility – or portions of the facility – are ready for reuse.

Exhibit: Links to Resources for UST Sites

Organization	Topic
EPA Office of Underground Storage Tanks (OUST)	Cleaning Up and Reusing Abandoned Gas Station Sites (RAGS)
EPA Office of Underground Storage Tanks (OUST)	USTfields Pilot Initiative in 2000
EPA Office of Underground Storage Tanks (OUST)	EPA Brownfield Grants for Petroleum Brownfields Properties
EPA Office of Underground Storage Tanks (OUST)	Internet Addresses for State UST, LUST, and Financial Assurance Fund Programs

Organization	Topic
Northeast-Midwest Institute	From Rags to Riches, Innovations in Petroleum Brownfields
Northeast-Midwest Institute	A Primer for Petroleum Brownfields, What Can Your Community Do To Revitalize UST Sites?
The Brownfields and Land Revitalization Technology Support Center	Brownfields Roadmap: USTs at Brownfield Sites: Technology Options for Tank Remediation

Federal Facility Sites

There are thousands of federal facilities across the country, such as military bases and nuclear plants, owned and operated by the U.S. Government. Technological advances, efficiency evaluations, and economic adjustments in the U.S. Government have created opportunities for these sites to be transformed to other beneficial uses for local communities and expanding businesses. However, as a result of facility age and industrial processes, some of the sites contain environmental contamination, such as hazardous wastes, unexploded ordnance, radioactive wastes or other toxic substances. To reduce the cost of cleanup and reuse of these sites, the EPA's Federal Facilities Restoration and Reuse Office (FFRRO) coordinates creative solutions to restore sites for reuse and to protect both human health and the environment. Community development solutions restore federal facility sites so they can once again serve an important role in the economy and welfare of local communities.

In particular, military base closures have impacted hundreds of communities around the country. The Office of Economic Adjustment (OEA) is the Department of Defense's (DOD) primary source for assisting communities that are adversely impacted by Defense program changes, including base closures or realignments, base expansions, and contract or program cancellations. Within OEA, the primary tool for DOD's economic adjustment projects is the Defense Economic Adjustment program for base realignment and closure (BRAC).

Since the first round of U.S. military base realignment and closure in 1988, the Pentagon has closed approximately 100 bases in the U.S., according to the Association of Defense Communities, formerly the National Association of Installation Developers (NAID). Many of these communities with closed military bases face a long, complex process of closure, reuse planning, implementation, and environmental cleanup. For other communities, base closures present an enormous opportunity. To reuse a closed military facility successfully, local government officials must lead the community through a number of military base reuse processes and laws. In addition the local government must work with the federal and state governments, other affected local governments, and neighboring communities.

Interstate Technology & Regulatory Council (ITRC) Brownfields team has prepared a document titled: Property Revitalization – Lessons Learned from BRAC and Brownfields. The document provides an overview of incentives and tools used to accelerate the cleanup and reuse of brownfield and BRAC sites and also includes case studies.

The National Environmental Policy Act (NEPA) requires federal agencies to integrate environmental

values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. To meet this requirement, federal agencies prepare a detailed statement known as an Environmental Impact Statement (EIS).

Links with further information on revitalization and federal facilities are listed in the Links to Resources for Federal Facilities Sites Exhibit.

Exhibit: Links to Resources for Federal Facility Sites

Organization	Topic
EPA	Office of Solid Waste and Emergency Response, Federal Facilities Restoration and Reuse Office (FFRO)
EPA	National Environmental and Policy Act
U.S. Department of Defense, Office of Economic Adjustment (OEA)	OEA Home Site
OEA	Base Redevelopment Planning for BRAC site
OEA	OEA Federal Facility redevelopment resource library
U.S. Department of Defense (DOD)	Base Realignment and Closure (BRAC)
DOD	Base Redevelopment and Realignment Manual
DOD	Base Reuse Implementation Manual
Association of Defense Communities (ACD), formerly NAID	ADC home site
Interstate Technology & Regulatory Council	Property Revitalization – Lessons Learned from BRAC and Brownfields
Site Specific Restoration Advisory Board Example	EPA's Restoration Advisory Board Implementation Guidelines

Superfund Sites

In 1980, Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA was intended to clean up abandoned or inactive hazardous waste sites. Commonly known as "Superfund" in reference to a fund available for EPA investigation and remediation of sites created with taxes imposed by the federal government on major oil and chemical companies, CERCLA was substantially modified by the Superfund Amendments and Reauthorization

Act (SARA). With the exception of limited liability defenses and exemptions created in 2001 and 2002, CERCLA's liability scheme as modified by SARA remains intact to this day.

