



# Regulated Asbestos Contaminated Soil Standard Operating Procedure

For City and County of Denver

Prepared by the Denver Department of Public Health and Environment

Environmental Quality Division

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Environmental Quality Division Denver Department of Public Health & Environment Regulated Asbestos Contaminated Soil Standard Operating Procedure

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# Acronyms

Acronym	Definition
ACM	Asbestos-containing Material
AHERA	Asbestos Hazard Emergency Response Act
AMS	Air Monitoring Specialist
AOC	Area of Contamination
AQCD	Air Quality Control Division
BDL	Below Detection Limits
BMP	Best Management Practice
САВІ	Certified Asbestos Building Inspector
CCOD	City and County of Denver
CCR	Code of Colorado Regulation
CDPHE	Colorado Department of Public Health and Environment
CFR	Code of Federal Regulation
СМИ	Concrete Masonry Unit
CSWR	Colorado Solid Waste Regulations
DDPHE	Denver Department of Public Health and Environment
GPS	Global Position System
НЕРА	High-efficiency Particulate Air
HVAC	Heating, Venting and Air Conditioning
IDW	Investigation-derived Waste
ММР	Materials Management Plan
mph	Miles Per Hour





Acronym	Definition
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NVLAP	National Voluntary Laboratory Accreditation Program
OSHA	Occupational Safety and Health Administration
PCM	Phase Contrast Microscopy
PLM	Polarized Light Microscopy
Poly	Polyethylene
PPE	Personal Protection Equipment
PSRMP	Project-Specific Regulated Asbestos Contaminated Soil Management Plan
RACS	Regulated Asbestos Contaminated Soil
RWA	Regulated Work Area
TEM	Transmission Electron Microscopy





# Definitions

"Adequately wet" means sufficiently wet to minimize visible emissions of dust and/or debris within the regulated work area (RWA) and to prevent the release of visible emissions from leaving the RWA. The observance of visible emissions, outside of the RWA, of dust and/or debris may be an indication that soils are not adequately wet.

"Adjacent Receptor Zone" means an area of uncontrolled access at a distance of 150 feet or less from the nearest RWA boundary during active Regulated Asbestos Contaminated Soil (RACS) disturbance. For the purpose of this definition, highways, streets, and roads without sidewalks, where only vehicles are permitted, are considered to be areas of controlled access and therefore not adjacent receptor zones. For the purpose of this definition "vehicle" means a device that is capable of moving itself, or of being moved, from place to place upon wheels, including bicycles and electrical assisted bicycles. For the purpose of this definition, an area for which access is not ordinarily controlled that is closed to the public during soil disturbing activities in the adjacent RWA is considered to be an area of controlled access and therefore not an adjacent receptor zone.

"Amended water" means water containing a wetting agent, such as 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, or as per manufacturer recommendations for the wetting of asbestos.

"Air Monitoring Specialist" (AMS) means a person trained and certified, in accordance with the requirements of Air Quality Control Commission Regulation No. 8 (5 Code of Colorado Regulation [CCR] 1001-10, Part B) (CDPHE, 2008), for the collection of air samples to determine airborne particulate and/or asbestos concentrations.

"Asbestos" means the asbestiform varieties of serpentine (chrysotile) and amphibole minerals, riebeckite (crocidolite), amosite (cummingtonite-grunerite), anthophyllite, actinolite, and tremolite.

"Asbestos-containing material" (ACM) means any material that contains more than one percent (1%) asbestos by weight, area or volume. It is during a CABI's RACS/Non-RACS Determination that ACM will be analyzed for.

"Asbestos Worker" means an individual trained and certified under the Colorado State Regulation No. 8, Part B to disturb, enclose, remove, and abate friable and non-friable asbestos containing material.

"Certified Asbestos Building Inspector" (CABI) means a person trained and certified in accordance with Air Quality Control Commission Regulation No. 8, (5 CCR 1001-10, Part B), for the identification of asbestos containing materials and the collection of samples to determine asbestos content inspection and sampling, and who has forty (40) verifiable hours of on the job asbestos in soils experience on a minimum of three (3) different asbestos in soils projects, conducted under either AQCC Regulation No. 8 or CSWR §5.5. The CABI shall be independent of the general contractor (GC) and/or abatement





contractor unless the CABI and the GC or abatement contractor are both direct employees of the property owner. However, the GC or abatement contractor may hire a subcontractor CABI, but the CABI shall not be a direct employee of the GC or abatement contractor.

"**Consultant**" refers to the entity contracted to perform all oversight actions in the form of training, inspections, field directions, air monitoring and documentation related to soil disturbing activities in accordance with this standard operating procedure.

"**CSWR**" refers to the Colorado Solid Waste Regulations (6 CCR 1007-2). The sections most applicable to this standard operating procedure are Section 5 "Asbestos Waste Management", and specifically Section 5.5 "Management of Regulated Asbestos Contaminated Soil (RACS)".

"**Debris**" means any discarded material that contains or consists of any of the following: construction, renovation and demolition debris (regardless of how it was generated), building or facility components, components of building systems (heating, venting, air condition [HVAC], plumbing, electrical, control, fire protection, roofing), components of pavement or drainage systems, industrial or machinery components, and/or mechanical components from motorized vehicles.

**"Debris Determination"** for the purpose of this standard operating procedure, means a determination, conducted in the field by the contractor and/or their sub-contractors for the possibility of visible debris to be either Non-Suspect for ACM or Suspect for ACM. Determinations of Non-Suspect/Suspect shall be based on the requirements set forth in Section 4.1 & 4.2 of this standard operating procedure.

"Facility Component" - for purposes of this standard operating procedure, means any part of a facility including equipment. For the purpose of this definition, "facility" means (as defined in Air Quality Control Commission Regulation No. 8 (5 CCR 1001-10, Part B): "any institutional, commercial, public, industrial, or residential structure, installation, or building (including any structure, installation, or building containing condominiums or individual dwelling units operated as a residential cooperative, but excluding: residential buildings having four or fewer dwelling units); any ship; and any active or inactive waste disposal site. For purposes of the definition, any building, structure, or installation that contains a loft used as a dwelling is not considered a residential structure, installation, or building. Any structure, installation or building that was previously subject to this subpart is not excluded, regardless of its current use or function."

"Friable ACM" means any material that contains more than one percent asbestos by weight, area, or volume, and when dry can be crumbled, pulverized, or reduced to powder by hand pressure. The term includes non-friable forms of asbestos after such previously non-friable material becomes damaged to the extent that when dry it can be crumbled, pulverized, or reduced to powder by hand pressure as determined in the field by a CABI.

"General Abatement Contractor" refers to State-certified entity contracted to perform asbestos contaminated soil disturbing activities in accordance with the standard operating procedure.

"Geofabric" means a permeable fabric or synthetic material used for both visual and physical separation.





"Green Waste" biodegradable waste that can be composed of garden or park waste, such as grass or flower cuttings and hedge trimmings, as well as domestic and commercial food waste.

"Mechanical" means operated or produced by mechanism, tool or machine. This may include but shall not be limited to, an excavator, backhoe, grader, tiller, auger, or hand shovel.

"Non-regulated Asbestos Contaminated Soil" (Non-RACS) means soil or debris that has been inspected by a CABI to contain only:

- Intact non-damaged, non-friable ACM(s).
- Damaged non-friable ACM(s) that do not have a high probability to release fibers based on the forces expected to act upon the material during disturbance as determined in the field by a CABI(s) through a "RACS Determination". The following ACM(s) are predetermined to be Non-RACS:
  - Resin-based materials including but not limited to phenolic-plastic (Bakelite), used in electrical and mechanical parts
  - Resilient flooring (vinyl, asphalt, rubber) excluding non-tar impregnated friable felt backing on sheet vinyl flooring (linoleum)
  - Tar-impregnated or asphaltic materials in good condition that have not become brittle
  - Elastic, pliable, or rubberized materials, including but not limited to:
    - Pliable duct sealant
    - Pliable fiberglass insulation sealant
    - Pliable fire-stop caulking /sealants
    - Pliable window and door caulking
  - Extremely hard materials, coatings and sealants including but not limited to:
    - Laboratory countertops and sinks
    - Epoxy-type Concrete Masonry Unit (CMU) coatings
    - Epoxy-type panel adhesive
    - Duct sealant
    - Ceiling tile adhesive
  - Other ACM(s) as approved by the Department at the request of the owner or person disturbing debris, to not have a high probability to release fibers.





**"Suspect Debris"** means non-soil debris that is Suspect, including ash, to contain ACM. This material requires a RACS determination by a CABI, and until the CABI determination is complete, will be assumed to be RACS and managed in accordance with this standard operating procedure. Although this material may not require special management as ACM, it may still require management as a solid waste. Co-mingled Suspect and Non-Suspect debris should be managed as Suspect Debris.

"Non-soil Debris" means materials entrained within the soil matrix that are not composed of soil. These may include Non-RACS, RACS, or Non-Suspect. Often associated with uncontrolled fill, or historical urban fill areas.

"**Project-specific Regulated Asbestos Contaminated Soil Management Plan**" (PSRMP) means a RACS management plan for a single project submitted in accordance with CSWR §5.5

"**Regulated Asbestos Contaminated Soil**" (RACS) means soil, ash or debris (plus six inches in all directions of surrounding soil or other matrix material) containing:

- Friable ACM as determined in the field by a CABI through a RACS determination; Previously non-friable ACM(s) that have been rendered friable as determined in the field by a CABI(s) through a RACS determination.
- Non-friable ACM(s) that have a high probability of releasing fibers based on the forces expected to act upon the material during soil disturbance as determined in the field by a CABI(s) through a RACS determination; deteriorated non-friable ACM(s) that are in poor condition resulting in a high probability to release fibers due to weathering, historical mechanical impact, fire damage (by evidence of ACM within an ash layer) or other factors as determined in the field by a CABI(s) through a RACS determination.
- The following broken, resized, or damaged ACM(s) are predetermined to be RACS:
  - Asbestos cement materials
  - o Plaster
  - Brittle caulking, glazing and sealants
  - Powdery Concrete Masonry Unit (CMU) sealant
  - Powdery floor leveling compound
  - o Drywall/wallboard and associated joint compound material
  - o Firebrick
  - Other material as determined by the Department, at the request of the owner or person disturbing debris, to have a high probability to release fibers.
- Soil or ash known to contain non-visible asbestos based on documented evidence.





"RACS Determination" for the purpose of this standard operating procedure means a determination, conducted in the field by a Certified Asbestos Building Inspector (CABI), of the friability of Asbestos Containing Material (ACM) and the probability of non-friable ACM to release fibers based on the condition of the material and the forces that are expected to act on it during disturbance. Determinations of friability shall be based on the requirements for such determinations set forth in Air Quality Control Commission Regulation No. 8 (5 CCR 1001-10, Part B). Determinations of the probability for non-friable ACM to release fibers during disturbance shall be based on the following:

1) The condition of the material prior to disturbance, based on observations of weathering, the integrity of the material, historical mechanical impact, or fire damage;

- 2) The potential for the material to be broken, resized or damaged during planned disturbance;
- 3) The material shall be considered RACS if the planned disturbance includes any of the following:
  - a. Augers
  - b. Rotary style trenchers
  - c. Driving on ACM lying on the surface (vehicles or equipment)
  - d. Blasting or other detonation
  - e. Intentional burning
  - f. Other types of direct mechanical impact which are:
    - i. In direct contact with ACM or result in observation of ACM after disturbance, and
    - ii. Causing damage to the ACM

"**Regulated Work Area**" (RWA) means the portion(s) of a site at which soil disturbing activities involving RACS occur

**"RACS Disturbance**" means activities such as removal, management, or other physical disturbance of RACS

"Soil-disturbing Activities" means digging, excavating, staging, loading, stockpiling, backfilling, compacting, grading, tilling, drilling, intrusive sampling, and equipment or vehicle movement or any other mechanical activity, that when used, disturbs the surface and/or subsurface soil. Disturbance or removal of soil, or soil with debris and/or RACS is considered a soil-disturbing activity. Hand disturbance or removal of RACS is subject to the State Regulation and this standard operating procedure but is not considered to be a mechanical disturbance.

"Staging" means the accumulation of RACS in the RWA for twelve (12) hours or less.

**"Stockpiling"** means the accumulation of RACS that will exist for more than twelve hours, up to and including ten calendar days





**"Storage"** means the accumulation of RACS greater than ten days but not exceeding six months unless a longer timeframe is approved by the Department and DDPHE.

"Visible Emissions" means any airborne or liquid emissions, coming from, or having come into contact with RACS, which are visually detectable without the aid of instruments. Proper disposal of appropriately filtered decontamination water does not constitute a visible emission.

"Visual Inspection" means observation with sufficient proximity to identify discrete visible materials, while maintaining the safety of the inspector.





# 1. Introduction

The City and County of Denver (CCOD) recognizes the need for construction activities to have a wellestablished agreement in place regarding the risks from management of construction projects where soil may be impacted by asbestos-containing materials (ACMs). While these agreements modify traditional construction work practices and required personnel, they do remain consistent with the established Colorado Department of Public Health and Environmental (CDPHE) rules and regulations and current industry standards for the management of regulated asbestos-contaminated soil (RACS). Today's public safety realities are highlighted by the numerous construction projects that encounter RACS, and the need for CCOD and its construction partners to have established field standards that protect public health from exposure to asbestos, and help the projects stay on schedule and on budget. This document has been prepared to be used on CCOD's projects. Implementation of this standard operating procedure on other projects not owned or controlled by the CCOD are in no way the responsibility of the CCOD.

