United States Environmental Protection Agency

Guidelines for Enhanced Management of Asbestos in Water at Ordered Demolitions

EPA-453/B-16-002a
July 2016

Guidelines for Enhanced Management of Asbestos in Water at Ordered Demolitions

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Sector Policies and Programs Division
Research Triangle Park, NC

GUIDELINES FOR ENHANCED MANAGEMENT OF ASBESTOS IN WATER AT ORDERED DEMOLITIONS

US EPA
Office of Air Quality Planning and Standards
Sector Policies and Programs Division

Acknowledgments

Susan Fairchild, Office of Air and Radiation / Office of Air Quality Planning and Standards
John Pavitt, USEPA Region 10
Ann Strickland, Office of Enforcement and Compliance Assurance / Office of Criminal Enforcement, Forensics, & Training
Everett Bishop, Office of Enforcement and Compliance Assurance/ Office of Compliance
Pamela McIlvaine, USEPA Region 4
Steve Anderson, Office of General Counsel / Air and Radiation Law Office
Andrea Kirk, Office of Land and Emergency Management/ Office of Superfund Remediation & Technology Innovation
Brian Schlieger, Office of Land and Emergency Management / Office of Emergency Management
Terry Smith, Office of Land and Emergency Management / Office of Emergency Management
Gilberto Irizarry, Office of Land and Emergency Management / Office of Emergency Management

Cover Photo: Water is used to control asbestos at ordered demolitions where asbestos remains in place during demolition activity. Water can act as a slurry, carrying asbestos-bearing sediments and other pollutants offsite to be deposited elsewhere if not contained and managed onsite. In this photo, the sidewalk acts as a berm to contain demolition water and prevent contamination of other areas. Photo courtesy of John Pavitt, USEPA Region 10.

Contents

Figures

1 Executive Summary

Asbestos is a type of mineral that has been mined and used in commercial products for many years. While there are currently no operating mines or milling operations in the US, asbestos is still used in commercial products both manufactured in, and imported into the US. Asbestos may be found in building materials such as pipe wrap, wall board, flooring materials, ceiling tile, insulation, siding, and roofing materials. Asbestos has not been banned in the US, so many buildings, even recently constructed structures, may have asbestos-containing materials in them.

The primary route of exposure to asbestos is through inhalation of the mineral fibers (see Figure 1). Several pulmonary disorders may be caused by exposure to asbestos, including lung cancer; mesothelioma, a rare form of cancer that is found in the thin lining of the lung, chest and the abdomen and heart; and asbestosis, a serious progressive, long-term, non-cancer disease of the lungs. There is no known safe level of exposure to asbestos.

Figure 1. The fibrous mineral anthophyllite asbestos as seen using TEM.

The EPA has identified enhanced management practices (EMPs) from existing regulations, guidance, and State and local government rules and policies and has collected them here to provide guidelines to owners/operators, demolition contractors, and State and local agencies to use to prevent the release of asbestos to the environment when asbestos-containing materials remain inside the building during demolition. EPA identified and requested participation from experienced subject matter experts throughout the Agency to contribute information on examples of the most enhanced management practices used for asbestos control and abatement. The EPA also consolidated relevant excerpts and portions of existing regulations, guidance documents, and other relevant materials into this document. We consulted with asbestos program professionals as well as EPA's National Pollutant Discharge Elimination System (NPDES) Construction Stormwater program to learn about program practices that prevent the migration of contaminated water from the

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

demolition site and reduce the potential for asbestos exposure due to evaporation and redistribution of asbestos fibers.

This document may be distributed by various means, including to EPA Asbestos Coordinators and state asbestos programs, at technical conferences and symposia, and through EPA's Asbestos website.

These voluntary guidelines do not change or substitute for any statutory or regulatory provisions. The statutory provisions and EPA regulations contain legally binding requirements, and to the extent any statute or regulatory provision is cited in this document, it is that provision, not this document, which is legally binding and enforceable. Thus, these guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

This document presents current technical information and recommendations of the Office of Air and Radiation (OAR)'s Office of Air Quality Planning and Standards (OAQPS), based on OAQPS's current understanding of a range of issues and circumstances involved in asbestos handling during demolition operations. The document contains information and recommendations designed to be useful and helpful to the regulated community, states, tribes, local governments, and the public. The word "should" as used in this document is intended solely to recommend or suggest and does not connote a requirement. Similarly, examples are presented as recommendations or demonstrations, not as requirements. To the extent any product, trade name or company appears in the document, their mention does not constitute or imply endorsement or recommendation for use by either the United States government or EPA. Interested parties are free to raise questions and objections about the appropriateness of the application of the examples presented in this document to a particular situation. In short, use of the guidelines provided in this document is voluntary.

2 How to Use this Document

> Demolition water can act as a slurry, carrying asbestos fibers off site where evaporation leaves a collection of fibers which then may become re-entrained into the ambient air.

The purpose of this document is to disseminate information on enhanced management practices (EMPs) for planning demolition work and for controlling, containing and managing asbestos-contaminated demolition water. The EPA identified EMPs in two key areas: 1) preparatory: advanced planning and allocation of resources, and 2) field: on site operational procedures, demolition activities, and site remediation. These management practices are useful when addressing potential releases of asbestos to the environment that may occur when demolitions of buildings that are structurally unsound and in danger of imminent collapse are conducted in compliance with the requirements of the Asbestos NESHAP (see Figure 2). The EMPs described in this document may be used to mitigate the potential risk associated with asbestos exposure from such building demolitions.

The intent of these EMPs as applied to structurally unsound building demolitions is to prevent demolition wastewater from carrying asbestos off-site. However, EPA recommends that EMPs be a primary consideration in all building demolition projects having the potential for asbestos exposure, especially those buildings that are declared structurally unsound and in danger of imminent collapse. These EMPs are ways to manage water and water-borne pollutants on-site that prevent their migration off-site. We therefore recommend that EMPs be a primary consideration in all building demolition projects having the potential for asbestos exposure. For these guidelines, EMPs are classified as either preparatory (advance planning) or field (demolition and clean-up) EMPs.

These guidelines can be used to inform demolition contractors, local and State environmental offices, and EPA Regional offices of effective methods to minimize release of asbestos fibers, and to reduce the movement of asbestos fibers in water from wetting debris at an ordered demolition site.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

We recommend State and local agencies, demolition contractors, and city planners use this document when building demolitions are being planned, scheduled and started with asbestos-containing building materials to remain in place during demolition. This can occur under NESHAP-compliant demolitions in three ways: 1) when asbestos containing materials (ACM) are below regulatory thresholds;[1] 2) the ACM is not expected to become friable;[2] and 3) when an ordered demolition under the Asbestos NESHAP's imminent danger of collapse requirement occurs with ACM remaining in place[3].

Figure 2. This photo illustrates the practical need for adequate wetting of asbestos contaminated materials. Dust containing asbestos is released when ACM are not removed prior to demolition. (EPA Photo courtesy of John Pavitt, Region 10).

Accessible asbestos should be removed prior to demolition, even for structurally unsound buildings. For example, consider a scenario in which one wall of a building is leaning over and ready to collapse. The leaning portion is declared by the Order to be in danger of imminent collapse. That wall would be pushed over, and abatement should be performed in other parts of the otherwise structurally sound building. So, as described in this scenario, during a NESHAP-compliant demolition, under existing guidelines, some asbestos (i.e., that on the leaning wall) would <u>not</u> be removed and some (i.e., that on the structurally sound parts of the building) <u>would</u> be removed.

When ACM is not removed prior to demolition, it can be made friable during the demolition process. As the structure is demolished, dust, including asbestos, is typically controlled by a water spray. This dust may be comprised of pulverized construction materials including cement dust, gypsum, wood fibers, plastic, and asbestos fibers. Without careful planning and good

[1] 40 CFR § 61.145(a)(2).
[2] 40 CFR § 61.145(c)(1) (specifying the circumstances).
[3] The appropriate state or local government authority can, through an "Order", declare a building/facility to be structurally unsound and in danger of imminent collapse. If such an Order is given, the Asbestos NESHAP specifies a subset of requirements than would otherwise apply. See 40 CFR § 61.145(a)(3).

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

controls, the demolition water can seep into soils or act as a slurry, carrying asbestos fibers off site where they may contaminate the surrounding environment. These re-entrained fibers, when dried, are likely to be released into the ambient air. Reference to regulations for asbestos management, control and reporting are included in the appendices to these guidelines. A checklist (see Table 1) is included to assist project managers, planners and staff with the various considerations that are likely to affect successful demolition projects.

Table 1. Checklist for water management at ordered demolitions.

