Chapter 6
Scoping Studies of Mining and Mineral Processing Impact Areas

6.1 Introduction

The purpose of this chapter is to discuss the scoping process at abandoned mining and mineral processing sites. The first section of the chapter will present background information on the scoping process in general. Details on the individual tasks associated with the scoping process used under CERCLA can be found in Chapter 2 of the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.*[1] The terms used in this chapter to identify scoping and activities are those used in the guidance. These procedures will prove valuable whether CERCLA or some other authority guides cleanup activities. The remainder of the chapter will address problems and issues to consider when scoping an abandoned mining or mineral processing site.

6.2 Scoping

The broad project goals for an investigation at an abandoned mine site are to provide the information necessary to characterize the site, define site interactions, define risks, and develop a remedial program to mitigate observed and potential threats to human health and the environment. The purpose of scoping is to:

Establish a procedure for determining the nature and extent of contamination associated with the site;
Identify possible response actions that may be required to address contamination at the site;
Determine whether interim or removal actions are needed to reduce risks, prevent damage, or mitigate current threats; and
Divide the broad project goals into manageable tasks that can be performed within a reasonable period of time and with a logical sequencing of activities.

Because of these activities, scoping should be conducted for any cleanup project, regardless of the administrative framework being considered for the action. While a mine site cleanup may not require that a traditional RI/FS be developed, the framework provided by that activity may prove useful in scoping and planning. For example, the RI/FS typically includes preparation of the following: a project work plan, a sampling and analysis plan (SAP), a health and safety plan, and a community relations plan.

The Work Plan. The work plan documents the decisions and evaluations made during the scoping process and presents anticipated future tasks. Five elements are included in the typical work plan: (1) an introduction, (2) site background and physical setting, (3) initial evaluation, (4) work plan rationale (including the identification of data needs and data quality objectives), and (5) tasks to investigate and cleanup the site. The information necessary to complete the work plan will become available as the tasks associated with scoping are completed. Additional information on the elements of a work plan can be found in Appendix B of the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.* At many sites, including large mining or mineral processing sites, the work plan may have to be amended as additional information (data) is acquired. Separate work plans should

[1] U.S. Environmental Protection Agency (EPA), October, 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. Washington, D.C. Office of Emergency and Remedial Response.

be prepared for major elements of the site investigation, analysis of cleanup alternatives, and design of cleanup actions.

The Sampling and Analysis Plan. The Sampling and Analysis Plan (SAP) ensures the consistency of sampling and data collection practices and activities over time, and ensures that data needs and quality objectives developed in the work plan are met. A SAP should be developed concurrently with the work plan. The plan should be prepared before any field activities begin, and should consist of two parts: (1) a quality assurance project plan (QAPP), which describes the policies and activities necessary for achieving data quality objectives (DQOs) for the site; and (2) the field sampling plan (FSP), which provides guidance for all field work by defining in detail the sampling and data-gathering methods to be used in the project.[2] The sampling and analysis process and sampling and analysis issues at abandoned mining and mineral processing sites are addressed in greater detail in Chapter 7 of this handbook.

The Health and Safety Plan. Health and Safety Plans (HSP) are frequently included as a part of the work plan, but may be submitted separately. Typical elements of an HSP include: names of site health and safety officers and key personnel; a health and safety risk analysis for existing site conditions; employee training assignments; a description of personal protective equipment used by employees; medical surveillance requirements; a description of the frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used; site control measures; decontamination procedures; standard operating procedures for the site; a contingency plan that meets the requirements of 29 CFR 1910.120 (i) (1) and (i) (2); and entry procedures for confined spaces.

Specific HSP issues for mining sites include physical hazards such as open shafts, subsidence, steep slopes, landslide potential, remoteness of sites, and chemical hazards from contaminants. Structures can present a special hazard at mill sites and abandoned processing facilities (e.g., buildings may be unsafe for entry, or contain high concentration residues). Additional information on the Health and Safety Plan can be found in Appendix B of the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.*[3]

The Community Relations Plan. Community relations planning is particularly important when the extent of contamination and appropriate response actions are being determined at mining and mineral processing sites where the community is impacted. Community relations activities keep the community informed of site activities and help Superfund personnel anticipate and respond to community concerns. The Community Relations Plan, which documents these activities, should include the following sections: an overview of the plan, a capsule site description, background information about the community, highlights of the community relations program, information about community relations activities and timing, a contact list of key community leaders and interested parties, and suggested locations for meetings and information repositories. Additional information on community relations can be found in Chapter 5 of this reference document.