The Denver Department of Public Health and Environmental (DDPHE) and CDPHE have worked cooperatively to develop a solution designed to be followed by any contractor or its sub-contractor when performing soil-disturbing activities (as defined within this standard operating procedure) during excavation at CCOD's construction projects. Initially, the solution establishes standard operating procedures that are intended to be followed during construction projects where activities have disturbed and/or identified non-soil debris within the soil matrix. Additional standard operating procedures are predicated on the type and amount of non-soil debris and coordination with and the approval by the CCOD project manager.

Soil that is not to be disturbed by planned construction on a project will remain in-place. Characterization and remediation of soil not directly disturbed by project activities are beyond the scope of this standard operating procedure, unless specifically directed by DDPHE. If remedial actions are required, additional planning would be conducted under the direction of DDPHE.

# 1.1 Purpose

This standard operating procedure has been prepared to ensure compliance with the Colorado Solid Waste Regulations CCR 1007-2 Part 1, Section 5.5 (Colorado Solid Waste Regulation [CSWR] §5.5; CDPHE, 2014), and provides the procedures for identification, safe handling, transport, and disposal of Non-RACS or RACS that may be encountered during soil-disturbing activities. Provisions of CSWR §5.5, not specifically referenced within this standard operating procedure, must be followed; therefore, any contractor working on CCOD projects must be familiar with both this document, and CSWR §5.5. In the event of any disparity between the two, CSWR §5.5 will supersede provisions included within this document.





This standard operating procedure has been prepared to minimize potential delays, and to develop approved standard procedures that the contractor will implement as needed for future soil-disturbing where Non-RACS and RACS may be encountered. The quick disseminating of critical information to participating parties is key to the proper identification of debris, management of Non-RACS and RACS, and protection of public health and environment.

This standard operating procedure has been approved by the CDPHE (Appendix A) and incorporates by reference CDPHE Regulations Pertaining to Solid Waste Sites and Facilities (6 CCR 1007-2, Part 1), CSWR §5.5 - Management of Regulated Asbestos Contaminated Soils (CSWR §5.5). The Regulation can be found at: <u>https://www.colorado.gov/pacific/cdphe/solid-waste-regulations</u>.

## 1.2 Applicability

The requirements of CSWR §5.5 apply to the owner or operator of any property with RACS at which soildisturbing activities are occurring or planned. The owner/operator may choose to follow the procedures set forth in CSWR §5.5.1(A) and (B) when debris is exposed or disturbed to determine if the debris is RACS. Soil-disturbing activities involving Non-RACS, where no RACS is present or generated, are not subject to the requirements of CSWR §5.5, but Non-RACS must be disposed as non-friable asbestos waste in accordance with the disposal requirements set forth in Section 5.2 of the CSWR, where applicable.

It is the responsibility of the general contractor (contractor), including the contractor's subcontractors, to incorporate this standard operating procedure into a project's scope for identifying debris or other environmental hazards and the subsequent management of that material according to this standard operating procedure and the Materials Management Plan (MMP) (if applicable). Unless otherwise written, separate from this standard operating procedure, it is the responsibility of the contractor to employ appropriate personnel capable of meeting the requirements of this standard operating procedure and CSWR §5.5 during identification and management of all debris and RACS.

Prior to commencing soil-disturbing activities, if there is no visible or documented evidence, such as construction drawings or analytical reports or environmental investigations, of RACS during a soil-disturbing action, the contractor does not have a duty under this standard operating procedure or CSWR §5.5 to sample or otherwise investigate for RACS. However, if RACS or suspect RACS is discovered, the contractor is obligated to follow this standard operating procedure.

This standard operating procedure may be incorporated within a MMP and/or Health and Safety Plan for site-specific safe work practices. Should either of those plans or other site-specific environmental work plans require changes to this standard operating procedure, the contractor shall present a written draft amendment to be reviewed by the CCOD Project Manager (who will coordinate with DDPHE) prior to submittal for review and approval by CDPHE.





## 1.3 Non-RACS vs. RACS

As described in CSWR §5.5 (and the definitions presented in this standard operating procedure):

- Non-RACS is soil or debris that contains intact, non-damaged ACM, or damaged non-friable ACM that does not have a high probability to release fibers as determined by a Certified Asbestos Building Inspector (CABI) (note, additional description provided in the definitions).
- RACS is soil, ash, or debris (plus 6 inches in all directions) containing friable ACM, non-friable ACM that has been rendered friable, or deteriorated ACM that has a high potential to release fibers due to weathering or other processes (note, additional description provided in the definitions).

Essentially, Non-RACS material contains ACM that is unlikely to release asbestos fibers, and RACS is material that contains ACM that is likely to release asbestos fibers. Although Non-RACS is technically not subject to the provisions of CSWR §5.5, disposal requirements still apply per CSWR §5.2. Further, the presence of Non-RACS still requires special attention during management activities, as there is a high potential that RACS and Non-RACS may be co-located at a project, or that management activities may result in Non-RACS releasing asbestos fibers, and thus transforming into RACS.

# 1.4 Project-specific Regulated Asbestos Contaminated Soil Management Plan

As determined by DDPHE, a Project-specific Regulated Asbestos Contaminated Soil Management Plan (PSRMP) may be prepared for individual projects; the PSRMP would detail project-specific RACS management protocols, amended best management practices (BMPs), or other applicable changes to this standard operating procedure. If DDPHE determines that a PSRMP is necessary, the PSRMP would be reviewed and approved by DDPHE then CDPHE, and management techniques may supplant those presented in this standard operating procedure. At a minimum, this standard operating procedure should be utilized a foundation for the PSRMP.

# 1.5 Key Parties and Responsibilities

The following table provides contact and general responsibility information for key parties. A full contacts list may not be established at the beginning of every project. In cases where RACS management will be needed, contact information shall be amended as required.





Party	Contact	Responsibility
CDPHE	Brian Long Phone: 303-691-4033 Email: briant.long@state.co.us	Regulatory Agency – State of Colorado
CCOD – DDPHE	Steve Gonzales Phone: 720-865-5447 Email: steve.gonzales@denvergov.org If no immediate response, call 720-460-1706	Environmental Quality Technical Oversight – City and County of Denver
CCOD Project Manager	TBD	Overall project management of CCOD Project
Contractor	TBD	General Construction; RACS Management
Specialized Abatement Contractor (if applicable)	TBD	RACS Management
Environmental Consultant (CABI, AMS)	TBD	CABI, RACS Oversight and if necessary Air Monitoring Specialist (AMS); discovery notification to CCOD Project Manager and DDPHE, and to CDPHE if approved by DDPHE

#### Table 1Key Parties and Responsibilities

Responsibilities for key personnel are summarized in Table 2, and discussed in detail in the standard operating procedures. Key personnel will be contacted as required, as described in the text of the standard operating procedure.





#### Table 2Responsibilities

	Project Personnel				
Duties per Standard Operation Procedure	Contractor	Sub- contractors	САВІ	Air Monitoring Specialist (AMS)	GAC
Provide Awareness Training			$\boxtimes$		
Receive annual RACS Awareness Training (All Site Personnel)	$\boxtimes$	$\boxtimes$			$\boxtimes$
Receive Project-Specific Annual Asbestos Awareness Training (to enter any Regulated Work Area [RWA] during RACS disturbance)	X	$\boxtimes$	$\boxtimes$	$\boxtimes$	$\boxtimes$
Environmental Consultant Responsibilities			$\boxtimes$	$\boxtimes$	
Handling, Disturbing, Removing RACS	$\boxtimes$	$\boxtimes$	$\boxtimes$	$\boxtimes$	$\boxtimes$
Decontamination of Equipment, Personal Protective Equipment (PPE) and RWA			$\boxtimes$	X	X
Wind Speed Monitoring			$\boxtimes$	$\boxtimes$	
Air Monitoring				$\boxtimes$	
Documentation	$\boxtimes$	$\boxtimes$	$\boxtimes$	$\boxtimes$	$\boxtimes$





# 2. Process Flow and Decision Scenarios

The following process flow and corresponding figures present the more likely scenarios related to the discovery of debris and management of RACS for CCOD's projects, and the decisions to be made for conducting continued soil-disturbing activities under these discovered conditions. Note that these scenarios are general. Each RACS discovery and project is unique, so the actual steps necessary to reasonably respond to a RACS discovery and management may change. Coordination with DDPHE on the most practical management strategy is required when there is reason to believe that RACS is present or is identified.

# 2.1 Scenarios

This standard operating procedure has been prepared to provide guidance for five soil-disturbing scenarios, which are described in detail below.

### 2.1.1 Excavation in Areas with No Debris

This scenario applies when soil disturbance is planned and there are no RACS concerns (e.g., soil that is "clean" with no visible debris) (**Figure 1**). This scenario applies where the contractor has been provided information from the CCOD Project Manager, or has determined for himself, that the project area is not likely to have RACS or Non-RACS present because, through visible inspection or other research, no debris is present. The contractor will then proceed with work as planned, but must be familiar with this standard operating procedure, and must be observant regarding unexpected debris discovery.

### 2.1.2 Excavation in Areas with Non-Suspect Debris

This scenario applies when soil disturbance would occur in areas where Non-Suspect Debris is present [e.g., soil containing pieces of clean concrete (with no associated or attached materials)], but when no Suspect Debris has been identified (**Figure 2**). In this standard operating procedure, the contractor is empowered to make this determination himself. However, if the contractor is unsure of the nature of debris, a CABI should be consulted to provided certainty of the debris identified. Additional information about the classification of debris is presented in detail in Section 4.

### 2.1.3 Discovery of Suspect Debris or Suspect RACS During Excavation

This scenario applies when soil disturbance occurs where Suspect Debris, including RACS, is suspected or encountered unexpectedly (e.g., work within a known historical urban fill area [https://www.denvergov.org/opendata/dataset/city-and-county-of-denver-historical-fill-areas] (Figure 3). There are many areas in the CCOD where uncontrolled fill is present in the subsurface, including historical urban fills, areas where buildings once stood but have since been demolished, areas where





channelization along streams and rivers occurred or where floodplains or gravel pits were filled, or where heavy industries were once present. A key component of discovery is to: conduct interim actions that are described in this standard operating procedure in detail; contact a CABI to make a RACS determination; and, coordinate stabilization, removal actions and required documentation.

### 2.1.4 Excavation in Areas with Known RACS

This scenario applies where soil disturbance is planned in an area where known RACS is present (as confirmed through prior investigation or via a RACS determination by a CABI) (Figure 4). In this scenario, careful planning would be conducted to perform management actions in accordance with this standard operating procedure and CSWR §5.5.

### 2.1.5 Subsurface Investigations

This scenario applies when soil disturbance is conducted related to subsurface investigations, including environmental, geotechnical or utilities (Figure 5). These investigations are generally small in scale, where a drill rig may be used to drill a small-diameter hole to evaluate geologic conditions; a small test pit/trench is excavated to visually assess subsurface conditions (primarily in the investigation of Suspect Debris conditions); or a vacuum truck/water knife is used to locate a utility line. Detailed analysis of the RACS management strategies are presented in Section 5.1.5 of this standard operating procedure. Note, if a utility investigation utilizing a vacuum truck/water knife is proposed in a known historical urban fill site and/or area with known RACS or Suspect Debris, additional project-specific planning will be necessary BEFORE work is initiated as there is a high potential that equipment may become contaminated. Coordination with DDPHE will be required.













#### Figure 2 Excavation in Areas with Non-Suspect Debris



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#### Figure 3 Discovery of Suspect Debris or Suspect RACS During Excavation



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# 3. General Requirements

The following sections describe general requirements for the management of RACS.

## 3.1 Training for Site Personnel

As described in CSWR §5.5.3, personnel overseeing, directing, inspecting, and/or handling RACS (including suspect asbestos) and all personnel inside the Regulated Work Area (RWA) during the disturbance of RACS, shall have annual asbestos awareness training, and provide documentation to the CABI.

Personnel who enter the RWA during disturbance of RACS will receive project-specific training by a CABI familiar with this standard operating procedure and CSWR §5.5, as well as the project. This includes drivers of trucks carrying contaminated material for off-site disposal. The training will cover the provisions of this standard operating procedure, as well as the following:

- Background of asbestos, including health effects
- Overview of the requirements of CSWR §5.5 and this standard operating procedure and its implementation
- Recognition of Suspect Debris that may contain asbestos and which requires further evaluation by a CABI
- Overview of Non-Suspect Debris, Suspect Debris, RACS, and Non-RACS, and standard operating procedure protocols for each
- Controls and notifications to be followed when debris that may contain asbestos is encountered
- The nature of operations that could result in exposure to asbestos fibers
- Spill prevention and contamination reduction techniques
- Proper use, handling, and disposal of PPE
- Respiratory protection levels required for various activities and conditions
- Engineering controls and other measures to prevent contact with contaminants
- Engineering controls to prevent visible emissions from leaving the RWA
- Personnel and equipment decontamination and the establishment of decontamination stations
- Emergency procedures





- Project chain-of command and identification of authorized personnel with stop-work authority
- Hands-on training specific to the soil-disturbing activities the individual will be performing subject to CSWR §5.5.