	YES/NO	DATE	If no, explain:
Has a certified asbestos inspector provided an inspection report of the building(s) to be demolished?			
Has a Work Plan been developed for demolition of building(s)?			
Does the Work Plan comply with all applicable local ordinances, and State and Federal rules?			
Does the Work Plan include planning for contingencies, such as weather events, interruption in electric service, water, or other utilities?			
Does the Work Plan incorporate EMPs for the surface and soil types present at the demolition?			
Do all personnel assignments reflect the appropriate level of expertise for the work expected to be performed, per the work plan?			
Are the training requirements for all personnel up to date?			
Have regular meetings been scheduled for effective communication?			
Have weather forecasts been checked for possible weather events?			
Have satellite imagery, geospatial maps and the site terrain been reviewed by the project manager to check the expected direction of water flow against the locations of placed berms and barriers?			
Have the surfaces and surface soils been evaluated at the work site?			
Have sufficient resources been allocated for the demolition, cleanup, and remediation work?			
Have all water management tools and equipment been ordered and are these expected to be delivered to the work site in time to prepare the site for the planned demolition work?			
OTHER TO Dos:			

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

3 An Overview of Identified Enhanced Management Practices

> Each site should be evaluated on a case-by-case basis, to include in the work plan useful practices for the management and control of ACM.

Several State and local agencies have developed specific guidance and/or requirements that address the management, control and abatement of asbestos contamination in water (both water to provide adequate wetting of the ACM and worker shower water) used at asbestos demolition sites. For example, the Spokane (WA) Clean Air regulations require that building owners or operators submit an Alternative Work Plan if they believe they need to leave asbestos in place during a demolition. The city's work plan may be required to include a number of administrative and planning requirements.

In the state of Washington, discharges under the state's Construction Stormwater General Permit must not cause or contribute to a violation of surface water quality standards (Chapter 173-201A WAC), groundwater quality standards (Chapter 173-200 WAC), sediment management standards (Chapter 173-204 WAC), and human health-based criteria in the National Toxics Rule (40 CFR Part 131.36). Discharges not in compliance with these standards are not authorized under the Washington State Construction Stormwater General Permit.

Preparatory EMPs are pre-demolition institutional designs, planning strategies, resource allocation, and documentation of plans to prevent or reduce the release of pollutants into the environment as a result of a demolition operation. Examples include development of a work plan, formation of a pollution prevention plan, contingency planning, correct application of relevant regulations, worksite design optimization, appropriate employee training, scheduling sufficient inspections of worksite before and during demolition, use of aerial and geological mapping resources, reporting, and record keeping.

Field EMPs are practices, operations, and strategic use of engineered supplies and equipment to prevent and reduce pollutants from entering the environment during and after the demolition operation. Examples include: good housekeeping practices; preventive maintenance procedures; the use of barriers, berms, absorbent media, covers, and vacuum trucks; collection, treatment and disposal of excess water; spill prevention; and site remediation.

4 Preparatory EMPs

Preparatory source control EMPs in conjunction with field EMPs could be a very cost-effective practice to minimize fiber release during an ordered demolition. For the preparatory EMPs, the coordinated development and implementation of a work plan is an approach to proper management and control of asbestos fiber release during the demolition operation. The work plan should consider site terrain, soil type and permeability, topography, available utilities, and

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

potential contingency plans. Citations to all Federal rules that may apply (i.e., the Asbestos NESHAP, TSCA, CERCLA, NPDES construction storm water regulations), as well as to the applicable Federal, State and local rules and requirements, help to ensure that personnel are knowledgeable in regard to rules governing the work, and that all work complies with the applicable regulations. A well-defined distinction between regulatory requirements and recommended work practices provides clarity when adaptations to a plan are needed or flexibility is appropriate.

4.1 Personnel Assignments

- Consider assigning one or more individuals to be responsible for demolition water pollution control.
- Establishing clear lines of responsibility for inspections, operation, maintenance, and emergencies is effective for organizing field responsibilities and preventing overlap or omissions of field activity protocols.

4.2 Training

Certain training requirements are already in place under regulations governing the removal work for asbestos-containing materials under OSHA and EPA. Beyond these requirements, we recommend additional training for management of asbestos-contaminated demolition water. These include training in:

- Effective control measures for asbestos–contaminated waste water
- Response to releases of asbestos–contaminated waste water
- Environmentally acceptable handling practices for asbestos–contaminated waste water

4.3 Inspections

Certain inspection requirements apply under the Asbestos NESHAP (see appendices). Beyond these requirements, we recommend additional inspection measures. We recommend establishing and maintaining an on-site record of each inspection that:

- Identifies the ACM as provided by the inspector[4]
- Verifies that the field EMPs are functioning as intended
- Describes the current site conditions, meteorology, geography, etc.
- Includes written observations of the presence of suspect ACM in debris that is being wetted

[4] This can be very limited as the inspector may not be able to collect samples due to the building being structurally unsound and in danger of imminent collapse.

Figure 3. Training is needed to safely inspect buildings and to identify asbestos containing materials. US EPA photo.

We recommend that the building construction date and any renovation dates be noted in the inspection report and the permit. These dates cannot be used to rule out the presence of asbestos because asbestos-containing building materials are still found in commercial products. However, construction dates and renovation dates can be used to indicate the likelihood of the presence of asbestos. For instance, a building constructed in 1990 *may* have asbestos-containing materials such as vinyl asbestos floor tile, roofing materials, vermiculite insulation, and other such asbestos-containing materials. A building constructed prior to 1978[5] *very likely* has such materials, to the extent that many types of building materials from that era (paint, sheetrock, carpet, mastic, floor tiles, pipe wrap, ceiling texture, spray-on fireproofing, etc.) widely contained asbestos.

The information available in the inspection report should be used to develop the work plan. The inspection report identifies asbestos-containing materials in those parts of the building which are accessible for sampling. It identifies the types of building materials which can be segregated and where in the debris demolition water should be collected and sampled for movement of asbestos fibers.

4.4 Reporting and Recordkeeping

We recommend a minimum 3-year retention period for inspection reports, reportable quantity reports, and other records. The inspection reports should include:

- Time and date of the inspection
- Locations inspected
- Statement on status of compliance with regulations and the permit
- Summary report of any remediation activities required; and the
- Name, title, and signature and training of the person conducting the inspection

We recommend that both the owner and operator maintain records of all related pollutant control and pollutant generating activities such as training, materials purchased, material use and disposal, water analysis, water collection and disposal, maintenance performed, etc. All inspections and maintenance conducted during demolition, removal and support activities should be recorded in writing and retained with the work plan.

[5] The Asbestos NESHAP was first promulgated on April 6, 1973, and included regulations for manufacturing, fabricating new products, demolition work practices, and limited spray-on insulation to 1% asbestos content. EPA successfully banned all sprayed-on application of asbestos, such as fireproofing, in 1978. However, EPA did not propose a ban on asbestos in manufactured products until 1989, and, on October 18, 1991, the U.S. Court of Appeals for the Fifth Circuit vacated and remanded most of that rule. Consequently, numerous building materials are still manufactured or imported using asbestos, including asbestos cement (AC) corrugated sheet, AC flat sheet, asbestos clothing, pipeline wrap, roofing felts, vinyl asbestos floor tile, AC shingles, millboard, AC pipe, roof coatings, and automotive parts and products.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

Documentation may include aerial or GIS photographs with markings indicating the site boundary, work area, points of entry, clean water tanks, wastewater tanks, waste piles, fences, ditches, berms, absorbents, conduits and other similar marking overlaid onto photos of the work site. Planning the locations of these added elements on a work site can help to prevent incorrect assumptions of best locations, inadvertently locating too many elements in one place, or locating them in such a way that access to critical areas is impeded or blocked. Planning the locations of these elements on top of the topographical maps also allows planners to check that berms and absorbents are located on the correct downward facing slopes, conduits are located below to receive runoff, wastewater tanks are located further below to contain all runoff, and ditches are dug in the areas that allow best drainage of off-site storm water. All photographs of work, test results, project plan, inspector's checklists and reports, etc. may be retained and made available if the property is under contract for resale. Retention of these materials indicates how the demolition work was conducted and whether problems arose during demolition or asbestos waste handling. Complete documentation of a well-managed demolition operation promotes prompt resolution of site status and may also be needed for later real estate transactions.

4.5 Work Plan Development

The objective of the work plan is to lay out the procedures for ensuring the control of asbestos-contaminated water and to prevent asbestos and other pollutants from leaving the site during the demolition operation. A site-specific work plan can be developed and implemented for each demolition that is to be conducted with asbestos-containing materials left inside the building. You may also consider incorporating the work plan into the stormwater plan that is submitted to the State, if one is required at the site.