Under CERCLA, the EPA is given the authority and resources to clean up sites contaminated by releases of hazardous substances. EPA's priority is to identify responsible parties—those public and private entities that have caused contamination—and require them to investigate and clean up contaminated sites at their own expense.

The EPA follows a detailed procedure to evaluate hazardous waste sites and ranks them according to the severity of risk to human health and the environment. The national priorities list (NPL) includes those sites that are deemed eligible for cleanup by Superfund. NPL sites are the main focus of the Superfund Redevelopment Program.

A federal Superfund site generally describes an area contaminated by hazardous substances as defined by CERCLA that pose a threat to human health and the environment, where EPA may fund the cleanup of the site, work with the state to clean up the site, oversee cleanup by those responsible for the contamination, or some combination of the three approaches. In contrast, the term "brownfield" is commonly used to describe the large majority of contaminated properties, which are generally less contaminated than federal Superfund sites. Federal Superfund sites that are successfully de-listed may become eligible for EPA brownfields program funding or various state and federal redevelopment program funding.

Like many state cleanup or "state superfund" laws, EPA's Superfund Redevelopment Initiative (SRI) commits EPA and stakeholders to consider reasonably anticipated future land uses when making remedy decisions and Ready for Reuse (RFR) Determinations at Superfund hazardous waste sites. Beneficial results of having future land use in mind during initial redevelopment stages include: protecting greenfields, minimizing infrastructure investments, encouraging infill development and open space preservation, and creating business and employment opportunities. Currently, there are six types of Superfund site reuse categories under the SRI program: commercial, recreational, ecological, public service, residential, and agricultural.

On November 10, 2004, EPA announced a new phase of SRI, the "Return to Use" Initiative**.** The Initiative focuses on National Priorities List sites that were cleaned up before EPA's current emphasis on considering reuse during response activities. Many of these sites have remained vacant. Returning these sites to beneficial use will provide local communities with valuable green space, recreational amenities, or commercial property. Removing the stigma associated with fenced and vacant Superfund sites may also increase local property values and the tax base.

There have been more than 240 Superfund site use success stories. Hundreds more are expected in the next few years. Superfund site reuse helps to protect human health and the environment. It makes land productive again, improves aesthetics, and gives communities a new resource to enhance the ways they live, work, and play.

Exhibit: Links to Resources for Superfund Sites

Organization	Topic
EPA	Superfund General Information

Organization	Topic
EPA	Superfund Redevelopment Program
EPA	Superfund Redevelopment Program: Tools and Resource
EPA	Reuse Assessments: A Tool to Implement the Superfund Land Use Directive
EPA	Presentation: Successful Reuse at Superfund Sites
The Brownfields and Land Revitalization Technology Support Center	Brownfields Roadmap: Superfund Redevelopment Initiative
University of Virginia	Center of Expertise for Superfund Site Recycling

RCRA Sites

Congress enacted the Resource Conservation and Recovery Act (RCRA) in 1976 to protect human health and the environment from the hazards of waste disposal. RCRA gives EPA the authority to control hazardous waste from "cradle-to-grave," including generation, treatment, storage and disposal activities. In 1984, Congress enacted the Hazardous and Solid Waste Amendments (HSWA), which expanded RCRA's scope and included the creation of a corrective action program. Under this program, owners or operators of hazardous waste treatment, storage or disposal facilities are responsible for investigating and cleaning up releases at or from their facilities, regardless of when the releases occurred.

EPA established the RCRA Brownfields Prevention Initiative to encourage the reuse of RCRA Brownfields so that the results of site redevelopment better serve the commercial, residential, or landscaping needs of the community. The initiative links RCRA facilities with the brownfields program to facilitate the use of economic redevelopment as the vehicle for environmental remediation.