Records of this training will be retained by the CABI, and will be available for inspection for the duration of the project for which the training is conducted.

# 3.2 Health and Safety

There is a potential for increased risk to the health of workers during disturbance/removal of RACS. Awareness by site personnel of these hazards is of the highest priority. Therefore, a site-specific Health and Safety Plan will be developed by the contractor prior to any RACS management. Site personnel will be provided with a copy of the Health and Safety Plan for review, and will be required to sign a form stating that they are aware of, agree to, and understand the requirements of the plan. The contractor will be required to employ the proper personnel, and PPE, to provide a safe working environment for its employees, consultants and subcontractors.

# 3.3 CABI and AMS Requirements

When a *Discovery of Unknown Suspect Debris or Suspect RACS,* or *Known RACS* is present, a CABI who meets the training, certification, and experience requirements of CSWR § 5.5.3(D) (and an Air Monitoring Specialist [AMS] if a RWA is required) shall be on-site on a full-time basis during all soil-disturbing activities, to physically observe and monitor the air and site conditions and provide information to the contractor to help limit and avoid asbestos fiber release. The CABI and AMS can be the same person if she/he meets the CABI and AMS requirements listed below. Ideally, the CABI and AMS will be the same person. Depending on site conditions and scope, more than one CABI, AMS, or both may be required.

When a *Discovery of Suspect Debris or Suspect RACS,* or *Known RACS,* is present, the CABI(s) will be responsible for the following:

- Have all current applicable training certificates and State of Colorado Certification(s) in accordance with the CDPHE-Air Quality Control Commission (AQCD Reg. 8) and Hazardous Materials and Waste Management (HMWMD) regulations to be a CABI (CSWR § 5.5.3 (D)).
- Be on-site on a full-time basis and continuously observe all soil disturbing, excavation, and loading activities.
- Identify if suspect RACS is present.
- Complete necessary sampling of suspect asbestos, and make RACS determination(s).





- Complete CABI Work Day Documentation Form (Appendix B), thoroughly detailing site activities as presented in Section 8 Close Out Report.
- Maintain all pertinent documentation related to adherence of the standard operating procedure, including sampling results, air monitoring data, waste manifests, photographs, etc.
- Inspect the RWA and equipment after removal of RACS to evaluate whether remaining ACM is present on the surface or on equipment.
- The CABI will have "Stop Work" authority if it is believed that work is being performed outside the guidelines of this standard operating procedure or of CSWR §5.5, or if actions harmful to life and health, or the environment, are observed; the CABI will not be responsible for consequential damages for any work stoppage, including real or perceived harm, including lost productivity, that may result.
- Notification of RACS disturbance to CDPHE on behalf of the contractor.
- Updates to CCOD Project Manager and CDPHE on contractor decisions regarding RACS management.
- Notification of deviations from this standard operating procedure to the CDPHE (note: deviations from this standard operating procedure and/or CSWR §5.5 will require approval by DDPHE and CDPHE; deviations may be addressed through preparation of an amendment to this standard operating procedure, PSRMP, or other means as approved).
- Monitor and log wind speed and direction during soil disturbing activities.

If RACS management is required by Section 7.2.5 of this standard operating procedure or CSWR §5.5, the AMS(s) will be responsible for the following:

- Have all current applicable training certificates and State of Colorado Certifications in accordance with the CDPHE-AQCD regulations to be an AMS (Air Quality Control Commission Regulation No. 8 (5 CCR 1001-10, Part B).
- Be on site on a full-time basis during disturbance, excavation, and loading of RACS.
- Monitor RWA during removal and disposal of RACS for compliance of this plan.
- Place and monitor air samples on site and around RWA during soil-disturbing activities.
- Monitor and log wind speed and direction during soil disturbing activities.
- The AMS will have "Stop Work" authority if it is believed that work is being performed outside the guidelines of this plan or of CSWR §5.5, or if actions harmful to life and health, or the environment, are observed; the AMS will not be responsible for consequential





damages for any work stoppage, including real or perceived harm, including lost productivity, that may result.

• Submitting an Emission Control Plan for each detection of asbestos by TEM analysis as required by CDPHE in accordance with CSWR § 5.5.7 (E)(2)(f)(i)(ii) & (iii).

### 3.4 Contractor Requirements

The following contains requirements for the contractor performing RACS disturbance/removal:

- The contractor shall provide documentation to the CABI and CCOD that all individuals performing RACS-disturbing activities have completed a project-specific awareness training that provides information necessary to perform their duties in a way that ensures compliance with the requirements of the CSWR §5.5. If the contractor cannot provide this documentation, then the applicable training will be conducted by the CABI.
- The contractor shall ensure that individuals performing RACS-disturbing activities have completed asbestos awareness training in accordance with Occupation, Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1926.1101(k) Communication of Hazards (9)(10).
- Records that document the training, experience, or certification requirements in CSWR §5.5. Documents shall be available on-site for review throughout the duration of soil-disturbing activities.
- The contractor will be required to prepare and implement a Health and Safety Plan in accordance with the applicable regulations, including OSHA. The contractor will be responsible for the health and safety of its employees, subcontractors, consultants, etc., as well as provide all necessary training and PPE for completion of work.
- The contractor will be responsible for maintaining all necessary site controls to prevent unauthorized entry into the RWA in accordance with Section 5.2 of this standard operating procedure, and with CSWR § 5.5.7(A) "Establishment and Control of a Regulated Work Area (RWA)".
- The contractor will be responsible for adherence to this plan at the direction of the CABI/AMS. The CABI/AMS will be completing air monitoring in accordance with Section 7.2.5. Based on the air monitoring results, the CABI/AMS will direct the contractor to institute additional BMPs, if necessary, to eliminate fugitive dust emissions or visible emissions.

The following contains requirements for the contractor performing any soil disturbing activity:





## 3.5 Notifications

The Notification of RACS Disturbance form (Appendix C) must be submitted to CDPHE prior to commencing work in planned RACS management or within twenty-four (24) hours of unexpected discovery of RACS areas. The notification shall indicate which management approach will be utilized per the project's soil-disturbing scenario as presented in Section 2 of this standard operating procedure:

- Use this standard operating procedure (and note what, if any, deviations are proposed [with DDPHE approval]); or
- A project-specific PSRMP (with DDPHE approval); or
- Standard Requirements of CSWR §5.5 (with DDPHE approval).

Planned RACS disturbance shall not commence until approval has been granted by CDPHE. Notification must have the approval of the CCOD Project Manager and DDPHE must be notified before any notification is submitted to CDPHE. Notification is not required when only sampling debris for ACM content by a CABI.

For all soil-disturbing activities where the contractor or subcontractor will perform RACS management:

- Within twenty-four (24) hours of **unplanned** RACS discovery, the contractor or CABI shall submit a Notification of RACS Disturbance form (Appendix C) to CDPHE indicting that the project will be using the RACS management steps as detailed in this standard operating procedure.
- Ten (10) days prior to start of RACS disturbance for **planned** RACS management, the contractor or CABI, shall submit a Notification of RACS Disturbance form (Appendix C) to CDPHE indicting that the project will be using the RACS management steps as detailed in this standard operating procedure.
- Notification of RACS Disturbance form shall be emailed to CDPHE address on the form, and copied to the CCOD Project Manager and DDPHE contact.
- Maps, figures, drawings, or other applicable information shall be included with the Notification of RACS Disturbance form.
- In the event of an emergency (a condition which is immediately dangerous to life or property; e.g., broken water main, broken gas line) in which a soil-disturbing activity must continue or commence at once, notification shall be made as soon as possible, but within 24 hours of identifying or assuming the presence of RACS within the soil-disturbing area. During the initial response to the immediate emergency, the standard requirements of RACS management in accordance this standard operating procedure shall be implemented to the extent possible. Within 48 hours, any disturbed and/or exposed RACS shall be managed in accordance with this standard operating procedure.





RACS management must be approved by the CCOD Project Manager prior to commencing ongoing soil-disturbing activities involving RACS. Exceptions would be RACS inspection, stabilization, and necessary decontamination activities. Any planned changes to this standard operating procedure must be approved by the CCOD Project Manager, DDPHE, and CDPHE prior to commencing RACS disturbance activity.

## 3.6 Soil Reuse

In some circumstances, an MMP will be prepared for a project. Soil reuse, and management of soil not impacted by RACS, should be followed in accordance with the MMP. If an MMP is not available, coordination with DDPHE, and potentially CDPHE, may be necessary. Regardless, all CCOD projects must follow the DDPHE *Guidance for Reuse of Soil on City Projects*. Some general requirements (but not all requirements) are described as follows:

- If the soil generated at a project would be reused at a third-party property, coordination with DDPHE will be required, as well as other requirements noted in the *Guidance for Reuse of Soil on City Project*, which define soil quality and analytical requirements.
- Soil that is proposed for reuse at a CCOD-owned park must meet the requirements defined for Unrestricted Reuse, and cannot contain any debris (Suspect or Non-Suspect).
- Soil that is not to be disturbed by planned construction on the project will remain in-place, regardless of its reuse classification. Characterization and remediation of soil not directly disturbed by project activities are beyond the scope of this standard operating procedure, unless specifically directed by DDPHE. If remedial actions are required, additional planning would be conducted under the direction of DDPHE.
- No debris (including Non-Suspect), RACS, or impacted soil may be left exposed at final grade surfaces. Depending on the conditions discovered, it may be necessary to over-excavate these materials 12 inches or more (18 inches minimum if RACS is present), and backfill with clean soil to the final grade (see Section 5.1 of this standard operating procedure).
- No soil containing debris, whether Suspect or Non-Suspect, may be reused onsite or offsite. There may be certain circumstance where approval may be obtained, but only through coordination with DDPHE, and possibly with CDPHE, in accordance with applicable regulations.
- All soil destined for landfill disposal, including RACS managed according to this standard operating procedure, must be disposed under proper waste characterization and waste profiling procedures at the Denver-Arapahoe Disposal Site.





# 4. Debris Identification

The contractor and/or sub-contractor(s) to the contractor, while performing soil-disturbing activities under this standard operating procedure, shall have the responsibility of inspecting all soil-disturbing activities through continuous visual inspection for the presence of Suspect Debris or Non-Suspect Debris. All visible debris will have a debris determination as **non-suspect for ACM** (Non-Suspect), or **suspect for ACM** (Suspect). The contractor/sub-contractor shall follow the directions given in this standard operating procedure related to findings and debris classifications. If the contractor/sub-contractor is unsure of a classification or unable to make this classification, the contractor/sub-contractor shall contact a CABI to assist in the final classification of soil and/or debris, or contact DDPHE.

The contractor and/or sub-contractor shall evaluate any debris encountered to see if it meets the parameters of Section 4.1 of this SOP and CSWR § 5.5.2 (H) & (I) during all soil-disturbing activities. To ensure an accurate evaluation is made, any contractor and/or sub-contractor performing any soil-disturbing activities while operating under the provisions of this SOP and not identified as a General Abatement Contractor, shall be required to have all project field personnel complete a general RACS awareness training as detailed in CSWR § 5.5.3 (A) annually. This training is required to be presented by a CABI that meets the training and experience requirements of section CSWR § 5.5.3 (D) and will specifically address all necessary protocols and actions for debris identification regarding sections 4.1 and 4.2 of this SOP. Furthermore, the contractor and/or sub-contractor shall document their debris evaluation(s) and debris encounters(s). Debris documentation and training records shall be made available at upon request by CCOD and/or CDPHE.

## 4.1 Debris Classified as Non-Suspect for ACM

Materials will be defined as **non-suspect for ACM** when it meets the following criteria:

- The material is soil only, where there are no visible signs of construction debris at the point of soil disturbance; or
- Soil that contains the following non-suspect debris:
  - Metal with NO associated materials on it (e.g. sealants, insulation, adhesives, etc.)
  - o Glass with NO associated materials on it (e.g. caulking, glazing, sealants, etc.)
  - o Plastic with NO associated materials on it (e.g. sealants, adhesives, etc.)
  - Wood with NO associated materials on it (eg. drywall, plaster, adhesives, caulking, etc.)
  - Concrete bare, with NO associated materials on it (e.g sealants, adhesives, waterproofing, tars, floor tiles, etc.)
  - Plant material, including plant wastes from the food processing industry and vegetative food waste
  - Yard trimmings





- Untreated wood wastes
- Non-industrial and non-insulative paper products (e.g., newspaper, magazines, food wrappers)
- Debris that has been evaluated during a project-specific subsurface investigation, and has been determined by a CABI as Non-Suspect (documentation must be maintained on the project at all times); special caution is recommended, as subsurface conditions in areas where filling has been conducted can be highly variable, and unexpected discoveries may be identified
- Or other material as approved by CDPHE

### 4.2 Debris Classified as Suspect for ACM

The contractor shall classify all other debris types not specifically listed as non-suspect for ACM above, as **suspect for ACM**, and therefore must have a RACS determination completed by a CABI following the definitions sections of this standard operating procedure and CSWR §5.5, or be assumed to be RACS and managed in accordance with this standard operating procedure (with approval from DDPHE).