For these guidelines, we reviewed several work plans provided by demolition contractors to State and Federal authorities engaged in demolition activities. Many of these work plans are publicly available. Appendix 3 provides example work plans that identify EMPs, many of which appear in these guidelines. For additional EMPs that may be useful in controlling water runoff, please see http://water.epa.gov/polwaste/npdes/stormwater/Stormwater-Discharges-From-Construction-Activities.cfm

The following list identifies options for EMPs that may be considered for inclusion in a work plan.

1. The work plan should account for removal and/or management of all suspect ACM identified in the inspection report.
2. Experienced licensed and accredited asbestos abatement professionals should review and approve the work plan prior to beginning the demolition operation.
3. The work plan should include a schedule of inspections. Unsound portions of a building should be inspected to the extent possible to identify ACM.
    a. The work plan should include the submitted 10-day Notification Form. If a building cannot be entered because it has been declared structurally unsound

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

and in danger of imminent collapse, the work plan should identify all suspect ACM/RACM. In lieu of this, all materials in the demolition debris pile should be suspected to contain or be contaminated by asbestos. A copy of the Demolition Order should be included in the work plan.

4. The inspection reports should be attached to the work plan along with the results of any sampling/analysis conducted on the post-filtration wastewater before disposal.
   a. Schedule with asbestos inspectors to attend the demolition and to conduct regular site visits.
   b. Routinely inspect the demolition site during the active demolition, removal and support activities and within 24 hours after any significant weather event, such as additional water burden due to a rainfall event, high winds, hail, or other severe weather events. These events can impact the demolition site by overburdening runoff diversion systems, moving or dislodging berms, conduits and barriers, and shorting out electrical services.
   c. Critical operations in locations that that have the potential to generate a significant amount of sediment or fugitive dust should be inspected at the end of the work day to ensure the integrity and effectiveness of structural EMPs at the work site.
   d. The work plan may require inspector reports, but a standard reporting form can be used to streamline the reporting process
5. The work plan should identify all the EMPs that are to be used for the management of abatement and shower water, contingency plans, stop work provisions for any departure from the work plan, and site remediation. The work plan should specify the type of demolition equipment to be used, including but not limited to misting nozzles, water amending chemicals (i.e., detergent), demolition vehicles, and personal protective equipment (PPE).
6. Inspections that incorporated the placement of signage can help prevent releases to soil and stormwater inlets. For instance, the posting of signs on wastewater tanks (“Asbestos-contaminated water, Do not release”) and on worksite perimeter washing stations (“Wash all equipment prior to exit”). Additionally, signs should be considered for the worksite perimeter. Signage on the exterior of the perimeter can warn trespassers from entering the site at any point and seek the proper entrance; and signage can remind workers to doff their PPE and use the sanitation station before exiting.
7. Include in the work plan specific areas to note fulfillment of the work plan provisions (like checked boxes), replacements to planned EMP, other departures from the plan, and all instances in which stop-work orders were given. The prevailing wind direction and rainfall during the days of demolition should also be noted. By including these items in the work plan, it can be used as a record of adherence to EMPs.
8. Scheduling and conducting regular meetings to review the overall operation of the EMPs can help identify weaknesses and problems in advance of field demolitions.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

4.6 Estimate Resources Needed for Project Completion

Aspects of careful demolition project planning include the assessment of available resources and an estimate of the resources needed for completion of the project. Each project presents site-specific challenges, and should be reviewed on a case-by-case basis. The following sub-sections present some aspects of project planning that can be used in evaluating the site and allocating appropriate resources to a demolition project.

> …it is easier and less costly to prevent contamination of a site than to abate it through the remediation process…

4.6.1 Evaluate Each Site's Characteristics on a Case-by-Case Basis

Suspect ACM that might be visible to a trained inspector include materials such as vinyl asbestos floor tile, carpeting, mastic, and 'popcorn' ceiling spray texture. Other sources might not be visible if the building cannot be inspected. These include materials behind walls (e.g., , electrical insulators, thermal insulation spray or batts), beneath floors (e.g., pipe wrap, vinyl asbestos floor tiles, mastic, carpet backing, impact deadening compound) and above ceilings and in stairwells (e.g., vermiculite attic insulation, asbestos insulation, spray-on fire proofing, pipe wrap, roofing sealants). These are examples of common sources of asbestos materials that can contaminate demolition water. The EPA published in the Federal Register the responses to the Asbestos Information Act, a one-time listing of products known to contain asbestos based on industry responses, which can be found in Appendix 2 to this document. For more information on asbestos containing materials, you may also refer to EPA's website at: http://www2.epa.gov/asbestos/learn-about-asbestos#find

4.6.2 Plan for precipitation events

Rainfall can adversely affect containment at an asbestos demolition worksite, especially if high amounts of precipitation fall in a short period of time. We recommend during resource planning, the purchase of water diversion structures such as berms, straw, hydromulch, and slash mulch. We advise reserving a slurry pumping system, tanks, and/or slurry capture mats to absorb excess storm and demolition waters.

4.6.3 Site Assessment

The steepness of the terrain, the permeability of the soil, the direction of slope, potentially impacted areas (that could receive wastewater in the event of an unexpected release), presence and locations of ditches and catch basins, stormwater and sanitary sewer locations, and proximity to locations of concern (such as daycare centers, schools, playgrounds, parks, and high density population centers) are some of the factors to consider when assessing the EMPs needed for a site.

4.6.3.1 Utilize Available Aerial Photography, Geospatial Maps, and Other Tools

As illustrated by several available work plans, it may be useful to include aerial photography or satellite imagery in the work plan. Site boundaries; locations of rivers, streams, and other bodies of water; storm water access points; residential areas; and EMPs protecting these areas may be indicated in the aerial photographs for reference and planning. Aerial images may be superimposed over topographical (geospatial) maps to check water flow paths.

4.6.3.2 Evaluate the Terrain

The terrain at the demolition site and surrounding area can influence the types of supplies that are planned to be used at the site for control and management of demolition water. Multiple methods of control and direction may be warranted depending on the terrain. For instance, a primary control and a secondary backup control may be useful to control runoff on steep inclines with low permeability such as paved surfaces.

Absorbents are “first line” containment and should be followed by berms/directional apparatus or other secondary controls. An EMP for directional flow construction is the use of plastic-coated, non-porous barriers or berms. These are used to divert runoff to waiting drainage tank(s) and may be cleaned and re-used afterward. Earthen berm barriers can be constructed surrounding the demolition sites, but cannot be cleaned and must be disposed of with the other waste materials that contain or have been contaminated with asbestos, in compliance with the waste disposal requirements of the Asbestos NESHAP.[6]

When the primary control is undergoing replacement, repair, maintenance, or cleaning, a backup control can be in place to direct any demolition water into waiting conduits to a collection tank. Consider a tertiary control for the unexpected situation where a backup control fails.

All materials contaminated with asbestos resulting from the demolition, including segregated RACM, absorbents, earthen berms, contaminated soils, and filter cakes, must be disposed of as asbestos-containing waste material.

4.6.3.3 Evaluate the Soil and Surfaces

Water always runs downhill seeking the lowest place. Water will drain directly through soils that are highly permeable, such as gravelly, sandy or loamy soils (Figure 4). When the surrounding surface is non-permeable, such as with asphalt, concrete, or similarly impenetrable materials, demolition water can be expected to run downhill if the site is not level, and to pool in low spots. Consider protecting surrounding soils using plastic sheeting embedded below the runoff level. Consider studying the area on topographic maps (available from the State Geological Survey office) to anticipate the likeliest direction, depth, and path of water flow. Place drainage conduits and other collection apparatus to direct wastewater to leak-proof tanks for containment and later filtration.

[6] see 40 C.F.R. section 61.150.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

Figure 4. Ordered demolition of a structure on sandy soil in a coastal area. Water drains readily through this soil, and asbestos carried by the demolition water becomes embedded in the sandy soil. Photo courtesy of Pam McIlvaine, US EPA and Robin Mack, SCDEQ.

4.6.3.4 Include Factors Related to Soil Permeability in the Work Plan

Soil permeability is defined as the capacity of the soil or rock to allow fluids to pass through it. This is important because the permeability of the soil determines the extent to which asbestos in water runs off soils at the surface, or penetrates through soils at the surface. Asbestos-laden water that is released into highly permeable soils, such as sandy loose soil, can deposit asbestos at depths of a foot or more of soil[7]. Soils that are impermeable, such as highly plastic clays, are more likely to be contaminated by asbestos nearer to the surface, but problems associated with runoff, capture and containment should be anticipated when permeability is extremely low. When the permeability of the soil is evaluated, the appropriate EMPs can be planned, and measures can be taken to prevent absorption of demolition water and/or water runoff that may impact neighboring areas or streams. Table 1 shows the permeability of common soils, as evaluated by Geotech in 2013.