The ultimate goal of the initiative is to utilize opportunities for statutory and regulatory flexibility in RCRA to prevent future brownfields and Superfund sites by expediting cleanup, community dialogue, and integrating reuse and redevelopment issues into cleanup decisions.

In March 2000, EPA announced four pilot projects intended to provide case studies of techniques, tools, and strategies to integrate RCRA cleanups and brownfields redevelopment. During the summer of 2001, five additional RCRA Brownfield Pilots were launched, bringing the total pilots up to nine. The link below provides a summary of the results and lessons learned from the pilot studies.

Web links with further information on RCRA sites are listed in the RCRA Sites Exhibit.

Exhibit: Links to Resources for RCRA Sites

Organization	Topic
EPA	RCRA Brownfields Prevention Initiative
EPA	RCRA Brownfields Prevention Initiative- Pilot Project Summary Reports
EPA	RCRA Brownfields Prevention Initative – Resources
EPA	Region 3 RCRA Redevelopment and Reuse
EPA	RCRA Online

Railfields

According to the rail companies, a common hurdle in disposing of railfields is the misconception that all rail properties are large, polluted areas. Although fueling stations and large transportation hubs are heavily polluted, there are many former rail properties that have minimal or no contamination. Many rail companies are interested in confronting the stigma associated with their properties by working with local groups and state and federal agencies. Through the EPA Railfields initiative which includes Successful Rail Property Cleanup and Redevelopment,many of these rail properties are returning to productive use through the efforts and partnerships of communities, rail companies, and other stakeholders.

The history of railroads in the United States began almost two centuries ago when the first charter for a railroad was awarded in 1815. After the completion of the transcontinental railroad in 1869, the growth of the railroad industry continued rapidly, and by 1916 the rail network had grown to 254,000 miles. However, in the mid-twentieth century, the rail industry began facing significant competition. Competition led to declines in the rail industry and significant consolidation over several decades. By the second half of the twentieth century, the miles maintained by the entire rail system had decreased by 50 percent, leaving an extensive legacy of underutilized, contaminated, and sometimes abandoned rail properties also known as railfields, across the United States (EPA, 2005).

Brownfields, of which railfields are a subset are located in rural, urban, and suburban areas, and vary greatly in size and former usage. Railfelds include rail tracks, right-of-way, rail depots, industrial areas, and other support facilities. Residual contamination including herbicides, petroleum products and byproducts, metals, and creosote, is often present as a result of former railroad operations and associated industrial activities. However, a majority of rail companies perform an environmental review on every property transaction as an evaluation process to determine if there are significant contamination concerns. A wide variety of activities take place at a railroad yard that can result in environmental problems. These activities can be broken down into roughly four areas:

- Locomotive maintenance
- Rail car refurbishing and maintenance

- Track maintenance
- Transportation operations

Contamination resulting from locomotive and engine maintenance are degreasing solvents, polychlorinated biphenyls, and heavy metals. Solvents and heavy metal based paints can be found in the area surrounding rail car refurbishing and maintenance operations. Further environmental problems can result from creosote and pentachlorophenol from the rail ties. The slag base for the railroad ties can contribute to heavy metal contamination. Finally, contamination from the transportation operations can be from diesel fuel associated with the fueling as well as possible contamination from spillage or leakage of hazardous cargo during transport.

Railfields resources are available in the Links to Resources for Railfields Exhibit.

Exhibit: Links to Resources for Railfields

Organization	Topic
U.S. Department of Transportation	Surface Transportation Board
U.S. EPA	Technical Approaches to Characterizing and Cleaning Up Railroad Yards
U.S. EPA	Successful Rail Property Cleanup and Redevelopment: Lessons Learned and Guidance to Get Your Railfields Projects on Track

Dry Cleaner Sites

In spite of the name, dry cleaning is not completely dry. Fluids are used in the dry cleaning process. In the early days, garment scourers and dryers found several fluids that could be used as dry cleaning solvents including camphene, benzene, kerosene, and gasoline. In the 1930s, perchloroethylene (PERC), a non-flammable synthetic solvent was introduced and is used today in many dry cleaning plants. There are various makes/models of dry cleaning machines. Despite the differences, all dry cleaning machines have the same basic components:

- Holding or base tank
- Pump
- Filter
- Cylinder or wheel

The holding tank holds the dry cleaning solvent. A pump is used to circulate the solvent through the machine during the cleaning process. Filters are used to trap solid impurities. A cylinder or wheel is where the garments are placed to be cleaned. The solvent is drawn from the tank by the pump. The pump send the solvent through the filters to trap the impurities. The filtered solvent then enters the cylinder to flush soil from the clothes. The solvent leaves the cylinder button trap and goes back to the holding tank. This process is repeated throughout the entire cleaning cycle, ensuring that the solvent is maintained to give effective cleaning at all times. After the cleaning cycle, the solvent is drained and an extract cycle is run to remove the excess solvent from the clothes. This solvent is drained back to

the base tank. During extraction, the rotation of the cylinder increases in order to use centrifugal force to remove the solvent from the clothes. Once the clothes have finished extracting, the cylinder stops. At this time, clothes are either transferred to a separate dryer or, on most machines, dried in the same unit, a closed system. The drying process uses warm air circulated through the cylinder to vaporize the solvent left on the clothes. The solvent is purified in a still. Here the solvent is heated. The vapors are then condensed back to a liquid leaving behind all impurities in the still. This clean solvent is then pumped back into the holding/base tank.

The main source of pollution from a dry cleaner is the solvent used in the cleaning process. Dry cleaners typically use perchloroethylene (PERC), petroleum solvents, and freon-type solvents. These pollutants can affect human health and safety and the environment:

- PERC – is a known cancer-causing chemical in animals and may contribute to cancers in humans. In addition, spills and leaks, can lead to PERC contamination of soil, surface water, and groundwater.
- Petroleum solvents – When released to the environment in liquid form, petroleum solvents can contaminate soil, surface water, and groundwater. When released into the air, they react with sunlight and contribute to smog.
- Freon type solvents – break down the protective ozone layer in the earth's upper atmosphere.

Common dangerous wastes present at dry cleaning facilities include:

- Filters
- Filter coatings
- Still bottoms
- Discarded solvent
- Muck
- Separator water
- PERC sludge

Solvent contamination from dry cleaners can pose a very real danger to human and environmental health. Remediation of sites contaminated by dry cleaning solvents can be costly and time consuming, but it can be done. The State Coalition for Remediation of Dry Cleaners provides an overview of the contaminants and remediation technologies typically used at dry cleaner sites, yet every site is unique, and developers will need to develop a remediation plan based upon the contamination actually present on-site.

Resources for Dry Cleaners areavailable in the Links to Resources for Dry Cleaner Sites Exhibit.

Exhibit: Links to Resources for Dry Cleaner Sites

Organization	Topic
Washington State Department of Ecology	Dry Cleaner Reference Manual

Organization	Topic
U.S. EPA	Plain English Guide for Dry Cleaners
U.S. EPA	Cleanup Enforcement (CERCLA)
U.S. EPA	State Coalition for Remediation of Dry Cleaners
CO Dept. of Public Health and Environment	Dry Cleaner Remediation Guidance Document

Pulp and Paper Mill Sites

Contamination from pulp and paper mills can pose a very real danger to human and environmental health. The contaminants released span the full spectrum of toxicity, from suspended solids to carcinogens like dioxins. Remediation of sites contaminated by these chemicals can be costly and time consuming, but it can be done. The Technical Approaches to Characterizing and Clean Up of Pulp and Paper Mill Brownfields Sites provides and overview of the contaminants and remediation technologies typically used at pulp and paper mill brownfields, yet every site is unique, and developers will need to develop a remediation plan based upon the contamination actually present on-site.

A centerpiece in America's agricultural and industrial past, wood product and paper mills were some of the earliest mills in the country. From the first paper mill established in Pennsylvania in 1690 to modern, large-scale sawmill operations in the South and the Pacific Northwest, wood product and paper mills were always a staple of the American economy. The shift is to a global market, fluctuations in the availability of timber, and the modernization of the manufacturing process left many communities with abandoned and/or underused wood and paper mill properties. According to the 1972 U.S. Census data, there were approximately 40,000 operating wood and paper product facilities in the U.S. In 2002, that number had dropped to approximately 23,000 (EPA, 2002).