Soil or ash known to contain non-visible asbestos fibers, based on documented evidence such as construction drawings or analytical reports, is RACS, and if exposed during a soil-disturbing action, shall be managed in accordance with this standard operating procedure.

Because ash can contain burnt building debris that contains asbestos materials, it is automatically assumed to be RACS. However, it can be evaluated by a CABI (including through laboratory analysis), to be non-ACM during the RACS determination.





# 5. Initial Actions and Stabilization for RACS Discovery

This section describes the immediate and interim actions that will be implemented by the contractor if he identifies debris that is classified as **suspect for ACM**. When Suspect Debris is discovered during soil-disturbing activities, the critical requirements are: 1) **avoid generating dust and avoid being in direct contact with airborne soil emissions**, thereby limiting potential exposure to asbestos fibers; and 2) **stabilize the discovery**. Each Suspect Debris encounter scenario will vary; however, the following general processes must be followed:

- Stop all soil-disturbing activities around the discovery until a CABI's RACS determination can be made that has been reviewed by DDPHE.
- Remove all contractor personnel out of the Suspected Debris area.
- Contact DDPHE, and CCOD Project Manager, of the discovery to coordinate next steps.
- A layer of 6-millimeter (mil) polyethylene (poly) sheeting may be used to prevent crosscontamination onto clean soils during initial characterization activities by placing the poly on the ground and then placing the potentially contaminated soil, which has been adequately wetted, directly on the poly.
- Poly will be used to cover the suspect materials to prevent cross-contamination and spreading; care should be taken to make sure the poly will remain attached to the ground, even in high-wind conditions.
- Wet the area immediately surrounding the suspect RACS with water, prior to performing sampling activities that disturb the material (note: visual inspection does not require wetting). Maintain wet conditions throughout sampling activities.
- Isolate the area where the discovery has been made to prevent worker or public exposure and cross-contamination. It may be necessary install fencing or other measures to preclude such access.
- Coordinate with CABI to perform a RACS determination within 24 hours.
- The CABI will evaluate if personnel decontamination is required and advise accordingly.
- The CABI should evaluate equipment for the need for decontamination, and advise accordingly.
- The CABI will collect samples of the suspect RACS according to procedures provided in this standard operating procedure (Section 6).
- If leaving the site unattended, cover the disturbed soil with a layer of 6-mil poly sheeting, or spray with magnesium chloride solution (or equivalent) in sufficient amounts to adequately





wet the soil to prevent dust generation. The contractor shall implement control mechanisms to prevent unauthorized or unintended contact with the material (e.g., install fencing).

• After confirmation of RACS by the CABI, the CABI, in coordination with DDPHE, will direct the contractor on proper implementation of this standard operating procedure.

## 5.1 Temporary Stabilization Procedures

Any contractor who exposes RACS during a soil-disturbing activity, but does not disturb or come into contact with the RACS debris, such as a side-wall or bottom of excavation, and determines to have the RACS remain in place, shall have it covered or stabilized using one of the following methods:

### 5.1.1 Horizontal Excavation Faces (Excavation Floors)

- Cover RACS with geofabric, followed by eighteen (18) inches of fill suitable for unrestricted use, and vegetation; or
- Cover RACS with geofabric, followed by six (6) inches of fill suitable for unrestricted use, and concrete or asphalt.

### 5.1.2 Vertical Excavation Faces (Excavation Side Walls or Trenches)

- Cover RACS with geofabric, followed by fill suitable for unrestricted use to grade or six (6) inches, whichever is greater; or
- Alternate cover designs as approved by the CCOD Project Manager and CDPHE.

### 5.1.3 Standard Requirements for Temporary Sub-Surface Stabilization of RACS.

Any contractor who excavates RACS during a soil-disturbing activity, where it is decided that RACS will be put back into place for a future planned RACS removal not to exceed six (6) months, shall comply with the following

- RACS may only be placed within the Area of Contamination (AOC) that it was originally removed from; and
- Placement and stabilization of RACS shall utilize standard RACS management requirements in accordance with Section 5.1.1 of this standard operating procedure; and
- Provide DDPHE with a plan to coordinate with the CDPHE on how DDPHE/CCOD will track the 6-month time storage of RACS.





### 5.1.4 Standard Requirements for Permanent Stabilization of RACS

Except as provided in Section 5.5.1(D)(5) of CSWR §5.5, a contractor who disturbs or exposes RACS shall make the decision upon the initial discovery of RACS to either manage the RACS in accordance with Section 7 of this standard operating procedure, or cease soil-disturbing activities and permanently stabilize the disturbed or exposed RACS to control the release of asbestos fibers in accordance with one of the following:

- Cover RACS with geofabric, or equivalent visible and physical barrier, and restore the site to pre-disturbance conditions using fill suitable for unrestricted use; or
- Cover RACS with geofabric, or other equivalent visible and physical barrier, followed by eighteen (18) inches of fill suitable for unrestricted use, and vegetation; or
- Cover RACS with geofabric, or other equivalent visible and physical barrier, followed by six (6) inches of fill suitable for unrestricted use, and concrete or asphalt; or
- Cover RACS with geofabric, or other equivalent visible and physical barrier, followed by fill suitable for unrestricted use to grade for vertical excavation faces or trenches; or
- Alternate cover designs as approved by CDPHE.
- Determinations as to what materials would constitute an equivalent visible and physical barrier replacing geofabric shall be made through consultation with DDPHE and CDPHE.

All procedures shall follow standard requirements for RACS management as per Section 7 of this standard operating procedure.

### 5.1.5 Standard Requirements to Stabilize Investigation-Derived Waste

During the process of investigating or examining subsurface conditions during project design, Suspect Debris (debris classified as suspect for ACM) may be found. Investigations may include: geotechnical or environmental investigations (generally using continuous-flight augers advanced by a truck-mounted drill rig); environmental investigations utilizing excavated test pits or test trenches, utilizing an excavator or backhoe; or utility investigations using a water knife and vacuum truck to locate buried utilities. After investigation or examination, the soil generated during the investigation may be placed back into the subsurface area of origination (e.g., soil boring or test pit from which the material came). The following provisions shall apply:

- Subsurface Suspect Debris locations will be documented and can be made available to CDPHE upon request.
- Only soil generated during the subsurface investigation, at the location of origination, may be placed back into the subsurface.





- Upon discovery of Suspect Debris, drilling or excavation activities will cease. If a CABI is present, the material will be sampled, and the remaining Suspect Debris will then be placed directly back into the point of origination, at the deepest depth as practicable.
- Suspect Debris shall be placed at the bottom of the excavation (boring or test pit), and then covered with clean over-burden soil. At least 12 inches of clean soil must cover Suspect Debris. If a CABI is not present when suspect material is first identified, investigation and replacement of soil may not continue until a CABI is present for the remainder of investigation.
- In lieu of stabilization, Suspect Debris and the surrounding 12 inches of soil can be removed, and then managed and disposed as RACS in accordance with this standard operating procedure.
- If a utility investigation utilizing a vacuum truck/water knife is proposed in a <u>known</u> <u>historical urban fill site and/or area with known RACS or Suspect Debris</u>, additional project-specific planning will be necessary BEFORE work is initiated as there is a high potential that equipment may become contaminated. Coordination with DDPHE will be required.
- The contractor completing the investigation work must report to DDPHE Suspect Debris discoveries, including the location, depth, and disposition of the material. These findings will be used to determine applicable actions during the implementation/construction of the project.
- No additional stabilization or management of Suspect Debris, including RACS if confirmed, is required after these steps have been completed.
- The CABI will evaluate the need to decontaminate personnel and/or equipment, and advise accordingly.
- Information collected during the investigation shall be made available to the CCOD Project Manager and DDPHE, who will consider design strategies during the project design to avoid, minimize, or mitigate (via this standard operating procedure) RACS during project construction.
- Notification to the CDPHE of an unexpected discovery is required if stabilization procedures and documentation to DDPHE are performed in accordance with this standard operating procedure.




## 5.2 Site Access Control

The contractor will be responsible for maintaining effective project access control by establishing and taking measures to prevent access to the RWA (or areas where discoveries have been made and are being evaluated) by unauthorized persons. A fence should be erected around the perimeter of the project area to limit access to the site. Instances of unauthorized access not under the control of the contractor shall be evaluated to determine if additional access controls are warranted. The unauthorized access, and the response actions taken, shall be documented and provided to the CDPHE within 48 hours of the incident. Access will be limited to individuals that are approved to be on site.

If RACS is encountered/confirmed, the contactor will install proper signage stating the area is a RWA because of the presence of asbestos, and that the area is off-limits to unauthorized personnel. Personnel working on the site shall be advised and directed not to disturb areas where suspected or known asbestos is encountered. Personnel driving onto the site shall be notified of suspect or known asbestos locations and directed to not drive on or disturb those areas. At no time will vehicle traffic be allowed on surfaces where samples have shown positive test results, or where visible asbestos is present, or where untested suspect materials are located. This excludes equipment that is to remain off the road and on the project area for removal operations. Project equipment/vehicles moving across contaminated soils must do so in a way as to not generate visible emissions, and the soil shall be wetted to control visible emissions. Equipment/vehicles that come into contact with RACS will require decontamination as per section 7.2.7 of this standard operating procedure.





# 6. Suspect Asbestos Bulk Sampling

If Suspect Debris (which is suspect for ACM) is visually identified, the following steps will be applied to sample and analyze potential ACM by the CABI (only a CABI who meets the requirements discussed in Section 3.3 of this standard operating procedure may collect samples to determine asbestos content). Additional information is presented in Appendix D (CSWR §5.5 – Appendix 5A). All sampling and analysis shall be conducted in accordance with CSWR §5.5 – Appendix 5A.

- Samples of suspect asbestos material will be placed in appropriate sample containers such as sample bags or jars.
- Care should be taken to ensure that suspect asbestos material is adequately wetted to prevent visible emissions during the sampling process.
- Bulk samples shall be collected by homogenous type based on color, pattern, texture, thickness, associated materials, or by other identifying characteristics.
- The quantity and location of a suspect material shall be used to determine the number of bulk samples required to characterize the asbestos content of each homogeneous suspect material. For the purpose of determining that a homogeneous suspect material does not contain asbestos:
  - A minimum of three bulk samples shall be collected from the homogeneous material, unless there is insufficient material to constitute three samples.
  - If one of the collected samples of a homogeneous bulk material is determined to be ACM, then the homogeneous material shall be considered ACM.
- A field sampling form or log book entry will be maintained for each sample obtained. The form or log book entry will include the location using a hand-held global positioning system (GPS) instrument, date and time of each sample, depth below the ground surface the sample was identified, description of the type of material, assessment of friability of the material, and other observations made.
- Proper chain-of-custody procedures will be followed for all samples collected.
- Samples of newly discovered suspect asbestos materials will be analyzed by a National Voluntary Laboratory Accreditation Program (NVLAP)-accredited laboratory by Polarized Light Microscopy (PLM) methodology to determine if any asbestos fibers are present.
- Suspect materials not sampled according to these procedures must be assumed to be ACM and managed as such.





# 7. RACS Management

Through coordination with the CCOD Project Manager and DDPHE, the contractor may be retained to conduct RACS management. CCOD will require that the contractor, in coordination with the CABI/AMS, utilize management strategies that are protective of human health and the environment, meet the CSWR §5.5 requirements, and provide the best value to the CCOD. A detailed scope of work detailing how this standard operating procedure will be implemented, including costs, will be required prior to initiating RACS management.

A specialized asbestos abatement contractor may also be retained to conduct these services. Any entity who wishes to engage in RACS management must understand the intricacies of the CSWR §5.5 regulation, the materials, the risks, and management of the material. Due to the complexity of the work, it is highly encouraged that only experienced contractors conduct RACS management activities. The CCOD Project Manager and DDPHE will evaluate the experience and qualifications of the contractor conducting RACS management prior to implementing RACS management on a project through review of the detailed scope of work and other qualifications, as requested.

Two standard RACS management strategies are provided in this standard operating procedure, which are described in this following text. The Hand Removal strategy may be effective where small amounts of RACS (or Non-RACS) is likely to be found. The mechanical removal strategy may be effective where large amounts of RACS (or Non-RACS) is likely to be found. Again, the CCOD Project Manager, DDPHE, and the key parties should thoroughly evaluate site conditions before determining the appropriate RACS management strategy. Some projects may use both strategies at different times as the most effective way to manage RACS.

# 7.1 Hand Removal

During this action, the CABI will direct the contractor (or perform themselves) in the removal of these pieces of suspect or confirmed ACM (including RACS and Non-RACS) using the procedures listed below:

- The CABI will conduct a visual inspection of area and surrounding surface for the presence of suspect or confirmed RACS.
- Establish the RWA according to Section 7.2.1 (an RWA is not required if the material is determined to be a Non-RACS).
- Adequately wet the suspect or confirmed RACS and surrounding soil (12 inches) with amended water containing a wetting agent, such as a 50:50 mixture of polyoxyethylene ester and polyoxyethylene ether.
- Gather the RACS and remaining 12 inches of surrounding soil and place into double-bagged, 6-mil poly bags.