[7] Improper demolition methods at Bainbridge Naval Training Center in 1996 resulted in contamination of the soils at the site at depths of about 8 inches. In that cleanup, the asbestos-contaminated soil at the site was removed until sampling and analysis showed the remaining soil was below background levels of asbestos.

Permeability may be represented by the permeability coefficient (k) through Darcy's equation[8]:

$$V=ki$$

Where:

V is the apparent fluid velocity through the medium

i is the hydraulic gradient, and

k is the coefficient of permeability (hydraulic conductivity) often expressed in m/s

The permeability coefficient (K) depends on the relative permeability of the medium for fluid constituent (often water) and the dynamic viscosity of the fluid as follows:

$$K= (\Gamma_w)*K/ (\mu)$$

Where:

Γ_w is the unit weight of water

μ is the dynamic viscosity of water, and

K is an absolute coefficient depending on the characteristics of the soil.

Hazen's equation[9] may be used to estimate the coefficient of permeability for sands:

$$k = 10^{-2} D_{10}^2$$

where D_{10} is the effective grain size, in millimeters.

4.6.3.5 Evaluate and Estimate Building Size and Materials

The debris pile will not have a greater volume than the intact building, so an estimate of the maximum volume of the debris pile is length X width X height of the building. Alternatively, the architectural plans of the building may be available from the building department of the municipality. Unless the building can be safely entered to determine the volume of its contents,

[8] The law of flow of water through soil was first studied by Darcy (1856), who demonstrated experimentally that for laminer flow conditions in a saturated soil, the rate of flow or the discharge per unit time is proportional to the hydraulic gradient.

[9] Hazen's equation is the most accepted method to predict the saturated hydraulic conductivity, *k*, of clean sand and gravel.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

it is safest to estimate the maximum debris pile size and be able to scale down from there to the size of the actual debris pile.

It may be possible to remove and recycle some building materials prior to demolition. However, once the building is down, if the ACM have not been removed first, asbestos contaminates the entire waste pile and it is considered asbestos containing waste material. The entire waste pile must be disposed of properly.

Pipe wrap: estimate the length and diameter of pipe wrap, and apply the EMPs for pipe wrap. Assume the pipe wrap is amosite asbestos if sampling and analysis cannot be conducted due to the structural integrity of the building. Amosite repels water, even when it is amended with surfactants that are effective on other types of asbestos. Special considerations are appropriate for situations in which pipe wrap is present[10].

Vermiculite: when vermiculite is present (typically as attic insulation and in the interstitial spaces of cinder block buildings), special care is recommended for demolition. The EPA, the Agency for Toxics Substances and Disease Registry (ATSDR), and the Center for Disease Control (CDC) released a joint guidance document on vermiculite, which can be accessed through the EPA's website at: https://www.epa.gov/asbestos/protect-your-family-asbestos-contaminated-vermiculite-insulation

[10] See section 5.7 of this document, "Dedicated Wetting for Pipe Wrap"

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

Table 2. Permeability of Common Soils[11]

	Description	min (m/s)	max (m/s)
LEAST PERMEABLE	Inorganic silts of high plasticity	1.00E-10	5.00E-08
	Compacted clay	-	1.00E-09
	Inorganic clays of high plasticity	1.00E-10	1.00E-07
	Inorganic clays, silty clays, sandy clays of low plasticity	5.00E-10	5.00E-08
	Organic clays of high plasticity	5.00E-10	1.00E-07
	Compacted silt	7.00E-10	7.00E-08
	Organic silts and organic silty clays of low plasticity	5.00E-09	1.00E-07
	Inorganic silts, silty or clayey fine sands, with slight plasticity	5.00E-09	1.00E-06
	Clayey gravels, clayey sandy gravels	5.00E-09	5.00E-06
	Clayey sands	5.50E-09	5.50E-06
	Well graded sands, gravelly sands, with little or no fines	1.00E-08	1.00E-06
	Silty sands	1.00E-08	5.00E-06
	Silty gravels, silty sandy gravels	5.00E-08	5.00E-06
	Clean sands (good aquifers)	1.00E-05	1.00E-02
	Poorly graded sands, gravelly sands, with little or no fines	2.55E-05	5.35E-04
	Well graded sand and gravel without fines	4.00E-05	4.00E-03
<<<<< MOST	Very fine sand, very well sorted	8.40E-05	
	Alluvial sand and gravel	4.00E-04	4.00E-03
	Well graded gravel, sandy gravel, with little or no fines	5.00E-04	5.00E-02
	Poorly graded gravel, sandy gravel, with little or no fines	5.00E-04	5.00E-02
	Uniform sand and gravel	4.00E-03	4.00E-01
	Peat and other highly organic soils	-	-
	Medium sand, very well sorted	2.23E-03	
	Coarse sand, very well sorted	3.69E-01	

REFERENCES

1. Swiss Standard SN 670 010b, Characteristic Coefficients of soils, Association of Swiss Road and Traffic Engineers
2. Carter, M. and Bentley, S. (1991). Correlations of soil properties. Penetech Press Publishers, London.
3. Leonards G. A. Ed. 1962, Foundation Engineering. McGraw Hill Book Company
4. Dysli M. and Steiner W., 2011, Correlations in soil mechanics, PPUR
5. West, T.R., 1995. Geology applied to engineering. Prentice Hall, 560 pp.

4.6.3.6 Estimate the amount of water needed to maintain adequate wetting

You can use the site assessment, workplan, number of days needed for demolition, number of hoses, water nozzle rating (volume of water sprayed per minute) to estimate the amount of water needed for the demolition and worker hygiene stations (showers). We recommend adding a 10-20% variance for unforeseen circumstances. Consider bringing spare water tanks

[11] Source: Geotechdata.info. Soil void ratio. http://www.geotechdata.info/parameter/permeability.html(http://www.geotechdata.info/parameter/permeability.html (as of October 7, 2013).

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

onsite as a backup in case of municipal water utility disruption in order to maintain adequate wetting.

$$Wg = [1.7 \times R \times Dn]$$

Where
Wg is the total amount of water needed for a demolition, in thousand gallons
R is the volume rating for water nozzles, in gallons per minute
Dn is the duration of the demolition, in days (refer to the workplan).
The nozzle rating (R) is determined by summing the volume rating, expressed in gallons per minute, for each nozzle to be used:

$$R = R1 + R2 + R3 \ldots Rn$$

Convert to thousands of gallons per day to be used. Here, a 15% variance is included for unforeseen circumstances:

$$\left(60\frac{m}{h} \times 24\frac{h}{d}\right) \div 1000 = 1.44 \times 1.15 = 1.7$$

If you choose to estimate water usage in this way, adjust from a 24-hour day to the actual period of time that the misting should continue. Many demolitions are completed over an 8-hour work day. In such cases, estimate water needed for an 8-hour day instead of a 24- hour day. Other larger scale demolitions may occur over several days. Since the regulated asbestos-containing materials must remain adequately wet until collected and contained or treated in preparation for disposal in accordance with the regulations, we recommend evaluating the total period that the demolition is expected to be conducted to estimate water resources needed for the demolition activity.

To prevent contamination of bodies of water by asbestos, contain and treat demolition water prior to release to a stormwater sewer, sanitary sewer, or body of water. Consider bringing spare wastewater tanks to the demolition site.

4.6.4 Contingency Plans

In general, contingency plans serve to compensate for equipment failures, unforeseen weather events, and other unanticipated challenges at the work site. Spare nozzles, water amending chemicals, extra PPE, spare duct tape and 4 mil plastic sheeting, fresh water trucks, spare wastewater tanks, and electricity generators are examples of field EMPs to include in the contingency plans. Consider trucking in water to use for demolition activity in the event that the planned water source is unavailable or is interrupted. Consider including extra leakproof wastewater tanks in the event a tank is compromised.

Real-time weather forecasts should be updated during the work day so that the on-scene coordinator can remain apprised of weather conditions and can make decisions for the work site, as needed. Excessive rain can impact the work site if flooding results, potentially contaminating nearby rivers, streams and lakes, and contributing to a potential violation of the

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

NPDES permit. You may want to consider the total amount of rainfall that is expected during the demolition and site remediation period, and be prepared to handle stormwater runoff from the demolition site.