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[2] Guidance for the selection of field methods, sampling procedures, and custody samples can be acquired from U.S. Environmental Protection Agency. *Compendium of Superfund Field Operation Methods,* 1987.

[3] U.S. Environmental Protection Agency (EPA), October 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.* Washington, D.C. Office of Emergency and Remedial Response.

6.3 Difficulties in Scoping Abandoned Mine Sites

There are a variety of characteristics of abandoned mine sites that make the scoping and completion of characterization and cleanup activities complex. The following is a discussion of some of the issues that can be encountered in scoping an abandoned mining and mineral processing site.

Size and Location of the Site. Some, although certainly not all, abandoned mine sites have impacts over large areas, especially if mining areas or districts or impacted watersheds are considered. In addition, some abandoned mines sites may be more difficult to characterize and cleanup because of their remote locations, in some cases without road access and/or located at high altitudes areas. The size and location of abandoned mine sites can make remediation planning, site characterization, and actual remediation complex.

Volume of Contaminants. Typical of some abandoned mining operations is the removal of large volumes of waste material during the mining process. Furthermore, beneficiation and mineral processing operations, which are often co-located with mining operations, typically generate very large volumes of process waste. As an example, one tailings impoundment in the now closed Anaconda mine/smelter site near Butte, Montana covers more than 1000 acres and ranges in depth up to 100 feet. These large volumes make traditional remediation (such as excavation, stabilization, and landfilling) economically difficult even if technical issues can be resolved. Furthermore, due to the large volumes, complete removal or remediation of the problem may not be possible, or remediation may take place in a phased approach.

Type of Wastes. There may be numerous different types of waste at abandoned mining and mineral processing sites. These wastes could include tailings, slags, overburden, waste rock, ore stockpiles, and remaining process chemicals. A variety of sampling strategies may be needed to characterize each waste type.

Persistence of the Contaminants. Metals, often a primary contaminant at abandoned mine sites, do not readily decompose or biodegrade into less toxic byproducts as do volatiles and some organic compounds. Therefore, mine sites abandoned for decades or even centuries can still have metal concentrations at levels of concern. Furthermore, metals that are not of toxic concern can generate other problems that can occur for decades, such as acid generation.

Variety of Media Affected. Contamination at abandoned mine sites often affects many media. Surface water and ground water are frequently contaminated by metals leached from mining and mineral processing wastes and by acid generated within the mines or waste units. Soils are often contaminated onsite by historical waste management practices and offsite by fugitive dust and smelter emissions. Sediments within surface waters may also contain contaminants. In addition, the air may be recontaminated during remediation operations or by fugitive dust blown from abandoned waste units. The wide dissemination of contamination at some mining and mineral processing sites generally requires the collection of a large variety of data from several different sources. Information about sources, migration pathways, and human and environmental receptors is generally critical to characterizing the site and formulating plans for possible remediation alternatives.

Historical Mining Areas. Abandoned mine sites are often located in areas where the remnants of mining activity is considered to be historical. The local population is often deeply rooted in the mining and mineral processing activities, and environmental investigations undertaken by site managers must take this into consideration. Historical preservation is an issue at some sites. Historical artifacts, including old mine buildings, mine openings, and

associated towns now abandoned, may be located on the site and their continued presence, as well as access to structures, is expected to remain despite remediation activities. Finally, the long history of mining and mineral processing in these areas often poses problems in determining levels of metals naturally occurring in the local water and soils prior to mining activity.