- The CABI will then complete a second visual inspection of the area and surrounding surface where minimal material was discovered to safeguard that no further RACS is in the scope area.
- If the CABI encounters further material after removal of the original discovery in which hand removal is not practical or effective, mechanical removal methods inside a RWA should be implemented.
- If RACS remains as part of the scope, it shall be managed according with Section 5.1.4 of this standard operating procedure.
- Dispose of waste in marked, 6-mil poly bags with attached generator labels in accordance with the CSWR §5.
- Hand-removed, bagged RACS waste may be stored in a leak-tight and secure container labeled for asbestos, and disposed in accordance with CSWR §5. Bagged RACS may not be stored for more than 10 days without a CDPHE-approved RACS storage plan.
- Asbestos worker and equipment decontamination shall be performed in accordance with Section 7.2.7.

Where there are minimal amounts of RACS/Non-RACS discovered as described above, the CABI may conduct the removal actions as stated in this standard operating procedure, and the utilization of an abatement contractor is not required (although an abatement contractor may provide trained asbestos workers to complete removal actions under the supervision of the CABI).

This method may also be applicable where other contaminants are present in soil (such as heavy metals or petroleum hydrocarbons), which are being managed in accordance with a MMP. During mechanical removal actions of special solid waste, the CABI must carefully (and safely) observe soil during the excavation process, prior to the material being loaded into trucks, to ensure that RACS is not overlooked. It may be necessary for the contractor to remove soil, carefully spread on the ground where it may be adequately visually inspected by the CABI (wetting as needed so there is no visible dust), and then re-excavate the material and place in dump trucks for landfill disposal. In no event may excavated soil that contains non-soil debris of any kind (Suspect or Non-Suspect) (e.g., non-ACM bricks, concrete, ceramic) be reused at an off-site location, whether if the property is owned by CCOD or not. These soils must be disposed at the Denver-Arapahoe Disposal Site (3500 South Gun Club Road, Aurora, Colorado 80018) as a special solid waste according with the MMP and CCOD's soil reuse policy (Section 3.6).

## 7.2 Mechanical Removal

Mechanical removal of RACS is often the safest and most cost-effective method of RACS management, particularly where large quantities of RACS/ACM is present, or is expected to be present.





### 7.2.1 Establishing a RWA after Confirmed Discovery of RACS

The contractor, under the direction of the CABI, will be responsible for establishing any RWA(s) for discovered RACS the CABI identifies, which will be removed, as follows:

- Establish a visible perimeter around the discovered material, which is identifiable to all persons on site, to prevent cross contamination. Demarcate area suspected of containing RACS with barrier tape, or other means, and provide access control.
- Post-labeling and signage to demarcate RWA(s). The RWA shall be demarcated with a visual means that defines the full extent of the RWA. Labeling and signage shall indicate the potential presence of asbestos, and that the area is off limits to unauthorized personnel.

#### 7.2.2 Engineering Controls

#### 7.2.2.1 Initial Minimum Controls

Minimum engineering controls will be implemented when excavations occur within the footprint of the RWA. The minimum engineering control include, but are not limited to, the following:

- A CABI must observe each area where soil disturbing or loading activities are taking place; therefore, if multiple excavations are occurring simultaneously, a CABI must be available to visually inspect each excavation location (i.e., utilize multiple CABIs).
- The CABI(s) will be on site at all times that RACS is being removed to ensure that no visible emissions are generated at any time during soil-disturbing activities. Additionally, the CABI will verify that the soil moisture is sufficient during removal to suppress dust, and to ensure that the material is adequately wet. If visible emissions are observed, then work practices will be modified.
- Stockpiled soils will be stabilized using the application of water or magnesium chloride, and/or by covering with overlapped poly sheeting or appropriate cover/stabilization.

#### 7.2.2.2 Wind Break Barriers

As needed, wind break barriers should be constructed prior to commencement of removal activities, and constructed of materials appropriate to site conditions. Ultimately, wind break barriers will be the responsibility of the contractor. It is recommended that the wind break barriers be relatively portable and adequate to minimize soil dispersal from the work area. The wind break barriers will be placed to completely encompass the work area and loading area, as this will assist to prevent uncontrolled access to the work area by unauthorized personnel during and after work shifts.





#### 7.2.3 RACS Disposal Procedures

#### 7.2.3.1 Mechanical Removal/Disturbance of RACS from a Regulated Work Area

- Removal and disturbance of RACS will be conducted utilizing a direct-load system. RACS and its associated required removal quantities will be removed adequately wet and transported directly to DADS. Trucks will be prepared prior to loading by installing at least one leak tight 6-mil layer of poly as a liner (for non-friable RACS), or at least two layers of leak tight 6-mil poly (for friable RACS). The liner(s) will be installed such that under normal conditions, it (they) will not rupture during loading, transportation, and disposal. The poly liners will be sealed at the opened ends for transport with mechanical fasteners (i.e., tie wire, zip-ties, etc.).
- The project will have the option for all loads, based on continuous visual inspection and documentation by a CABI, to be determined to contain less than one percent (by volume of the load or container) of friable RACS, non-friable RACS or assumed ACM debris. In these cases, the loads shall be packaged and disposed of with one leak tight 6-mil layer of poly as a liner. If debris is assumed to be ACM, continuous CABI visual inspection is still required to determine if the amount of RACS remains below 1% of the disposal load.
- An area to load the trucks with RACS will be prepared as close to the RWA as possible, allowing safe access in and out of the site. A layer of 10-mil poly will be placed on the ground as a loading pad to capture potentially spilled RACS and immediately cleaned or replaced if any spillage or damage to the liner occurs.
- Standard erosion control BMPs must be established by the contractor to prevent stormwater run-on/off for the duration of the loading and transportation activities.
- Spill prevention measures, as outlined in CSWR §5.5.7(G), will be incorporated during loading of the RACS to prevent cross-contamination of adjacent areas. Specific measures include;
  - Protect surfaces of loading, transport or container equipment not meant to be in direct contact with RACS materials. Should these surfaces come into contact with RACS, they shall be decontaminated per section 7.2 of this standard operating procedure;
  - Do not overfill the excavator or loader bucket and return the bucket to a closed position prior to moving from the loading point;
  - Replace protective coverings when worn or damaged in order to prevent breaches;
  - Control runoff in order to prevent cross contamination outside of the RWA from water containing asbestos.
- Spilled RACS shall be treated as an RWA and cleaned up immediately in accordance with CSWR § 5.5.7 (J). It will not be allowed to dry out or accumulate on any surface. The





Department's Hazardous Materials and Waste Management Division shall be notified, through the spill reporting hotline, in the event that spills of RACS cannot be cleaned up within 24 hours of spill identification.

- Where there are breaches in ground coverings that have the potential to allow water contaminated with asbestos to impact the material below the covering or surfaces that are contacted by asbestos-contaminated water, a minimum of three (3) inches of soil, or other matrix material, shall be removed.
- If ground coverings are placed on top of a durable surface such as concrete or asphalt, the surface shall be decontaminated using wet methods, followed by CABI inspection that all soil and debris has been removed from the surface.
- Rinsate, runoff, or any other water that has come into contact with RACS shall be considered to be asbestos contaminated water and shall be collected. However it cannot be for discharge to a sanitary sewer or other Department-approved disposal facility. It may be re-applied to RACS that will be stabilized and managed under this SOP.
- Surfaces that are contacted by asbestos contaminated water can be permanently stabilized as per Section 5.1.4 of this standard operating procedure.
- Trucks carrying friable RACS (friable material over 1% by volume of the disposal load) must be labeled in accordance with the requirements of CSWR §5.5 using one of the following legends in type at least five inches tall:

# CAUTION CONTAINS ASBESTOS AVOID OPENING OR BREAKING CONTAINER BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH

## DANGER CONTAINS ASBESTOS AVOID CREATING DUST CANCER AND LUNG DISEASE HAZARD

- Non-friable RACS will be labeled "Asbestos, Danger" along with the name of the generator during transport.
- The contractor will be responsible for Department of Transportation protocols and labeling for transportation of RACS.

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- It is likely that an excavator or front-end loader will be utilized for RACS removal, disturbance, management, and loading. During all soil-disturbing activities involving RACS, adequate wetting of soils will be performed. At least one water hose operator is required at each excavation, and other means may be employed to ensure that RACS is adequately wet (e.g., misting bars, additional hose operators).
- The equipment operator(s) will load the RACS directly into the pre-lined truck; the truck drivers will not be allowed to exit the trucks during loading operations and will be required to keep their windows closed and air handling systems off while their trucks are being loaded.
- The excavation bucket will not be filled greater than 2/3 its capacity to avoid overfilling and spilling.
- The CABI will continuously observe excavation and loading operations to verify that adequate wetting has taken place and that no visible emissions occur, and that compliance to this standard operating procedure is adhered to.
- During mechanical removal, if the CABI observes solid waste material (e.g., Non-Suspect material as described in Section 4.1), with no visible evidence of suspect ACM, and there is sufficient quantity, the CABI and contractor may elect to segregate this material for disposal as non-ACM.

#### 7.2.3.2 RACS Removal Quantities

The extent of removal quantities differs depending on where the RACS disturbance is taking place as follows:

- When RACS is being removed from the <u>surface</u> Wet and remove all RACS and its associated six-inches in all directions, plus a minimum of six inches of soil or other matrix material, in all directions from the last occurrence of visible ACM with CABI confirmation that the visible extent of RACS has been removed (i.e., removal of visible ACM plus a minimum 12-inches of soil in all directions).
- When RACS is being removed from the <u>subsurface</u> Wet and remove all RACS and its associated six-inches plus a minimum of three linear feet of soil or other matrix material, in the direction of planned excavation with CABI confirmation that the visible extent of RACS has been removed.

#### 7.2.3.3 Off-Site Disposal of RACS

It will be the responsibility of the contractor to direct the schedule of transportation of RACS to DADS. When loaded, each truck will be assigned a waste manifest to serve as the shipping document for that load. Documentation stating that the soil originating from the project shall not be used as a daily cover





or sold as clean fill will accompany each load of RACS removed from the project. DDPHE will coordinate the waste profile and obtain waste manifests if requested.

RACS will be transported to DADS. Disposal of RACS will be conducted while adhering to CSWR §5. The landfill processes will be followed, specifically regarding notification, profiling, and on-site disposal.

Disposal of Non-RACS will require notification to the landfill that the material to be disposed contains Non-RACS, and based on the DADS requirements, the material will be handled accordingly (e.g., unlined trucks, single-lined trucks). Special precautions shall be undertaken during the management of non-RACS to prevent the material from being turned into RACS (i.e. being rendered friable).

#### 7.2.4 Wind Speed Monitoring

Periodic wind speed measurements will be taken during RACS disturbance within each RWA by an AMS or CABI at least once per every half hour. This frequency will be increased at the AMS's or CABI's discretion when it has been determined that wind conditions may be approaching threshold limits, and during wind gusts. It will be the responsibility of the AMS or CABI's to take and record all wind speed measurements onto the daily logs. All wind speed measurements will be taken within the work area in a location deemed representative of the area. The following are conditions where work will be shut down and started:

<u>Shut down Conditions</u> – RACS disturbance operations should immediately and temporarily cease when one or more of the following conditions have been met:

- Any wind gust reaches or exceeds 20 miles per hour (mph) as determined by hand-held instruments
- Sustained wind speeds reach or exceed 12 mph averaged over a 10-minute period
- Winds produce visible emissions or create movement of dust or debris in or near the work area or loading area
- Winds impact any engineering controls and prevents them from functioning as designed
- During wind-related project shutdowns, other work not related to RACS disturbance may continue

<u>Startup Conditions</u> – RACS disturbance operations may resume after all the following conditions have been met:

- All wind gust readings drop below 20 mph for a period of 20 minutes as determined by hand-held instruments
- Sustained wind speeds are below 12 mph averaged over a 20-minute period





- Winds no longer produce visible emissions or create movement of dust or debris in or near the RACS disturbance area
- Winds are not impacting the ability of engineering controls to work as designed

#### 7.2.5 Air Monitoring

CDPHE will require minimum air monitoring when suspect or confirmed ACM/RACS is being disturbed within a RWA, after the second consecutive day of RACS management. An appropriately trained and certified AMS must perform the air monitoring activities at the project. The CABI will characterize debris and air monitoring requirements will be made by the AMS based on the CABIs identification of the debris and applicable regulations. The CABI and AMS can be the same person if she/he meets the CABI and AMS requirements in Section 3.3. Ideally, the CABI and AMS will be the same person.

Air monitoring samples will be collected by the AMS using the procedures outlined below. All air samples will be collected and analyzed in accordance with CSWR §5.5 – Appendix 5A.