4.6.5 Example Calculation

Example Scenario:
The work plan calls for demolition of a burned out office building (circa 1952) that is structurally unsound and in danger of imminent collapse and is situated on a third-acre site. In the emergency response, a debris pile was created which tested positive for asbestos. High asbestos content of demolition water is expected. The building is situated upon highly plastic clays having a very low permeability rating. High runoff potential is therefore expected. After evaluating the site and planning the location of berms, absorbents, a vacuum truck at the lowest point of the site and water filtration, a resource allocation is made for three low-volume misting nozzles to be used to maintain an adequately wet site. One nozzle, which has a broad sweep and rating of 0.6 g/m, is to be used on the debris pile. Two nozzles, each with a wide diameter spray, and a rating of 0.8 g/m, are to be used on the building (one at the contact between demolition equipment and the building and the other on interior spaces). The demolition is scheduled to occur over a 3-day period. Precipitation in the form of rain is a possibility during the afternoon of one day of the demolition period, and the expected rainfall is estimated to be no more than 0.25 inches.

Determine How much water will be needed to demolish the building properly.

Using the above equation to estimate the combined nozzle rating:

$$R = R1 + R2 + R3 \dots Rn$$
$$R = 0.6 + 2(0.8) = 2.2g/m$$
$$Dn = 3$$

$$Wg = [1.7 \times R \times Dn]$$
$$Wg = 1.7 \times 2.2 \times 3 = 11.22$$

Rounding up, we can estimate about 12,000 gallons of water will be needed for the demolition alone.

Cross-contamination of homes and businesses has occurred in the past from poorly managed asbestos work sites. Because asbestos should remain in the waste at the worksite to be properly managed and not taken home with workers, worker hygiene showers should be planned for the end of each workers shift.

4.7 Use the Variance and Demolition Permit Processes to Evaluate and Enforce Requirements of the Work Plan

When an Order is issued for the demolition of a structurally unsound and in danger of imminent collapse facility, states and/or local environmental agencies may require owners/operators to

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

file a permit request for exemption from the inspection and asbestos removal requirements of 40 C.F.R. Section 61.145. This is also referred to as a 'variance request'. In those situations, the agency would review the variance request to determine if EMPs are included in the demolition planning. The variance requests can be used as the vehicle to review work plans, inspector accreditation records, testing results, and other information indicating what measures will be taken to contain asbestos under the ordered demolition.

Each site should be evaluated on a case-by-case basis to include in the work plan those practices that are useful and will be enforced in a variance request or similar enforcement vehicle.

Under the Clean Water Act (CWA), point sources require CWA permits, but stormwater point sources are only required to obtain permits if they have been designated to do so. For instance, if an active construction stormwater point source is below the size threshold designated for regulation in the NPDES program, a permit is not required under Federal law, but may still be required by State law.

5 Field EMPs

The preparatory EMPs developed at the desk become field EMPs as they are transferred to the field at the demolition site. Field EMPs are physical, structural, or mechanical devices or facilities intended to prevent pollutants from entering stormwater, penetrating soils, and impacting neighboring sites.

Measurements and locations of all materials should be verified and noted in the work plan. When workers are setting up equipment such as tanks, berms, conduits, absorbents, etc. at the worksite, care should be taken to place them in their appropriate locations as shown in the work plan, and any departure from the work plan should be noted and explained. For instance, the work plan may account for berms of different lengths or sizes, a certain number of feet from the structure, to allow for movement of equipment and personnel onsite. A long 20-foot berm may be planned 40 feet downhill from the demolition. Similarly, the wastewater tanks are usually located at one of the lowest points for proper drainage, and the supervisor should check to ensure it was placed properly so that when demolition work begins, and demolition water is generated onsite, it drains through the conduits and into the wastewater tanks. In general, the site supervisor should ensure that the correct sizes of equipment are placed in the correct locations and in such a way that they are able to function properly.

The function and performance of all equipment should be verified by inspection daily, and any deficiencies should be corrected by repair or replacement. A working copy of the work plan should be kept onsite for verification and guidance. Any departure from the EMPs in the work plan should be noted, along with the prevailing wind direction, any stop work orders, unexpected rainfall, contingency plan execution, or accidental releases.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

5.1 EMPs to Contain and Manage Demolition Water

The purpose of these EMPs is to prevent the discharge of unpermitted demolition wastewater to ground or surface water, or to storm drains that discharge to surface water, or to the ground. When asbestos-containing materials remain in the building, water used for demolition activities and showers should be contained and managed to prevent contamination of the demolition site and nearby areas.

EMPs to contain and manage demolition water include segregation, enclosures, structural source controls, absorbent devices, and vacuum trucks. We categorize containment and management EMPs into two groups: primary and secondary. Primary EMPs are those that first address the management of demolition water; secondary EMPs are those that follow the primary EMPs.

5.1.1 Primary EMPs

Primary EMPs are the first and most basic practices that can be used to reduce exposure to asbestos by controlling or eliminating the impact of outside elements from access to the demolition site. These measures can be written into the work plan so that they are not overlooked in the demolition process.

5.1.1.1 Control Access:

Curious spectators, collectors of memorabilia, salvagers, and trespassers can compromise the integrity of asbestos controls at the worksite. We suggest training workers to notice non-authorized personnel onsite, instituting display of identification at all times, and prompt corrections to maintain controlled access.

5.1.1.2 Communication:

Certain requirements for signage and labelling are included in the Asbestos NESHAP. We also recommend that workers be reminded of key housekeeping measures and work principles. Examples include:

- Stencil warning signs at stormwater catch basins and drains, e.g., “Dump No Waste – Drains to Waterbody.”
- Label wastewater tanks: e.g., “Asbestos Hazard. Non-Potable Water. Do not dump to sewer, land or waterbody.”
- Identify the location of absorbents for accidental spills and overruns.
- Post inspection schedule and reminders such as “Fill tanks to 80% only; Do not Overfill”
- Label holding areas for asbestos-containing waste: e.g., “Place Asbestos-Containing Waste Materials Here”

5.1.1.3 Segregation and Isolation:

When possible, we recommend physically segregating the asbestos-containing materials to confine the sources of asbestos that can impact demolition water to as small an area as possible. This can help to reduce the total amount of debris that would be contaminated by asbestos, and would have to be disposed of in a landfill permitted to receive asbestos wastes.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

Figure 5. The surrounding sidewalk functions as a berm at this demolition, (EPA photo courtesy of John Pavitt, Region 10).

We recommend enclosing and/or covering the asbestos-containing materials (e.g., within a building or other enclosure, a roof over storage and working areas, temporary tarp) to prevent cross-contamination of ACM with materials that are non-ACM, and to prevent the movement of asbestos fibers offsite. Rainfall can add to the water that may need to be managed at a demolition site, and failure to properly manage this additional water burden can lead to unintentional stormwater and wastewater impacts as well as a potentially expanded site remediation area. Consider using available impervious areas that are compatible with the materials handled, such as cement or asphalt paved surfaces. Alternatively, consider temporary construction of a cement or asphalt pad for storage and management of ACM.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

5.1.1.4 Water Management

Water management during and after the demolition operation is important for several reasons. First, water is a valuable natural resource and protecting it is vital to the environmental success of the project, and to the natural resource itself. Water can impact the demolition site in at least two ways: first, water used for the demolition work must be managed. This includes water used at the hygiene stations, spraying operations within the structure, and spraying of asbestos-containing debris that accumulates on-site in segregated piles during the demolition process. Second, precipitation events can potentially impact a demolition site when storm water, or melting ice and snow form a slurry with demolition debris, and flow offsite, carrying asbestos with it.

Figure 6. A filter array that is designed to hold filters of sequentially decreasing pore size.

5.1.1.4.1 Management of Demolition Water

Two examples follow for water management that can be used at demolition operations. One EMP focuses on filtration and re-use of this non-potable water during the demolition process to greatly reduce the total amount of water consumed by the demolition project. The second EMP focuses on filtration of the demolition water for testing and return to the municipal water system through the stormwater sewer system.

5.1.1.4.1.1 *Filtration of Demolition Water: Focus on Water Conservation*

To minimize total water use, we recommend filtering and reusing demolition water for the duration of the demolition work. In the example shown by Figures 6 and 7, filters, starting with a sand filter (similar to those used for pools), followed by micropore filters in series, sequentially decreasing in size from 12 to 1 micron may be used to filter out asbestos with other suspended solid pollutants as sediment entrained in the water. This may be especially useful with

Figure 7. Examples of filters used for asbestos removal in the array in Figure 6. Photo courtesy of John Pavitt, USEPA Region 10. No endorsement implied. Information included for instructional purposes only.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

large industrial or commercial demolition projects and in areas that may undergo a curtailment of water resources. All filters must be disposed of properly as asbestos waste.