On-going Mining and Mineral Processing. Some abandoned mine sites may be affected by ongoing mining and mineral processing nearby. Often, mines abandoned as uneconomic utilizing past technologies have been reopened using new technologies or when prices rise. In other cases, neighboring claims and associated processing operations continue to operate. Where these new operations or historical neighboring operations are being conducted, sampling, risk assessment, and remediation may have to be modified. Any remedial actions on the site may be affected by ongoing mining and mineral processing operations. Ongoing mining and mineral processing operations can greatly affect both the data collection process itself and the quality of the data collected. Isolating the effects of ongoing operations from waste generated in the past can be challenging. Additional health and safety protocols may have to be taken into consideration if mining and mineral processing activities are occurring on the site. Efforts must be coordinated with mining and mineral processing operators to ensure the safety of remediation teams.

Location in Non-Industrial Areas. Many mining and mineral processing sites are located in areas that otherwise would be considered non-industrial natural resource areas. The Bunker Hill site in northern Idaho, for example, is in forested mountain country; however, large areas of the site have been denuded of most vegetation. Local governments or other entities associated with old mining and mineral processing areas may want a total cleanup because they are seeking an inflow of recreational dollars. They may also, however, want no cleanup because of their desire to avoid the stigma of a Superfund site or they may want to retain the historic features.

Because many abandoned mine sites are located in or near non-impacted environments, the ecological risk assessment can become more important, particularly if the human population around the sites is small or nonexistent.

6.4 Scoping Issues Associated with Mining and Mineral Processing Sites

Abandoned mining and mineral processing sites can present many challenges and issues during scoping. Characterizing mining and mineral processing sites and identifying problems and potential solutions can be very complex, particularly at the large sites where both mining and mineral processing have occurred. The remainder of the chapter will present important issues for consideration when scoping a mining and mineral processing site.

6.4.1 Operable Units

The size of abandoned mining and mineral processing sites can create special challenges for tasks associated with the scoping process. Sites are often far too large to address in a single response action, and the actions selected may require a longer time frame to undertake than is common for other smaller or more contained sites. For this reason, mining sites are often divided into smaller units, which are called Operable Units (OUs), that are then characterized both individually and as part of the whole site. The term Operable Unit has specific meaning under CERCLA, which may differ somewhat from the description in this chapter. Also, because human health may be of critical concern in some areas it may be appropriate to focus on units that impact human health first, with ecological considerations being investigated as a distinct unit.

Establishing Operable Units. While there are no definitive criteria for designating units, many area-specific factors are used: (1) similar contamination of waste material or environmental media (e.g., soils, flue dust, or ground water); (2) similar geographic locations; (3) similar potential cleanup techniques; (4) potentially similar cleanup time frames; and (5) sites that are amenable to being managed and addressed in a single decision making process. As an example, the East Helena Smelter Superfund site, an active smelting operation, has five operable units: (1) process ponds and fluids; (2) groundwater; (3) surface water, soils, vegetation, livestock, fish, and wildlife; (4) slag piles; and (5) ore storage areas.

Prioritizing Operable Units. Once units have been designated, they should be ranked to determine the order in which they will be addressed for remediation. Again, standardized criteria have not been established for determining unit priorities; however, exposure may be a significant factor in assigning priority to sites based on the degree of risk they pose to human health and the environment. See Chapter 8 for more information on risk. An example of response priority criteria for OUs is Shown in Exhibit 6-1.

Exhibit 6-1
Sample Criteria Used to Prioritize Operable Units

At the Clark Fork Superfund site in Montana, EPA used the following criteria to establish response priorities for OUs:

High Cleanup Priority
- High potential for exposure to humans or to the environment;
- Cleanup required to study or address other OUs.

Intermediate Cleanup Priority
- Moderate potential for exposure to humans or to the environment;
- Potential that cleanup efforts could recontaminate OUs located downstream, downgradient, or downwind
- Unusual complexity of problems that could require lengthy evaluation.

Low Cleanup Priority
- Currently low potential for exposure to humans or to the environment;
- Potential for higher levels of exposure in the future;
- Low risk of off-site contamination.

Primary Threats. For each unit, the site manager determines the primary threats and pathways. Primary threats are initially identified during scoping to assist in setting response priorities, to identify needed removal actions, and to prepare appropriate sampling and analysis strategies. They are later confirmed and evaluated during the baseline risk assessment (see Chapter 8 of this reference document) to guide decision-making about potential responses. Examples of primary threats at mining and mineral processing sites are displayed in Exhibit 6-2.