#### 7.2.5.1 Air Monitoring Matrix Tables

Personnel Monitoring and RWA Perimeter Sampling shall be performed in accordance with the following air-monitoring matrix tables:

Tahlo 2	Romoval/Disturbanco	lhu hand	or hand-hold	tools) r	of Non-Eriable RACS
TUDIE J	Nerrioval Distarbunce	(by nunu	or nunu-neiu	1001370	I NOTETTUDIE NACJ

Monitoring Type	Sample Frequency	Duration	Analysis
RWA Perimeter Monitoring	None	Not Applicable	Not Applicable

Table 4 Removal/Disturbanc	e (by hand or hand-held	tools) of Friable RACS
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Monitoring Type	Sample Frequency	Duration	Analysis
			PCM and Transmission Electron
RWA Perimeter Monitoring	Four samples at the perimeter of the RWA, at the points of the compass.	Ongoing after the 2 <sup>nd</sup> day of RACS disturbance	Microscopy (TEM) sampling around RWA. Any sample with PCM results exceeding 0.01 fibers per cubic centimeter (f/cc) must be analyzed by
			TEM.

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Table 5 Removal/Disturbance by Mechanical Means (Heavy Equipment) of Non-Friable RACS

Monitoring Type	Sample Frequency	Duration	Analysis
	Four samples at		
RWA	the perimeter of	Ongoing after	PCM and TEM sampling around RWA. Any
Perimeter	the RWA, at the	the 2nd day of	sample with PCM results exceeding 0.01
Monitoring	points of the	RACS disturbance	fibers/cc must be analyzed by TEM.
	compass.		

Table 6 Removal/Disturbance by Mechanical Means (Heavy Equipment) of Friable RACS

Monitoring Type	Sample Frequency	Duration	Analysis
Area of Disturbance Perimeter Monitoring	Four samples at the perimeter of the RWA at the points of the compass, and two downwind floater samples.	Ongoing after the 2nd day of RACS disturbance	PCM and TEM sampling around RWA. Any sample with PCM results exceeding 0.01 fibers/cc must be analyzed by TEM.

#### 7.2.5.2 Personnel Air Monitoring

Personnel monitoring will be the responsibility of the contractor, per OSHA requirements, and is not directed by this standard operating procedure.

#### 7.2.5.3 Required Preliminary and Area Air Sampling Protocol

- During the first five days of RACS disturbance/removal All air samples collected are required to be analyzed by PCM methodology. Additionally, a minimum of 25% of the samples collected from each RWA shall be submitted for TEM analysis. The sample(s) selected for TEM analysis shall have the highest PCM result(s) based on fiber concentration. If all PCM results are Below Detectable Limit (BDL) for fiber concentration, then the sample(s) selected for TEM analysis shall be determined by highest fiber count. If all samples have no fiber counts, then no TEM analysis is required.
- After five days of RACS removal/disturbance with no asbestos detections by TEM analysis – the frequency of analysis by TEM, on the highest 25% of PCM results(s), may be reduced to once every five days of RACS removal/disturbance, or portions thereof, using the same selection criteria as above. During the period of reduced frequency of TEM analysis, the first occurrence of high winds, exceeding wind shutdown criteria (Section 7.2.4), or visible





emissions, shall result in that day's samples (25%) being submitted for TEM analysis. In the absence of high-wind events or visible emissions the selected day for TEM analysis may be random, as determined by the AMS.

- If at any time, a sample analyzed by PCM returns results greater than 0.01f/cc, that sample shall then be analyzed by TEM as required by CDPHE.
- If there are any asbestos detections during the random once-every-five-days-analysis by TEM, then TEM analysis shall be conducted for three consecutive days of RACS removal/disturbance, or portions thereof. If there are no additional asbestos detections during the three consecutive days of RACS removal/disturbance with samples submitted for TEM analysis, then the frequency of TEM analysis may return to random, once-every-five-days of RACS removal/disturbance.

#### 7.2.5.4 Area Air Sampling

- Air samples will be collected continuously during all mechanical removal of RACS.
- Area monitoring shall consist of a minimum of four samples collected on the perimeter of the RWA, at the four-compass points, and at appropriate intervals to provide representative information regarding potential releases of asbestos fibers to the Adjacent Receptor Zone(s).
- Two additional downwind floating samples will be required for mechanical removal/disturbance of friable RACS. The samples shall be moved based on prevailing wind direction and adjacent receptors.
- Additional samples shall be collected for large perimeter RWAs (greater than one (1) acre). RWAs greater than one (1) acre shall require additional perimeter monitoring points be added at a rate of one (1) sample for every 200 linear feet (or approximately each additional ¼ acre).
- Air monitoring is not required where RACS management activities will occur in areas where there is no Adjacent Receptor Zone present according to the definition of an adjacent receptor zone where access to the public can be controlled (i.e., an area of at least 150 feet surrounding the RWA can be controlled allowing no public access).

#### 7.2.5.5 Sampling Media

Air samples will be collected by drawing air through a 25-millimeter mixed cellulose ester filter, 0.8micron pore size, with an open-faced, long cowl using low-flow personnel sampling pumps. The flow rate and the volume of the air passed through the filter will be determined based on the National Institute of Occupational Safety and Health (NIOSH) 7400 (NIOSH, 1987) analytical method. Each pump will be calibrated before and after the collection of each sample using a primary standard.





#### 7.2.5.6 Sample Analysis

Air samples submitted for Phase Contrast Microscopy (PCM) shall be analyzed according to NIOSH Method 7400 by a laboratory showing successful participation in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program or individual(s) certified through the AIHA Asbestos Analysts Registry (AAR) Program. Analysis of TEM air samples will be submitted to a National Institute of Standards and Technology (NIST) accredited laboratory using TEM in accordance with CSWR §5.5 Appendix 5A (Appendix D).

#### 7.2.5.7 Response to Laboratory Results

If an air sample analyzed by PCM indicates fiber concentrations over 0.01f/cc, that sample is then required to be analyzed by TEM. If an air sample has concentrations of airborne asbestos fibers after TEM analysis of personnel and/or work RWA samples, then the CDPHE will be notified immediately. The work practices and engineering controls, through consultation with CDPHE, will then be modified to reduce emissions. In the event that this should occur, the following actions shall take place:

- Excavation will immediately halt
- The source(s) of fiber release will be identified
- RACS management operations and engineering controls will be reassessed to safeguard that additional fiber releases do not occur
- If asbestos fibers are detected in air samples:
  - o All soil-disturbing activities will immediately cease
  - o The source of fiber release will be identified
  - An Emission Control Plan in accordance with Section 5.5.7 of the CSWR §5.5 will be derived and submitted to CCOD and the CDPHE for review
  - Soil disturbance shall not continue until the CDPHE provides verbal and/or written authorization to proceed.

#### 7.2.6 RACS Stockpiling

#### 7.2.6.1 Stockpiling of RACS

If RACS, which must be removed from the project, is in a location with limited or no access for direct loading into trucks, the material may be stockpiled on site if the conditions below are met in accordance with CSWR §5.5:

• The accumulation of RACS cannot exist for more than 10 calendar days without the approval of a RACS Storage Plan by CDPHE.





- Stockpiled RACS shall be placed on a minimum of 6-mil poly or a minimum of three-inches of soil, or other matrix material located under the stockpile which must be removed following removal of all stockpiled material.
- Rinsate/runoff shall be collected, filtered to five-microns, and discharged to a sanitary sewer (contractor must have appropriate authorizations) or re-applied to RACS that will be stabilized and managed under this standard operating procedure.
- The RACS must be adequately wet during stockpiling.
- The stockpile shall be stabilized by polyethylene sheeting, geofabric, or a chemical stabilizer demonstrated to be effective in the stabilization of RACS (e.g., magnesium chloride).
- The condition of the stockpile and cover sheeting/geofabric/stabilizer must be inspected daily and no later than 12 hours following storm events.
- All damage to the cover sheeting/geofabric/stabilizer must be repaired or replaced immediately upon discovery.

#### 7.2.6.2 Transporting RACS to Stockpile

The following directives and RACS handling must take place during on-site transport of RACS to a stockpile location:

- Driving speeds shall not exceed 12 mph while machine is moving RACS.
- Transportation equipment tires shall not contact RACS. If tires do contact RACS, the RACS must be adequately wetted to prevent dust/emissions and all equipment surfaces that have come into contact with RACS shall be decontaminated (Section 7.2.7).
- If the transport equipment tires come in contact with RACS:
  - The haul road shall be managed as RACS and maintained to prevent dust or emissions generation and if any RACS is visibly observed it is to be removed immediately, along with the required six inches of surrounding soil and handled appropriately.
  - Following completion of excavation and grading activities, the material used in construction of the haul road as well as three inches of underlying soil will be removed and managed in the same manner as the RACS.
  - Water and runoff from the haul road shall be collected and filtered to less than five microns (or applicable local requirements) and discharged to a sanitary sewer (contractor must have appropriate authorizations) or re-applied to RACS that will be stabilized and managed under this standard operating procedure.





#### 7.2.7 Decontamination Procedures

#### 7.2.7.1 Heavy Equipment or Machinery Decontamination

Heavy equipment will be decontaminated prior to leaving a RWA in such a manner as to ensure that residual soil and contaminants are removed and other hazards are not present. Heavy equipment decontamination will include the following steps:

- Decontamination will occur within a waste container when possible, and if not will be staged on 6- or 10-mil poly to prevent cross contamination or spills. This will include mechanical removal by asbestos workers using shovels or other hand-held tools while wearing appropriate PPE.
- Next, the equipment will be thoroughly cleaned with amended water and rags.
- All used rags and disposable PPE will be disposed of as asbestos waste and transported to the landfill.
- It will be the responsibility of the CABI to make final visual inspections and a final determination regarding the decontamination of equipment for release to other portions of the project, or off-site.

#### 7.2.7.2 Asbestos Worker Decontamination During RACS Disturbance in a RWA

A fully functioning decontamination unit or trailer will be utilized at the project whenever RACS disturbance within a RWA takes place. The decontamination unit will be located within 100 feet of the project, and as near the removal area as practical. The decontamination unit will consist of three chambers, should have fully operational hot and cold running water adjustable at the tap, and a functioning water filtration unit that will filter the waste water to five microns or less. Reuse of waste water from personnel decontamination is prohibited. For disposal, waste water may not be discharged to the sanitary sewer within the City and County of Denver. However, it may be added to RACS, generated by the project, as part of RACS disposal procedures if it does not interfere with the requirements of section 7.2.3 (RACS Disposal Procedures) of this SOP, and does not cause the load to fail a paint filter test. Disposal of decontamination water from equipment must also follow the same disposal protocols. In no event may decontamination water be discharged to any sanitary sewer, storm sewer, ditch, gutter, or stream.

To prevent cross-contamination, asbestos workers will wear clean outer protective suits as they exit from the work area(s) to the decontamination area. The asbestos workers will either double suit and remove the exterior suit, or don a second clean suit over the single suit, within the work area prior to moving out of the RWA to get to the decontamination unit. The decontamination unit should be utilized by the asbestos workers each time they exit the work area(s).





#### 7.2.7.3 Decontamination and Personnel Protection During Removal of RACS/ACM

Asbestos workers and equipment will be decontaminated on site; dirt and debris should not leave the immediate work area. The following procedures can be modified by the CABI based on the potential level of exposure:

- Decontamination of workers can consist of removal of disposable Tyvek<sup>®</sup> suites, gloves, and boot covers. These PPE will be bagged, labeled, and disposed as asbestos waste.
- Decontaminate non-disposable personal items by removing visible soil and dust with damp wipes or rags, or by use of a high efficiency particulate air (HEPA) filter equipped vacuum.
   Place wipes and rags in a plastic bag and dispose along with RACS materials. If additional clothing is available, clothes should be changed and potentially contaminated clothing should be bagged separately from wipes and rags.
- Decontaminate hand equipment and tools by removing gross soils and dust, then washing the equipment. Materials used for decontamination should be bagged and disposed along with RACS materials. Equipment decontamination rinsate water should be collected and filtered to five microns prior to disposal, or reused for wetting of asbestos contaminated areas that will be removed.

Based on analytical results of suspect materials, if asbestos is present, decontamination materials should be bagged and disposed of as asbestos waste at the Denver-Arapahoe Disposal Site or with RACS in accordance with this plan. If analytical results indicate that no asbestos is present, bags (non-asbestos waste bags) can be disposed as non-asbestos solid waste.

#### 7.2.8 Work Area Clearance

It will be the responsibility of the CABI to provide final visual clearance of the work area following completion of RACS disturbance/removal. The CABI will document locations, and other pertinent information, onto the daily logs for work area clearance.





# 8. Close-Out Report

The CABI will be responsible for maintaining complete documentation of the project in accordance to C.S.W.R 5.5.7 (L). After RACS disturbance/removal actions are completed, a project close-out report will be prepared for CCOD's files. The project close-out report will include at a minimum:

- Property description and description of area(s) with RACS
- Description of soil-disturbing activities
- Description of field operations or submittal of daily logs (Appendix B)
- Air monitoring logs
- Description/results of asbestos sampling events, including sample locations
- Analytical results
- Disposal summaries and manifests
- Details of excavation profiles
- Description of capped material left in place and site plan showing the capped area(s)
- Photographic logs
- Personnel certifications

Copies of the project close-out report will be submitted to the CCOD Project Manager. Project close-out reports for RACS management projects are not required to be submitted to CDPHE.