Former wood product and paper mill properties have several common features that make them particularly attractive to developers, including:

- Waterfront redevelopment potential – Most wood product and paper mills are located along bodies of water, creating opportunities for waterfront redevelopment. In rural areas, waterfront property is ideal for recreational use, while in towns or cities its scenic attributes make it valuable for greenspace and mixed-use redevelopment.
- Recreational development – Because of their proximity to public lands, many of these properties can be reused for recreation and tourism.
- Historic preservation – Since many wood product and paper mills date back to the 1800s and are considered historic landmarks, they are eligible for a variety of federal, state, and local historic preservation grants. Historic preservation also extends and enhances the heritage, value, and cultural elements of the community.

Pulp and paper mills are typically classified into the following categories:

- Market Pulp Mills – These mills produce pulp which is shipped to other facilities for the production of paper and paper products

- Non-integrated Mills – These mills manufacture paper from pulp, but do not produce either the pulp or the final paper goods.
- Intergrated Mills – These mills produce pulp for use in producing paper at the same facility (pulp and paper mills).
- Converting Facilities – These facilities use paper and paperboard stock to manufacture products such as envelopes and stationery, corrugated and paperboard boxes, bags, fiber cans and drums, napkins, tissues, and paper towels.
- De-inked Pulp Mills – These facilities remove ink from recycled paper and produce pulp that is blended with virgin pulp to form paper.

The redevelopment of former wood product and paper mill properties involves a number of complicating issues, including:

- Contamination – Former wood product mills typically are contaminated with wood-treating chemicals and residual waste material. Many still have abandoned and leaking underground storage tanks (USTs) that were once used to store fuel to power the machinery. Soil and groundwater contaminants can include petroleum, VOCs, creosote, dioxins, and lead.
- Unclear government jurisdiction – Because many former wood product mills are located on water bodies, government jurisdictions often overlap. Resolving jurisdictional issues can cause lengthy delays and contribute to setbacks in the implementation of cleanup and redevelopment plans.
- Historic preservation – Because many wood product and paper mills date back several centuries, they are considered historic landmarks and require preservation. Historic preservation enhances the cultural landscape and protects the heritage of the area, but it also can increase project costs.

Resources for Pulp and Paper Mills is available in the Links to Resources for Pulp and Paper Mills Exhibit.

Exhibit: Links to Resources for Pulp and Paper Mills

Organization	Topic
U.S. EPA	Brownfield Mill Projects
U.S. EPA	Industrial Processes and Contaminants at Pulp and Paper Mill Sites

Automotive Recycling Sites

The automobile industry is the largest manufacturing industry in the world, and as expected, the industry connected to the recycling of those automobiles is equally large. Every year over 11 million vehicles are recycled. These recycled cars and trucks produce almost 40 percent of the ferrous scrap for the scrap metal processing industry. The automobile recycling industry is a major source of scrap metal for the steel industry. This scrap metal is much cheaper than raw ore and as an added benefit, EPA estimates that steel mills which substitute low-sulfur scrap metal for high-sulfur raw ore can reduce their air pollution potential up to 86 percent and water pollution potential by up to 76 percent (EPA,

2002).

Automotive recycling facilities can vary in size from a small warehouse to a major manufacturing facility. Some operations are vertically integrated, meaning that more than one processing step takes place in one location. These facilities tend to have more environmental issues because a wide range of activities take place on-site. When deciding if and how to remediate an automotive recycling brownfield, the specific nature of the operation that was located on-site should be investigated to better characterize the pollution potential of that facility. There are a number of unique activities that take place in the automotive recycling process consisting of:

- Storage
- Dismantling
- Fluid Draining
- Parts Removal
- Powertrain Removal
- Crushing
- Shredding

There are many possible contaminants that could be located at an automotive recycling facility brownfield. Each step in the process generates waste streams which can impact soil and water in and around the vicinity of the recycling operation. Common soil contaminants at an automotive recycling facility include petroleum hydrocarbons, oil and grease, volatile organic compounds, and semivolatile organic compounds from gasoline, motor oil, antifreeze, and transmission fluids. There can be soil contamination from such metals as aluminum, cadmium, chromium, lead, and mercury. Cars older than 1993 models may contain chlorofluorocarbons in the air conditioning system. Older cars may also contain asbestos in brake shoes. Generally, the same contaminants that affect soil have the potential to affect ground and surface waters in around vehicle recycling facilities. There are two media which any remediation program must address: the soil and the water. Each media can be contaminated by the same chemicals, but the ways that developers and managers reduce or eliminate contamination in these media can vary.