Cleanup Objectives. Based on the primary threats, potential routes of exposure, and associated receptors identified in the site characterization and risk assessment, the lead agency identifies cleanup objectives (called Remedial Action Objectives (RAOs) under CERCLA) for each unit. Objectives consist of medium-specific or unit-specific goals for protecting human health and the environment. Because protection may be achieved by reducing exposure to contaminants (by capping an area, limiting access through institutional controls, or providing an alternate water supply) as well as by reducing the contaminant concentration, objectives for protecting receptors (see Exhibit 6-3) should be expressed both as a contaminant level and an exposure route, rather than as a contaminant level alone. Further, objectives should be expressed in terms of the medium of interest and target cleanup levels (i.e., Preliminary Remediation Goals), whenever possible.

Exhibit 6-2
Primary Threats at Superfund Mining and Mineral Processing Sites

Major Contaminants

Naturally Occurring: Lead, Zinc, Copper (and other heavy metals), Arsenic, Cadmium, Mercury, Antimony, Selenium, and Uranium

Introduced During Extraction, Beneficiation, and Processing: Cyanide, acids, bases, PCBs, asbestos, and others

Sources of Contamination

Mined Areas: Open pits, mine shafts, and tunnels

Impoundments: Tailings, run-off collection, wastewater treatment, and leaching solution ponds

Piles: Overburden, tailings, slag, air pollution control dust

Sediments: Sediments in river beds, mine pits, and drainage channels

Processing: Slag, air pollution control residues, wastewater, treatment sludges, and deposition of stack emissions

Exhibit 6-3
Receptors and Pathways

Human Receptors and Pathways	Ecological Receptors and Pathways
• Inhalation of contaminated/radioactive fugitive dust • Consumption of contaminated drinking water wells and aquifers • Ingestion of contaminated fish, vegetables, soil, or wildlife • External exposure to radionuclides	• Potential fish kills and degradation of aquatic systems from direct contaminant exposure • Riparian vegetation kills along contaminated streams/rivers • Wildlife exposure to contaminated soils and waters

If an overall site management plan is prepared, it should reflect the relationships between units and the danger of recontaminating an area where cleanup has been completed. The excavation or movement of contaminated materials at one area of the site may affect air, streams, rivers, or ground water, and may affect locations downwind, downstream, or downgradient. In addition, remediating a heavily contaminated area without remediating the source could result in later recontamination. These considerations should be important ones in making sequencing decisions for investigating response actions where multiple units exist.

6.4.2 Interim Actions

Interim actions may be appropriate for some units to protect human health and the environment from an immediate threat in the short term while a final remedial solution is being developed, or to stabilize a site or units with temporary measures to prevent further migration or degradation. Examples of interim actions taken at mining sites include: providing bottled water or temporary well filters to residents until private wells are reclaimed or water supplies are provided; relocating contaminated material from one area of a site (i.e., residential yards) to a more remote area of the site for temporary controlled storage; and temporarily capping waste piles to reduce fugitive dust until a more permanent remedy can be performed. Interim actions are discussed further in Chapter 9 of this reference document.

6.4.3 Unusual Requirements

There are many statutes that may be applicable to mining and mineral processing sites but would not ordinarily be considered appropriate for other sites (e.g., Endangered Species Act, National Historic Preservation Act, the Archeological and Historic Preservation Act, the Historic Sites, Buildings, and Antiquities Act, etc.). These statutes may be identified as Applicable or Relevant and Appropriate Requirements (ARARs) at CERCLA sites.

In addition, there are certain circumstances under which ARARs may be waived; these are stipulated in the NCP (40 CFR 300.430(f)(1)(ii)(C). Given the possibility of unusual site characteristics at abandoned mining and mineral processing sites (e.g., difficulty with background levels, large size, location, and multimedia effects), waivers may be necessary at these sites. Chapter 11 of this handbook discusses issues for ARARs at mining and mineral processing sites in greater detail. In addition, Appendix D of this handbook provide a general discussion of some of the most common federal ARARs at Superfund mining sites.

6.5 Sources of Additional Information

Additional information on scoping studies can be found in EPA-OERR's October 1988 *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. Another source of information can be found on the EPA website, including the information at http://www.epa.gov/superfund/whatissf/sfprocess.htm.

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