## 9. References

- CDPHE, 2008. "Regulation No. 8, Part B Asbestos", Colorado Department of Public Health and Environment, Air Quality Control Commission, Denver, Colorado, January 2008.
- CDPHE, 2014. "Deletion and Replacement of Existing Section 5.5 Regulations (Management of Asbestos-Contaminated Soil) with New Section 5.5 Regulations (Management of Regulated Asbestos Contaminated Soil (RACS)); the Addition of Appendix 5A (Sample Collection Protocols and Analytical Methodologies) and the Associated Additions and Revision to Section 1.2 Definitions." Colorado Department of Public Health and Environment, dated August 19, 2014.
- NIOSH, 1987. National Institute for Occupational Safety and Health (NIOSH) Method 7400 Entitled "Fibers" published in the NIOSH Manual of Analytical Methods, 3rd Edition, second supplement, August 1987.
- OSHA, 1987. Occupational Safety and Health Administration (OSHA) Regulation "Asbestos", 29 C.F.R. Part 1910.1001, Appendix B (OSHA 1987)





# Appendices

Environmental Quality Division Denver's Department of Public Health & Environment Regulated Asbestos Contaminated Soil Standard Operating Procedure

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# Appendix A CDPHE Approval Letter

Environmental Quality Division Denver's Department of Public Health & Environment Regulated Asbestos Contaminated Soil Standard Operating Procedure

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COLORADO

Hazardous Materials & Waste Management Division

Department of Public Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

May 2, 2019

Mr. Steve Gonzales City and County of Denver Department of Public Health and Environment 101 W. Colfax, #800 Denver, CO 80202

#### RE: **Approval:** Regulated Asbestos Contaminated Soil Standard Operating Procedure for City and County of Denver - dated May 2, 2019 SW/DNV/GEN 3.10

Dear Mr. Gonzales:

The Colorado Department of Public Health and Environment ("CDPHE"), Hazardous Materials and Waste Management Division ("Division") has reviewed the following standard operating procedure (SOP) regarding Regulated Asbestos Contaminated Soil (RACS) management activities in Denver, CO:

Regulated Asbestos Contaminated Soil Standard Operating Procedure for City and County of Denver (the SOP)

The SOP was initially received in our office electronically on May 9, 2018. The Division provided comments on the initial version of the plan that were dated June 13, 2018. A revised version of the plan was received electronically on September 5, 2018. The Division provided additional comments in a letter dated November 2, 2018. Another revision to the SOP was dated January 23, 2019. Additional discussion between the Division and the Denver Department of Public Health and Environment resulted in a final version of the SOP that was provided to the Division on May 2, 2019. The SOP was prepared and submitted by The Denver Department of Public Health and Environment.

The Division has completed its review and is pleased to hereby approve this SOP for RACS Management. Please keep in mind that all soil disturbing activities involving RACS must be performed in accordance with this approved SOP and the Colorado Solid Waste Regulations (6 CCR 1007-2, Part1).

In closing, the Division is authorized to bill for is review of technical submittals at \$125 per hour, pursuant to Section 1.7 of the Solid Waste Regulations, 6 CCR 1007-2. An invoice for the Division's review of the above referenced document will be sent out under separate cover.

The Division contact person for this project is Brian Long, and may be contacted at (303) 691-4033 or briant.long@state.co.us.

Sincerely.

Digitally signed by Brian Long Date: 2019.05.02 16:37:42 -06'00'

Brian T. Long **Environmental Protection Specialist** Solid Waste Compliance Assurance Unit Solid Waste and Materials Management Program

ec: Ed Smith, CDPHE HMWMD

4300 Cherry Creek Drive S., Denver, CO 80246-1530 P 303-692-2000 www.colorado.gov/cdphe

Jared Polis, Governor | Jill Hunsaker Ryan, MPH, Executive Director







# Appendix B CABI Work Day Documentation Form

Environmental Quality Division Denver's Department of Public Health & Environment Regulated Asbestos Contaminated Soil Standard Operating Procedure

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City and County of Denver									
	Certified Asbestos Building Inspector Work Day Documentation								
	Project Name								
Inspector Name		Date	e:						
Inspector Certification Number	:	Weatha	r.						
Inspector's Company/Affiliation		weathe							
Location Description									
Description of Site Activities	:								
Equipment Used (Model Number)	:								
	CABI Documenta	ation							
Identify environmental haza	rds discussed at the safety meeting:								
Delineation of Work	Area		Equipment Mobilization						
Work Zones			Emissions Controls						
Utility Identification			Fencing and Wind Barriers						
Haul Routes / Access			Other:						
	Description of Encountered Debris Materials and Practices								
Types of Debri	s Identified (List all materials, clarify depths of piles):								
14									

	Description of Suspect Debris Material (RACS	/ Non-RACS):					
1B							
	Description of Hand Removals (Assumed RAC	CS or Analyzed	To Be RACS):				
1C							
	Friability of Suspect Debris Materials:						
1D							
	Observation of Non-Earthen Material or the Ap	opearance of F	ill:				
1E							
	Observation of Any Other Impacted Soils (Nor	n-Asbestos Im	oacts):				
1F							
			В	ulk Sample Log			
	Sample ID#	Time Sampled	Depth	Sample Location/Description	Asbestos Content From Analytical		

# **RACS Management Detail**

	Decontamination			
No.	Items	YES	NO	
	Have all equipment surfaces in contact with RACS been decontaminated?	0	0	
2A	Details:			
	Have workers conducted personal and equipment decontamination in accordance with applicable procedures?	0	0	
20	Details:			
20				
	Engineering and Administrative Contro	bls		
No.	Items	YES	NO	
	Onsite Staging, Stockpiling, & Storage of RACS	0	0	
	Annual Awareness Training for Regulated Work Area Personnel	0	0	
2	Annual Awareness Training for Non-Regulated Work Area Personnel	0	0	
3	Details: (provide detailed description of any deficiencies)			
	Spill Response			
No.	Items	YES	NO	
		0	0	
4	Details (provide information on corrective actions):			
	Air Monitoring Information As A	pplicable		
	General Conditions			

No.	Items								NO	
	Were work conditions maintained below stoppage requirements?							0	0	
	Daily Wind Speed		Sust	ained High:		Gust Max:		-	-	
	Details (Provide	Prevailing Wind	d Direction and	30-Minute Rea	dinas):			J		
								Comments:		
	Time	Wind Speed	Direction		Time	Wind Speed	Direction			
	7:00				12:00					
	7:30				12:30					
	8:00				13:00					
	8:30				13:30					
5A	9:00				14:00					
	9:30				14:30					
	10:00				15:00					
	10:30				15:30					
	11:00				16:00					
	11:30				16:30					
	Details of Wind	Shut Down Eve	nt (If Applicab	e):						
						Visible omissio	ne observed?	0	$\cap$	
							0			
				If visible emis	sions were ob	served, was wor	ked stopped?	0	0	
5B	Details (provide	e information on	corrective act	ions):						

					Pe	rimeter Monit	oring				
				Adequate pe	rimeter sampli	ng points based	d on test area?	0	0		
	No disturbance to sampling equipment or power source							0	0	-	
6A	Were samples compromised in any way?								0	-	
073	Details:				-	-			<u> </u>		
								-	-		
	Has the pump been o	calibrated?						0	0		
6B	Details (Pump C	alibration Meth	nod):								
										1	
	Is there an adjacent	public receptor zor	<mark>ne within 1</mark> 50 ft. of	a Regulated Work	Area?			0	0		
6C	Details (Location	n):								ł	
					A	ir Sample Lo	g				
Sar	nnle ID#	Start Time	Ston Time	Total	Flow Rate	Flow Rate		Sample Location		Volume	f/cc
				Minutes:	Start:	Stop:			•	Volume	1700
					Contra	actor Monitoring					
No.				Items				YES	NO		
	ls con	tractor working	g in the regulate	ed work area co	onducting pers	onal monitoring	g?	0	0		
7	Details:										
					Work Pra	actices and C	ompletion				
No.				Items				YES	NO		
	Are work practices	conducted in acc	cordance with the	e project MMP ar	nd State regulatio	ons?		0	0		
				• • • • • • • • • • • • • • •						-	
8A	Have excavation a				e with applicable	procedures?		0	0		
	Details:										
								-			
	Have loading and	transportation re	equirements beer	n met?				0	0		
8B	8B										
L											
	Has visible materia	Has visible material and associated soils been removed?						0	0		
80	Details:										
	Have appropriate s	amples been coll	lected to confirm	ACS has been re	moved?			0	0		
חפ	Details:									•	

	Soils Disposition					
	Where did the soil originate (depth, specific area)?					
9A						
	Temporary or final disposition of soil (where on-site or disposed)?					
9B						
	Method of material movement (What type of truck and loading)?					
9C						
	How many cubic yards of soil excavated during shift? (0 - 10000 yds.)					
Comments:						
Provide	at least 4 Photos From Daily Operations Where RACS Management Is Being Done					
During RA	ACS management Operations, include a map of RACS management Location(s) with this Documentation					

ASSOCIATED PHOTOS



CABI Field Inspector Name

Date





# Appendix C Notification of Planned Soil Disturbing Activity

Environmental Quality Division Denver's Department of Public Health & Environment Regulated Asbestos Contaminated Soil Standard Operating Procedure

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#### COLORADO

#### Department of Public Health & Environment

#### NOTIFICATION OF REGULATED ASBESTOS CONTAMINATED SOIL (RACS) DISTURBANCE

Dedicated to protecting and improving the health and environment of the people of Colorado

A map, figure, or drawing, to a recognizable engineering scale, depicting the project area(s) must be submitted with this form. The form, plan (if applicable), and depiction of the project area, can be emailed to: <u>briant.long@state.co.us</u>; or, mailed to: Colorado Department of Public Health and Environment, HMWMD-B2 Attn: Brian Long, Solid Waste Compliance Assurance Unit, see address below.

Date and time reported:					
Planned management Start date: Estimated duration:		Unexpected discovery (submit within 24 hours of discovery) Discovery date and time: Estimated duration:			
Description of planned soil-disturbing activities:		Description of activities resulting in RACS discovery/disturbance:			
Description of any access and/or emission control measures already implemented at the site:		Description of type and quantity of RACS discovered/disturbance:			
☐ This is an EMERGENCY management event (submit this form within 24 hours of RACS discovery, and comply with the Minimum Standards to the extent possible during initial management, and fully comply within 48 hours) Detail the nature of the emergency (e.g., repair to an active utility line):					
Check the box to indicate which management approach will be utilized on this project:					
Project Specific RACS Mgmt. Plan Submit PSRMP for Division review and approval with this form at least 10 working days prior to commencing RACS disturbing activities. RACS disturbance shall not commence until the PSRMP is approved. However, the standard requirements from Section 5.5.7 of the Solid Waste Regulation may be used in the interim after the required notice. Standard Requirements The standard requirements of RACS management are found in Section 5.5.7 of the Solid Waste Regulations. Notification shall be submitted to the Division prior to commencing RACS disturbing activities. Please indicate which program this project wi Hazardous Waste Corrective Action (RCRA) Contact person for entity performing soil-dist	☐ Standard Operating Procedures         Has the Division approved SOPs for this project?         ☐ Yes, include the name of the SOP here:         Notification shall be submitted to the Division prior to commencing RACS disturbing activities.         ☐ No, submit SOPs for Division review and approval with this form at least 30 calendar days prior to commencing RACS disturbing activities.         ill take place under:       ☐ Solid Waste (general) / )         ill take place under:       ☐ Solid Waste (general) / )		Remediation Plan         Submit remediation plan for Division review and approval at least 45 calendar days prior to commencing RACS disturbing activities.         Remediation shall not commence prior to plan approval.         Risk Based Approach         Submit a site-specific risk assessment work plan for Division review and approval with this form prior to commencing RACS disturbing activities. RACS disturbance shall not commence until the plan is approved.         Voluntary Cleanup Program (VCUP) / Know		
Organization, company or agency:					
Email:		Phone:			
Name of property owner/operator:					
Owner/operator contact (if different):					
Email:		Phone:		Ext:	
Location of property: (Street address or other location description)	Street Address:				
	County:		City:		Zip:
General site description:					
Received by:	Date:				







# Appendix D Sample Collection Protocols and Analytical Methodologies

Environmental Quality Division Denver's Department of Public Health & Environment Regulated Asbestos Contaminated Soil Standard Operating Procedure

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#### CSWR §5.5 – APPENDIX 5A SAMPLE COLLECTION PROTOCOLS AND ANALYTICAL METHODOLOGIES

#### 1.0 Purpose

(A) The purpose of this appendix is to establish standard sample collection requirements and analytical methods and procedures for use in identifying and quantifying asbestos fibers in air, bulk material, and environmental media such as soil or ash.

#### 2.0 Sample Collection Requirements

(A) The following sample collection requirements shall be followed when collecting samples for the purpose of determining the applicability of Section 5.5, and when collecting samples necessary to comply with the requirements of Section 5.5. Remediation plans submitted in accordance with Section 5.5.6 shall include a site specific sampling and analysis plan that incorporates the sample collection methodologies and analytical procedures in this Appendix, or proposes alternatives, and include site specific clearance criteria.