Contamination from automotive recycling can pose a very real danger to human and environmental health. The contaminants released span the full spectrum of toxicity. Remediation of sites contaminated by chemicals associated with automotive recycling can be costly and time consuming, but it can be done.

Technical Approaches to Characterizing and Cleaning Up Automotive Recycling Brownfields provides and overview of the contaminants and remediation technologies typically used at automotive recycling brownfields, yet every site is unique, and developers will need to develop a remediation plan based upon the contamination actually present on-site.

Iron and Steel Mill Sites

Mills tell the story of America. Flourishing mills invoke images of America's industrial strength and

success. As mills thrived, so did their surrounding communities, developing into towns and cities. When the mills closed, these towns and cities were left to search for stability and new opportunities outside of their mill town identity. The mill industry's overall decline left an extensive legacy of vacant, often abandoned, and sometimes contaminated former mill sites. While today the industry is increasing its competitive stance through restructuring and operational efficiencies, it left behind a legacy of older, obsolete mills – including buildings and land – with which surrounding communities must contend (EPA, 2006).

Not all iron and steel mills are appropriate candidates for brownfields redevelopment because of high levels of contamination and their large size; however, a number of iron and steel mills have been redeveloped in their entirety. Often, part of these sites have been assessed, cleaned up, and redeveloped. Common types of iron and steel mills are:

- Integrated Mills – These mills use iron ore as a basic raw material and platform all operations from coke making to finishing.
- Specialty or Mini-Mills – These mills use scrap metal as a basic raw material and perform only certain operations (e.g., rolling, but not finishing).
- Stand Alone Coke Mills – These mills produce coke for use at other facilities.
- Stand Alone Finishing Mills – These mills take steel products such as sheets, billets, or rods and conduct forming and finishing operations.

Some iron and steel mills such as integrated mills, tend to be very large, consisting of several buildings on tens or even hundreds of acres. These buildings house coke ovens, sinter plants, furnaces, rolling mills, finishing operations, wastewater treatment plants, chemical storage units, and maintenance operations. Some buildings may have been used for different operations over the life of the facility; however, the furnaces will most likely have stayed in the same location.

The land surrounding the buildings at an iron and steel mill is generally used for:

- Bulk product storage
- Scrap metal storage
- Slag pits
- Iron ore storage
- Under- and above-ground storage tanks
- Rail lines and parking lots
- Cooling towers

The byproducts of iron and steel mill operations include a number of potentially hazardous wastes, some of which are regulated under the Resource Conservation and Recovery Act (RCRA), such as coal tars that contain polycyclic aromatic hydrocarbons (PAHs) and light oils, semivolatile compounds such as benzo(a) pyrene, benzo(a)anthracene, chrysene, creosote, napthalene, pyrene, and phenol, that are commonly found near coke battery areas. Volatile organic compounds such as benzene, toluene, and xylenes, are commonly found in the coke making areas. Ammonia and cyanide are also associated with

these operations.

Steel mill redevelopment offers unique opportunities for communities. Many former steel mills feature the following benefits:

- Central location – Because many towns and cities were built around steel mills, these properties are often still located in the heart of their communities, providing opportunities for revitalizing downtown areas.
- Transportation access – Many steel mill properties have established rail, highway, and river access, which can support new industrial development and/or facilitate transportation-oriented development.
- Easily parceled land – Large tracts of land, often in single ownership, lend themselves to parceling. Because parceling can lead to multiple reuses, redevelopment need not rely on attracting a single economic engine. Parceling can also make it possible to address the full site is smaller pieces, allowing for redevelopment of one parcel while other parcels continue to be addressed.
- Potential economic diversification – Redevelopment of steel mill properties offers communities the chance to diversify their economies, ending the dependencies on one industry.
- Greenspace and recreation- Because many steel mills were located along waterways and/or used rail transportation and are large in size, they lend themselves to greenway planning and recreational opportunities including rails to trails.