5.1.1.4.1.2 Filtration of Demolition Water: Focus on Return to Treatment System

Figure 8. Water from a building demolition drained into the basement and was pumped to this tank (circled in picture) for settling before filtration to remove asbestos and other pollutants. Photo courtesy of John Pavitt, US EPA Region 10.

For this second EMP, we use as an example, the Excavation Dewatering Permit through the Alaska Department of Environmental Conservation (ADEC)[12] in 2015. The water used to maintain adequate wetting during the demolition was drained into the basement of the building where it was collected.

This collected water was then pumped from the basement into a large (8'x8'x20') baffled tank, as shown in the photo in Figure 8, where grit and fine particulate debris settled out and hydrocarbons floated to the surface. The presence of hydrocarbons was indicated by a slight sheen on the water's surface. Sorbent pads were then used to remove the small amount of hydrocarbons.

Figure 9. A carbon-filter within this 60-gallon drum is used to remove hydrocarbons and asbestos from water collected in settling tank. Photo courtesy of John Pavitt, US EPA Region 10. No endorsement is implied. Information is included for instructional purposes only.

After settling and sorbent pad application, the water was run through a 55-gallon drum holding a granulated activated carbon filter, as shown in the photo in Figure 9, where it polished off any remaining hydrocarbons. The output water was sampled from the filter, and the results indicated that it met surface water discharge standards. The initial round of testing followed this procedure but discharged the filtered demolition water back into the basement until sample results confirmed that the effluent met storm water quality standards. In this case, a storm drain catch basin right at the curb by the building, shown in the photo in Figure 10 was an added convenience.

---

[12] Demolition of the Gastineau Apartments in Juneau, AK, 2015.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

Directional devices, such as berms and conduits, are useful to divert water into collection and containment. We recommend their use in areas expected to receive most of the asbestos-contaminated demolition water. For example, these devices should be utilized along slopes and impermeable surfaces to aid in the containment strategy of the excess demolition water. Devices should direct contaminated water to appropriate treatment EMPs (to prevent discharge to a sanitary sewer).

Figure 10. After filtration and testing of demolition water showed the water met effluent standards, it was released into the stormwater drain adjacent to the demolition project. Photo courtesy of John Pavitt, USEPA Region 10.

5.1.1.4.1.3 *Management of On-Site Storm Water*

We recommend that sediment generated by the demolition process be retained onsite. Storm sewer inlets can be protected with sandbags or rocks as make-shift filters, and sediment controls may be established at the perimeter of the site.

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and protecting water. When demolitions are conducted close to a body of water that could potentially be negatively impacted by the demolition, we recommend the collection and filtration for asbestos of all water generated onsite. Additional requirements may apply in a particular Clean Water Act permit.

5.1.1.4.1.4 *Management of Off-Site Storm Water*

We recommend segregating storm water off site from all waters onsite to avoid over burdening the tanks and absorbents with water that does not need treatment prior to release. Diverting the worksite runoff to containment in a tank or other impermeable structure and diverting off-site storm water around the worksite area are recommended EMPs.

When storm water can potentially impact a demolition site, we recommend ditches and trenches as useful EMPs to divert off-site storm water to retention ponds or other sediment-filtering areas to prevent it from creating an overburden for the EMP devices. Storm water can create this situation when the demolition occurs on a hillside with an impervious surface.

Once directional devices have been placed to effectively divert offsite storm water to storm sewers or ditches, and on-site storm water and demolition water into tanks, the onsite asbestos-laden demolition water can be managed to remove asbestos. We do not recommend sending untreated demolition water to a storm water or sanitary sewer, even if the municipality allows it.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

It is important to note that we do not think these controls are EMPs for asbestos control, and we have no information indicating that asbestos is removed from water using silt fences and rock barriers. However, these may be useful for removing excess sediment from the total amount of water to be collected and subsequently filtered for asbestos removal, and potentially extending the life of the asbestos filters. Additionally, we don't recommend using retention ponds or other sediment-filtering areas for on-site diversion of asbestos-contaminated waste water because this could potentially expand the site contamination rather than limit it.

Installation of a silt fence as a perimeter control and onsite sediment filters at the lowest site elevation are effective controls to remove ***sediment*** from water. Additionally, if demolition or storm water has impacted the demolition site and flowed into the silt fence, the silt fence and all trapped sediments in this case would also be contaminated with asbestos and must be disposed of properly as an asbestos-containing waste material or converted into non-asbestos material.

Water spray: It is necessary to meet the Asbestos NESHAP requirement for keeping the regulated asbestos-containing material adequately wet at a demolition regulated by the Asbestos NESHAP, according to the Asbestos NESHAP.[13] Additionally, State or local dust control air quality ordinances may apply at the demolition site. We recommend the use of a low-volume misting nozzle to maintain dampness without excess water volume. Note: Do not hose down pollutants from any area to the ground, storm drains, conveyance ditches, or receiving water. This process increases the chances that you may release asbestos and other environmental hazards into the environment which may trigger a release of reportable quantities under CERCLA. For additional information on this EMP, see the field example in section 5.6 of this document.

Drains: We recommend that floor drains in potential pollutant source areas should not be connected to storm drains, surface water, or to the ground. EMPs are to block all drains within the work area using materials that are both impervious and not easily dislodged.

Correct equipment: We recommend the use of containers, piping, tubing, pumps, fittings, and valves that are appropriate for their intended use and for the contained demolition water.

Housekeeping Measures: We recommend that demolition water in impervious uncovered containment be cleaned up (vacuumed, absorbed, drained and filtered, etc.). Cleaning, steam cleaning, or pressure washing of equipment or containers inside a building or on an impervious contained area, such as a concrete pad, can help to prevent the accidental release of asbestos-laden water. Additionally, walled liners (i.e., 'drip pans') may be installed beneath equipment handling and storing demolition water (e.g., filter assembly racks, tanks, etc.) to catch spills and

[13] See 40 CFR 61.145(c)(6)

drips. We recommend drip pans be emptied immediately after a spill or leak is collected, especially if it is in an uncovered area that may be exposed to rainfall or stormwater.

Maintenance: Prompt repair or replacement of any leaking connections, pipes, hoses, valves, etc., can help to prevent contaminating areas of stormwater runoff. We recommend repair, replacement, and resealing any damaged paved areas, especially those at industrial facilities, such as damaged paved secondary containment, high-intensity parking, and any other drainage areas subjected to pollutant material leaks or spills.

5.1.2 Secondary EMPs

Contaminated water removal: We recommend the use of vacuum trucks for the removal of water that threatens to run offsite or to exceed the structural barriers in place at the demolition site. Vacuuming up water at and beyond the berms and barriers can be helpful to contain and manage the demolition water in one step. We recommend vacuuming all appropriate surfaces with wet vacuum trucks daily or more frequently as needed for the collection and disposal of asbestos-contaminated demolition water that could contaminate surrounding soils.

Figure 11. Sawdust-stuffed burlap tubes are weighed down with sandbags in 'U' and 'J' shapes (EPA photo courtesy John Pavitt, Region 10).

Absorption: Absorbent devices such as sawdust-filled tubes (a.k.a., "sausages"), sand bags, and peat berms may be used to absorb demolition water. In order to protect neighboring property, we recommend their use in areas that are not expected to receive a high water loss and on the perimeter of areas that are level. They are also useful at the far end beyond the berms and barriers and the vacuum truck, as a secondary or tertiary contingency plan and precautionary measure in case of an accidental overflow or miscalculated water path. Since absorbent devices have a maximum effectiveness level, at which point they are saturated and can no longer absorb water or function effectively, they are not primary containment EMPs. In Figure 11, the view is looking downhill after a rainstorm the previous evening. The demolition itself is controlled and these absorbent devices have been installed as a secondary backup. Any water from the demolition that makes its way off site would run alongside the curbs and be absorbed into the 'sausages' instead of running into the storm sewers located along the sides of the street, or into the river at the bottom of the hill.

Determine if a Release Has Occurred: We recommend testing water collected in ditches and runoff basins at the site for the presence of asbestos to determine whether or not a release has

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

occurred. Notification to the National Response Center, as well as remediation of the impacted and surrounding soils and catch-basins, may be required.

5.2 Tanks

We recommend collecting and containing the water that may be contaminated by asbestos from demolition, worker showers, or stormwater because the asbestos NESHAP requires containment of all regulated asbestos-containing material and proper disposal of all asbestos-containing waste material. The collected asbestos-laden water may be diverted to on-site properly labeled tanks for subsequent filtration and disposal.