Like other brownfields projects, steel mill cleanup and redevelopment can be challenging due to real or perceived contamination, liability and regulatory issues, permitting processes, cost overruns, and limitations on financing. Compared to typical brownfields projects, there are some challenges more commonly associated with steel mill redevelopment, including:

- Gaining control of property – Many steel mill properties are controlled by a bankruptcy court/trustees or the steel companies themselves. Negotiating terms of sale of property transfer with these entities can be a challenge.
- Subdividing large tracts of land – As many of these properties are large in scale (encompassing 100 acres or more), they must be subdivided to best fit the needs of multiple end-users.
- Contamination – Contamination typical of steel-related industries include petroleum based products (used to cut and coat steel) in spill areas, polychlorinated biphenyls (PCBs), asbestos in structures, underground storage tanks (USTs), and slag.

Contamination from iron and steel mills can pose a very real danger to human and environmental health. Remediation of sites contaminated by chemicals associated with iron and steel mills can be costly and time consuming, but it can be done. An example case study of a mill redevelopment is included in SMARTe. Technical Approaches to Characterizing and Clean Up of Iron and Steel Mill Sites under the Brownfields Initiative provides an overview of the contaminants and remediation technologies typically used at iron and steel mill brownfields, yet every site is unique, and developers will need to develop a remediation plan based upon the contamination actually present on-site.

Resources for Iron and Steel Mills is available in the Links to Resources for Iron and Steel Mills

Exhibit.

Exhibit: Links to Resources for Iron and Steel Mills

Organization	Topic
U.S. EPA	Brownfield Mill Projects

Metal Finishing Sites

Metal finishing facilities may use solvents or emulsion solutions (for example, solvents dispersed in an aqueous medium with the aid of an emulsifying agent) in the degreasing tanks to clean and prepare the surface of metal parts. Wastewaters generated from cleaning operations are primarily rinse waters, which are usually combined with other metal finishing wastewaters and treated on site by conventional chemical precipitation. These wastewaters may contain solvents, and solid wastes such as wastewater treatment sludges, still bottoms, and cleaning tank residues (EPA, 1999).

Not all releases are related to the industrial processes described above. Some releases result from the associated services required to maintain the industrial processes. For example, electroplating facilities are large consumers of electricity, which requires a number of transformers. At older facilities, these transformers may have been disposed of in unmarked areas of the facility, which makes it difficult to know where leaks of polychlorinated biphenyl (PCB)-laden oils (used as coolants in transformers) may have occurred. Similarly, large machinery requires periodic maintenance. In the past, chemicals used for maintenance operations such as solvents, oils, and grease, may have been flushed down drains and sumps after use. Stormwater runoff from paved areas such as parking lots may contain petroleum hydrocarbons and oils, which can contaminate areas located downgradient. When conducting initial site evaluations, planners should expand their investigations to include these types of activities (EPA, 1999).

In addition, metal finishing facilities may have been located in older buildings that contain lead-basedpaint and asbestos insulation and tiling. Any structure built before 1970 should be evaluated for the presence of these materials. They can cause significant problems during demolition or renovation of the structures for reuse. Special handling and disposal requirements under state and federal laws can significantly increase the cost of construction. An overview of the Technical Approaches to Characterizing and Cleaning Up Metal Finishing Sites Under the Brownfields Initiative can provide decision makers with:

- An understanding of common industrial processes at metal finishing facilities and the relationship between such processes and potential releases of contaminants to the environment
- Information on the types of contaminants likely to be present at a metal finishing site
- A discussion of characterization, screening and cleanup levels,and cleanup technologies that can be used to assess and cleanup the types of contaminants likely to be present at metal finishing sites
- A conceptual framework for identifying potential contaminants at the site
- Information on developing an appropriate clean-up plan for metal finishing sites where

contamination levels must be reduced to allow a site's reuse

Resources for Metal Finishing is available in the Links to Resources for Metal Finishing Exhibit.

Exhibit: Links to Resources for Metal Finishing

Organization	Topic
U.S. EPA	Guide to Developing an Environmental Management System for Metal Finishing Facilities