We recommend the wastewater tank not be filled to capacity because the potential for spills and leaks increases as the maximum capacity is reached. Spare wastewater tanks may be brought onsite, and the tanks can be changed out when no more than 80% full.
When possible, consider sizing the tanks larger than the estimated amount of water needed, and include extra double-wall tanks as a precautionary measure. Tanks may be cleaned and re-used for similar (non-potable water) projects. Consider dedicating wastewater tanks for demolition water under the program. See also the following website for additional information:
http://www.ertvideo.org/content/asbestos-managing-problems-addressing-concerns

5.3 Field Examples

5.3.1 EMP: Berms and Absorbents on a Sloped Site

For example, consider a demolition of a building on a hillside. The primary controls used in one such case were sandbags at the base of the demolition site. Secondary barriers of sawdust-stuffed burlap tubes ("sausages") were placed in 'J' and 'U' shapes lining the street inside the perimeter of the demolition area to prevent runoff from entering the river or the stormwater sewer at the base of the hill, as depicted in the photo in Figure 12.

Downhill from the sausages, concrete or earthen berms may be constructed which direct any water into waiting enclosed pipes and conduits where the water is diverted to flow into waiting tanks or absorbents. In order to prevent leaking and dribbling, the "sausages" should be replaced before they become saturated (to avoid leaking and dribbling). New sausages replace the soaked sausages which are double bagged for disposal.

In the replacement process, any demolition water that may pass over the area is directed by berms into the conduits, pipes and collection tank. Pre-existing structures may be present that can function as berms at a site. For instance, curbs and sidewalks in an urban or suburban setting may function to prevent wastewater from leaving the site.

5.4 EMP: Diversion Slurry Pumping System and Slurry Capture Mats

em to a tank vacuum truck and/or slurry capture mats especially for large demolitions on sloped surfaces, disturbed soils, and/or in proximity to

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

bodies of water that could become contaminated by runoff. This is typical of demolitions near rivers or on riverbanks or lake edges.

5.5 EMP: Vacuum Trucks

Vacuum trucks are useful in addition to 'sausages' to prevent contaminated runoff from the site. Consider using vacuum trucks to remove a wet slurry of asbestos debris as a clean-up method and / or a backup control, especially when steep slopes or impervious materials may indicate a higher runoff potential. We recommend double-checking for leaks on vacuum trucks since these vehicles may be fitted with small ducts which should be sealed after emptying to function properly, and these are easily overlooked. As water is flushed onto a demolition, the water and slurry can be vacuumed up and hauled away for disposal or further filtering. The total size of the structure, daily maximum amount of water use, washing of personnel and equipment, and heavy rainfall (especially when unexpected as this may not have been taken into account in the work plan) can significantly impact the total amount of contaminated water that must be managed from the demolition site.

5.5.1 EMP: Low-volume misting nozzle to adequately wet ACM

Buildings scheduled for demolition typically have asbestos-containing materials, many of which are regulated asbestos-containing materials (RACM). RACM includes materials that are in damaged or friable condition or that will be rendered friable during the demolition. When these asbestos-containing materials are not removed prior to demolition, the resulting dust also contains asbestos. Materials such as pipe wrap[14], transite siding, textured ("popcorn") ceiling coatings, sprayed-on fireproofing, vermiculite attic

Figure 12. This is an example of one type of low pressure misting nozzle, which is used to suppress and control dust. No endorsement is implied. Information provided for instructional purposes only.

[14] Most pipe wrap was manufactured from amosite (or 'brown') asbestos, and is considered to be among the most toxic forms of asbestos. Additionally, many surfactants do not successfully penetrate amosite. When pipe wrap is encountered, special care to identify effective water amendments and then to adequately wet, abate and remove it should be taken.

insulation, roofing materials, and many other building materials can be found in poor or friable condition. Using a low-volume nozzle prevents excessive water use and avoids damage to RACM which is typically in a friable state. Low-volume misting nozzles (Figures 12 and 13) can be particularly effective at adequately wetting all ACM before, during and after demolition without causing further damage to these materials.

> Water amendments (surfactants) reduce the surface tension of the water droplets … and improve the water's effectiveness by increasing its affinity for adhesion to asbestos fibers…

According to professionals in the field, the size range of the water droplets is critical to avoid the 'slipstream' effect that large droplets from sprinklers have on airborne dust particles. In most applications, fugitive particles are generally around 50 to 100 microns in size, but water droplets from a sprinkler are much larger, often 2000 to 6000 microns. The velocity of the large sprinkler droplet affects the airflow. When an airborne particle approaches it, the flow often deflects the particle without a collision between dust and droplet. In contrast, the atomized mist system creates droplets that are much closer in size to the dust particles which facilitates the necessary contact to bring dust particles to the ground. The sheer number of these miniscule droplets also increases the surface area available to contact airborne particles without over-saturating the debris.[15]

Prevention of pooling and runoff of toxics-contaminated demolition water was a primary objective in the remediation of a former lead-acid battery recycling facility in Throop, PA located adjacent to the Lacawanna River (Figure 13). For the project, engineers were required to meet a "no visible emissions" standard, find a way to control large volumes of lead-laden dust, confine surface dust to the immediate area, and prevent airborne particles from migrating to nearby residential communities. Although this particular project work plan was designed for compliance with the lead abatement program, not asbestos abatement, we believe these are EMPs that translate well into the asbestos abatement arena because they address rigorous requirements similar to those that must be met during demolitions under the asbestos NESHAP (work practice standards, having no visible emissions, compliance monitoring, removal and disposal of all contaminated materials, worker training and protection, inspections) and under overlapping State and Federal rules and local ordinances.

[15] Laura Stiverson, President, Dust Control Technology. Professional Demolition Americas, Issue 1, page 36. 2015. www.pdamericas.com

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

5.6 EMP: Use a Wetting Agent for most effective Fiber Adhesion and Control:

Figure 13. A machine delivering an atomized mist keeps materials adequately wet. This work is being conducted at a lead-remediation site with compliance requirements similar to the Asbestos NESHAP. (Photo used with permission from DustBoss, 2015). No endorsement is implied. Illustration provided for informational purposes only.

A very effective management practice is to add a wetting agent to amend the water used to wet the asbestos-containing materials in the building to be demolished. This "amended water" is used to maximize the adherence of asbestos to the water by lowering the surface tension of water. Water amendments (also called surfactants) also increase the misting capability and improve the water's effectiveness as it increases its affinity for adhesion to asbestos fibers, increases its penetration and increases its surface coverage. Wetting agents include soaps, alcohols and some fatty acids. The EPA's "Purple Book", or as it is formally known, Guidance for Controlling Asbestos-Containing Materials in Buildings, EPA-560/5-85-024 , recommended the use of a wetting agent that is a 50:50 mixture of polyoxyethylene ester and polyoxyethylene ether, or the equivalent, in a 0.16 percent solution (1 ounce to 5 gallons) of water.

Surfactants can be added to onsite tanks or through a port at the hose. Water hoses are usually attached to a faucet tap, fire hydrant or water tank. Generally, the hose has a nozzle attached which spreads the water stream so that a fine mist is created.

An engineering control often used is a misting unit which can be used to create a high level of humidity within a removal area. It is believed that fibers emitted into a saturated environment will absorb the wetting agent and fall out of the air faster thus reducing airborne fiber levels.

The wetting agents used for the demolition may not be safe to use for the showers. We recommend using specific wetting agents according to their intended use and consulting the product safety data sheets (SDSs) before handling or using any wetting agent to amend the shower water. All the SDSs should be kept onsite in a centrally accessible location.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

5.7 Dedicated Wetting for Pipe Wrap

Dedicated wetting nozzles for use when pipe wrap is encountered are recommended (see Figure 14). Note that amosite asbestos was used commercially for pipe wrap. Asbestos removal professionals take special measures whenever pipe wrap is involved because amosite asbestos repels water as well as most surfactant-treated or amended water. Special proprietary amending chemicals have been developed for use on pipe wrap that adhere to and are not repelled by the amosite asbestos. We recommend using these chemicals whenever pipe wrap is encountered.

Figure 14. Pipe wrap is frequently hidden and may be difficult to find. Special wetting agents may be needed for pipe wrap.

5.8 Decontamination of Waste-Hauling Vehicles

When the vehicles used to transport demolition waste may become contaminated by asbestos from the site, we recommend they be cleaned of contamination before leaving the site in order to prevent contamination of a wider area. Vehicles, including the tires and undercarriage, can be visually inspected for debris removal and rinsed using amended water while the vehicles are on an impervious surface (asphalt or concrete pad). The vehicle rinse pad may be designed as a slightly inclined surface draining into a collection system and tank. We recommend the collection and management of all rinse water along with the shower and demolition water.

6 Post-Demolition Clean Up and Site Preparation

6.1 EMP: Segregate Asbestos-Containing Waste Materials

- Where feasible, store containers of asbestos-contaminated debris inside a building or under a cover and/or containment.
- Stop, contain, and clean up all spills immediately upon discovery.
- If asbestos-containing wastes are stored on-site, have spill containment and cleanup kits readily accessible. These kits should be appropriate for the materials and the size of a potential spill. Locate spill kits at all transfer areas including berms, conduits, vacuum trucks, containment tanks, backup tanks, and water filter assemblies.
- If the spill has reached or may reach a sanitary or a storm sewer, ground water, or surface water, notify the local jurisdiction and the local sewer authority immediately. Notification must comply with federal spill reporting requirements. (See also record keeping at the end of this section).
- Do not flush or otherwise direct absorbent materials or other spill cleanup materials to a storm drain.
- Collect the contaminated absorbent material as a solid and place in appropriate disposal containers.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

- The kit(s) should include but are not limited to: salvage drums or containers, such as high density polyethylene, polypropylene or polyethylene sheet-lined steel; polyethylene or equivalent disposal bags; an emergency response guidebook; safety gloves/clothes/equipment; shovels or other soil removal equipment; and water absorbent barriers, booms and absorbent pads. All should be stored in an impervious container.

6.2 Post-Demolition Clean Up Activities

Under the Asbestos NESHAP, all asbestos-containing waste materials must be contained, labeled, kept adequately wet, and be properly disposed of as soon as practical[16]. These materials are likely to include berms, absorbents, contaminated soils, silt fence(s), filters, filter cakes and demolition debris that could not be successfully segregated before beginning the demolition process. Some barriers that are not permeable by water, such as plastic-coated berms, may be able to be cleaned and reused at other demolition sites.

The following sections provide EMPs for containing asbestos in the demolition wastewater.

6.2.1 EMP: Filter Post-Demolition Wastewater

It is easier and less costly to protect soil than it is to abate it through the remediation process. The management of waste water is key to the demolition process. Wastewater should be filtered to remove asbestos fibers before disposal. We recommend the collection, filtration and testing of all water used to maintain adequately wet requirements.

Filtration equipment can be set up according to the sediment profile that needs to be removed from the demolition water. For instance, when coarse, medium and fine sediments are present, a graduated filtration system may be used to process the collected demolition wastewater. Wastewater passes through a coarse filter, followed by a secondary finer filter, and lastly through a finest filter. Coarse filters, which are also less expensive, are changed frequently. Secondary filters, which are more costly, are changed less frequently. All wastewater filters are changed in this EMP before they are full, and any spillage that may occur during filter change out is collected in a tray and is also filtered. All filters are doubly bagged with the asbestos-contaminated debris for proper disposal.

The use of settling tanks can also be used to remove coarser sediments so that a graduated system is not needed.

6.2.2 EMP: Post-demolition Wastewater Testing

Demolition water should be tested after filtration for the presence of asbestos, and the analysis results should be retained in the work plan records. Filtered water may be disposed of in accordance with the local POTW requirements.

---

[16] For more details, see 40 CFR 61.150(a)-(b).

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

We recommend testing the catch basin sediments to indicate whether or not a release of asbestos is indicated. If asbestos is present in the catch basin sediments, this may indicate that asbestos was released to the environment as a result of the demolition activity and that some cleanup may be needed as a result (see soil protection and remediation). Further, when this requirement is part of the work plan and is communicated to all parties in advance of the demolition work, we believe it is likely that the work will be conducted using EMPs that are effective and would more likely prevent asbestos from reaching areas where it could be released into the environment.

An EMP is to require testing of all soils receiving abatement water, remaining soils and surrounding soils to show asbestos levels at or below background.

6.3 EMP: Remediate Soils at the Demolition Site and Surrounding Areas

If the work plan was well developed, contingency plans were followed, and the waste water from the demolition site was properly managed, controlled and contained, there may be no remediation of the site needed. However, when violations of the standard or unexpected and unforeseen circumstances arise that cause or contribute to asbestos contamination of a site, post-demolition remediation of the site may be required.

Figure 15. Micro-vac sampling is one method that may be used to indicate that non-porous surfaces, such as this asphalt parking lot, have not been contaminated by asbestos after the ordered demolition of the hotel featured in Figure 4. Photo courtesy of

We recommend maintaining documentation to show that the site is not contaminated. One way to document this is to sample the soils below the removal level (using a grid) to verify that the asbestos content is at or less than background. Clearance sampling may be conducted to show that soils below the removal level either did not contain asbestos or that asbestos was present at or below background levels.

After visual inspection and clearance, representative sampling and analysis may be conducted to indicate that the work performed was successful in avoiding asbestos contamination of nearby areas. Figure 15

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

shows one micro-vac sample being taken at a site to indicate that a nearby asphalt parking lot was not impacted by the ordered demolition of a hotel.

If asbestos has contaminated the demolition site, we recommend the controlled excavation and removal of soils:

- beneath debris piles that received water,
- for which sampling and analysis confirms are contaminated by asbestos, and
- which are suspected of being impacted by asbestos in the demolition debris.

All asbestos-containing materials, including soils, should be kept adequately wet during excavation, packaging, loading for transport, and while awaiting disposal (which is required under the Asbestos NESHAP to be done as soon as practical).

In 2008, the EPA Office of Solid Waste and Emergency Response (OSWER), now the Office of Land and Emergency Management (OLEM), released the *Framework for Investigating Asbestos-Contaminated Superfund Sites* (http://www.epa.gov/superfund/superfund-asbestos-technical-resources#framework). The framework (which is currently in revision) is part of many recent efforts to make sure that new developments regarding asbestos are used to better assess exposure and risk (e.g., EPA efforts to update cancer and non-cancer assessments for asbestos). The framework provides a process that supplements other EPA guidance concerning exposure and risk assessment (e.g., EPA's 1989 Risk Assessment Guidance for Superfund) and is specific to assessment of sites contaminated with asbestos. Because there are unique scientific and technical issues associated with the investigation of human exposure and risk from asbestos, it is important for risk assessors and risk managers to understand these issues when assessing asbestos sites. This framework discusses specific strategies based on the best available science and recommends common industrial hygiene methods for characterizing exposure and risk from asbestos, as well as discusses the various sampling and analysis methods for contaminated air, soil and dust. While the entire framework document may not be applicable to issues specifically related to NESHAP regulation, many sections, including sections related to sampling and analysis, may prove useful for site managers dealing with issues of risk assessment and sampling and analysis. It should be noted that the current framework document references two laboratory testing methods for determining asbestos concentrations in soil in Section 4 (NIOSH 9002 and California Resources Board, or CARB Method 435.). However, currently OLEM is recommending CARB 435 as the method of choice for the direct detection of asbestos in soil media. OLEM is in the process of evaluating an ASTM method and an internal EPA method for analysis of asbestos in soils, but a final decision on the applicability of these methods has not yet been made. Asbestos fibers in outdoor soil, indoor dust or other source materials typically are not inherently hazardous unless the asbestos is released from the source material into air where it can be inhaled.

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

6.4 Cross Reference to Selected Relevant Federal Regulations

Requirement	Government Authority	Law	CFR Citation
Permitting water discharges	Federal	NPDES	
Stormwater Discharge	Federal NPDES	NPDES	40 C.F.R. Section 450
Reportable quantity of released pollutant	Federal CERCLA	CERCLA	Section 103(a)
Asbestos NESHAP	Federal	CAA	40 C.F.R. part 61, subpart M
Asbestos Worker Protection	Federal / State	OSHA	29 CFR Part 1926.110129 C.F.R. section 1926.1101; 29 U.S.C. section 654; *see also* 29 C.F.R. sections 1910.1001 and 1915.1001
Asbestos Worker Protection for State & Local Government Employers	Federal	TSCA	40 C.F.R. part 763, subpart G49
Asbestos in Schools	Federal	AHERA	40 C.F.R. part 763, subpart E
Labelling and Transportation of Asbestos-Contaminated waste	Federal / State	DOT	C.F.R. part 100 - 185

These guidelines do not impose legally binding requirements, do not confer legal rights or impose legal obligations on anyone, or implement any statutory or regulatory provisions.

Appendices

Appendix 1: Applicable Regulations

Appendix 2: Guidance Documents

Appendix 3: Example Workplans

United States Environmental Protection Agency	Office of Air Quality Planning and Standards Sector Policies and Programs Division Research Triangle Park, NC	Publication No. EPA-453/B-16-002a July 2016