#### 2.1 Bulk Samples

- (A) Bulk samples shall be collected, in a manner sufficient to determine whether the material is asbestos-containing material (ACM) or not ACM, from each type of suspect ACM. Bulk samples shall be collected by a State of Colorado certified Asbestos Building Inspector (CABI). In the absence of bulk sample collection, any suspect ACMs must be assumed to be ACMs.
- (B) Bulk samples shall be collected by homogenous type based on color, pattern, texture, thickness, associated materials, or by other identifying characteristics. Additionally, the quantity and location of a suspect material shall be used to determine the number of bulk samples required to characterize the asbestos content of each homogeneous suspect material. For the purpose of determining that a homogeneous suspect material does not contain asbestos, a minimum of three (3) bulk samples shall be collected from the homogeneous material unless there is insufficient material to constitute three (3) samples. If one of the collected samples of a homogeneous bulk material is determined to be ACM, then the homogeneous material shall be considered ACM.

#### 2.2 Soil Samples

- (A) Samples collected to determine asbestos content in soil shall be ten (10) point aliquot composite samples collected from a maximum area of 1,250 square feet (representing 0-6 inches beyond the exposed surface) or a maximum volume of forty (40) cubic yards. Individual aliquots shall be approximately 1/10 of the entire sample volume. At each aliquot location approximately one (1) tablespoon of soil shall be collected. The total volume of the ten (10) aliquots should equal roughly a half cup. The total collected sample volume should be greater than one quarter (¼) cup, but should not exceed one cup. Aliquot locations shall be randomly selected but shall be representative of the entire sample area or volume (to be inclusive of the interior of soil piles in addition to the surface). However, aliquots shall be collected with any areas where friable ACM was formerly present. All samples collected to determine asbestos content shall be collected by a CABI.
- (B) Sampling for clearance purposes of any exposed horizontal or vertical surface shall have the following additional requirements:
  - 1) The aliquots of a clearance sample shall not be collected until after the RACS, and the required amount of associated material, has been removed.
  - A visual inspection shall be performed and passed (i.e., no visible ACM present) by a CABI prior to the collection of soil samples. Visual inspections shall include the following:
    - a) The area to be cleared shall be designated before the visual inspection; and
    - b) Former locations of friable materials shall be designated; and
    - c) The surface being inspected shall be dry enough to allow identification of suspect ACM; and
    - d) The visual inspection shall be conducted in adequate lighting; and
    - e) The area to be cleared shall be free of visual impediments (e.g. snow cover, plastic sheeting, standing water, etc.); and
    - f) At a minimum, the area to be cleared shall be inspected in at least two(2) perpendicular directions; and
    - g) Single or multiple inspectors may be used to perform a visual inspection and clearance. However, a single inspector shall not

visually inspect more than a five (5) foot width with each pass [i.e. for a clearance area that is 25' x 50' a single inspector would be required to make at least five (5) passes in one direction (25' length) and at least ten (10) passes in the other direction (50' length)]; and

- h) Detailed close examination of the area being cleared is required. The inspector(s) should use limited invasive inspection techniques, such as periodically sifting the surface being cleared and closely inspecting the disturbed area.
- 3) If sidewalls with six (6) inches or greater of vertical height are present, independent ten (10) point aliquot composite samples shall be collected from each of the sidewalls and the floor of the excavation.

#### 2.3 Ash Samples

(A) Ash that contains, or is comingled with, suspect ACM and/or construction and demolition debris shall be considered to be RACS unless the ash is sampled, and analysis demonstrates that the ash is not RACS. Representative samples of each type of ash materials shall be sampled and analyzed in the same manner as soil (including area/volumetric limitations of sampling). Ash samples shall be collected by homogenous strata, location, content of other surrounding material, or other observations indicating heterogeneity of the ash present. All samples collected to determine asbestos content shall be collected by a CABI. In the absence of suspect ACM or construction and demolition debris, and in the absence of documented evidence of non-visible asbestos, ash material may be treated as non-RACS.

#### 2.4 Cross Contamination Prevention

(A) All sample collection equipment shall be decontaminated in a manner sufficient to prevent cross contamination between individual samples or individual composite samples. Decontamination is not required between the collection of aliquots comprising a single composite sample.

#### 2.5 Air Samples for Standard RACS Management

(A) Air samples shall be collected by drawing air through 0.8-micron (μm), 25millimeter (mm), mixed cellulose ester (MCE) filters, using an open-faced cowl extension oriented face down at an angle of 45°. Sample flow rate shall be between 0.5-10 liters per minute depending on the anticipated duration of sampling and the specified detection sensitivity. The air sampling equipment shall be run until the minimum volume required is collected for each sample. However, if the minimum air volume required by the method, and/or to reach the required analytical sensitivity, being utilized cannot be met, the State of Colorado trained and certified Air Monitoring Specialist (AMS) shall request that the laboratory prepare the sample using an indirect preparation method, for TEM presence/absence analysis. Air samples shall be collected at a height that is representative of the disturbance activity taking place. However, air samples shall be located at a height between three (3) feet above the ground surface but not to exceed twenty (20) feet above the ground surface. Air samples shall be collected by an AMS.

#### 2.6 Air Samples for Risk-Based Air Threshold Monitoring

- (A) Air samples shall be collected by an AMS. Air monitoring shall be conducted during each partial or full day of soil management activities using fixed and mobile monitors as follows:
  - 1) A minimum of four (4) samples shall be collected for each regulated work area (RWA).
  - For the purpose of determining the number of samples necessary, each RWA shall be divided into four (4) equal quadrants. A minimum of one (1) sample shall be collected for each quadrant with an adjacent receptor zone.
  - 3) If an RWA is greater than one (1) acre, one (1) additional sample for each quadrant with an adjacent receptor zone shall be collected and analyzed for each additional one quarter (1/4) acre in RWA surface area.
  - 4) Samples shall be located along the RWA perimeter, between the RWA and each adjacent receptor zone. Samples shall be placed between the RWA and any fixed adjacent receptor(s). In the absence of fixed adjacent receptors, sample placement shall be at the AMS's discretion.
  - 5) The sample volume shall be the minimum necessary to meet analytical sensitivity.
  - 6) Samples shall be collected by drawing air through 0.8-micron (μm), 0.25-millimeter (mm), mixed cellulose ester (MCE) filters, using an open-faced cowl extension oriented face down at an angle of 45°.

#### 3.0 Analytical Requirements

(A) The following analytical methods shall be used to evaluate the presence of asbestos and/or to determine asbestos content when analyzing samples for the purpose of determining the applicability of Section 5.5, and when analyzing samples collected in accordance with Section 5.5:

#### 3.1 Bulk Samples

(A) Samples of suspect ACM shall be analyzed by polarized light microscopy (PLM), according to United States Environmental Protection Agency (USEPA) Method EPA/600/R-93/116 or equivalent method, to determine if any asbestos fibers are present. If the asbestos content of a sample is estimated to be 1% asbestos or less, but greater than 0%, by a method other than point counting (such as visual estimation), the determination shall be repeated using the point counting technique with PLM. Alternatively, the material may be assumed to be ACM. Analysis shall be conducted by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory.

#### 3.2 Soil Samples and Ash Samples

(A) Prior to preparation of a soil or ash sample, bulk materials shall be separated from the soil or ash sample for independent analysis. Any bulk materials identified in a soil or ash sample that contain any amount of asbestos shall be reported as independent layers of the whole sample. The samples shall be adequately prepared (crushed and dried) to facilitate stereomicroscopic analysis by the laboratory. The goal of the preparation process should be to produce dried conglomerates of approximately one eighth inch (1/8") to one quarter inch  $(\frac{1}{4})$  size. Rock and/or stone material does not need to be crushed (this process is not intended to be homogenization). Soil and ash samples shall be analyzed by PLM according to USEPA Method EPA/600/R-93/116 to determine if any asbestos fibers are present. Analysis shall be conducted by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory. During the stereomicroscopic analysis (10X – 50X) of the soil/ash sample the analyst shall sift through the sample at a rate of approximately one (1) tablespoon per minute. At the end of the stereomicroscopic analysis the sample shall be agitated or shaken as a final check for asbestos prior to the preparation of PLM grab mounts. At no time during the stereomicroscopic analysis shall a sub sample be collected. The entire sample shall be analyzed and the results reported. If no asbestos was identified by PLM after the initial stereomicroscopic examination, then three (3) random grab mount preparations shall be analyzed by PLM to determine if the sample is none detected for asbestos content. If any asbestos is found by the laboratory it shall be reported even in the absence of a second detection (i.e. there does not need to be a second detection to qualify a trace level of asbestos in the sample). Quantification of asbestos content shall be based on the entire sample volume, and be reported as such.

#### 3.3 Air Samples for Standard RACS Management

- (A) Air samples submitted for Phase Contrast Microscopy (PCM) shall be analyzed according to NIOSH Method 7400 by a laboratory showing successful participation in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program or individual(s) certified through the AIHA Asbestos Analysts Registry (AAR) Program.
- (B) Air samples submitted for Transmission Electron Microscopy (TEM), for which quantification of asbestos is desired, shall be prepared and analyzed according to the standard Asbestos Hazard Emergency Response Act (AHERA) method (AHERA; 40 CFR Part 763, Subpart E, Appendix A). All TEM analysis shall be performed by a NVLAP accredited laboratory. If a presence/absence analysis is desired, the analysis shall be performed using the AHERA method modified in the following manner:
  - 1) A minimum of two (2) preparations shall be prepared and utilized for each sample.
  - 2) Analysis shall be conducted on a minimum of four (4) grid openings or until three (3) or more structures are identified, whichever comes first.
  - Any structure (adhering to the AHERA counting rules) identified during analysis shall be reported.
    - a) Identification of less than three (3) structures shall be reported as present.
    - b) Identification of three (3) or greater structures shall be reported as detected.
- (C) Any air sample analysis that results in a "cannot be read (CBR)" determination from the analyst, or a "not analyzed (NA) or rejected" due to loose debris or uneven loading, shall be evaluated by the AMS to determine if a cause of the CBR or NA can be ascertained. If it is determined that the CBR is a result of overloading from airborne emissions, then the AMS shall request that the laboratory prepare the sample, using an indirect preparation method, for TEM presence/absence analysis.

#### 3.4 Risk-Based Air Threshold Samples

- (A) Air samples collected for TEM analysis shall be submitted to a NVLAP accredited laboratory. Samples shall be analyzed by TEM according to ISO Method 10312 with the following modifications for PCM equivalent (PCMe) structures:
  - 1) An aspect ratio of 3:1 shall be used when counting structures greater than 5  $\mu$ m in length, rather than the 5:1 ratio specified in the method.
  - 2) A width range of 0.25 to 3  $\mu$ m will be used when counting PCMe structures, rather than the 0.2 to 3  $\mu$ m specified in the method.
  - 3) A minimum of ten grid openings will be counted, rather than the minimum of four (4) grid openings specified in the method.
  - 4) Calculations shall be made based on total fibers rather than primary fibers.
- (B) The maximum number of grid openings (GOs) to be counted to achieve the specified analytical sensitivity shall be estimated as follows:

Number of GOs = EFA  $\div$  (A<sub>GO</sub> x V x S x CF)

where:

EFA = effective filter area (385 for a 25-mm filter) A<sub>GO</sub> = area of a grid opening (approximately 0.01 mm<sup>2</sup>; actual value to be provided by the analytical laboratory) V = volume of air sampled (in liters [L]) S = analytical sensitivity (structures per cubic centimeter [s/cc]) CF = conversion factor (1000 cc/L)

- (C) Any air sample analysis that results in a "cannot be read (CBR)" determination from the analyst, or a "not analyzed (NA) or rejected" due to loose debris or uneven loading, shall be prepared by the laboratory, using an indirect preparation method, for TEM presence/absence analysis.
- 3.5 Data Evaluation for Risk-Based Air Threshold Samples

(A) General requirements:

1) Samples collected for comparison to risk-based air thresholds shall be evaluated based on the average (mean) concentration over the exposure duration.
- 2) All valid data shall be used to calculate daily and ten (10) day rolling averages.
- 3) For all projects a minimum of three (3) samples per day must have quantifiable data (not CBR or rejected). If less than three (3) quantifiable analytical results are available then the daily average is invalid.

(B) Project days 1-9:

- 1) The results of the daily samples must be averaged to calculate a daily average for use in comparing to the risk based air threshold for days 1-9 of monitoring.
- A ten (10) day average shall be calculated for days 1-9. The ten (10) day average shall be comprised of at least eight (8) valid daily average results. However, all valid data shall be used to calculate the ten (10) day average.
- If the ten (10) day average exceeds the risk-based air threshold, engineering controls shall be adjusted to reduce the daily average.
- 4) The Department shall be notified within 24 hours if the calculations in paragraphs 1 and 2 above cannot be completed due to invalid data.

(C) Project days 10 and greater:

- 1) Starting on day 10, a ten (10) day rolling average shall be calculated and compared to the risk-based threshold.
- If average concentration trends indicate the risk-based air threshold will be exceeded before project completion, engineering controls shall be adjusted to reduce the daily asbestos emissions.
- If subsequent evaluation of average concentration trends indicates that the risk-based air threshold will still be exceeded before project completion, additional adjustments to engineering controls shall be made.
- 4) If changes in engineering controls are not effective in reducing airborne concentration trends such that the risk-based air thresholds can be met, consultation with the Department is required.
- 5) The Department shall be notified within five (5) working days if the averaged airborne asbestos concentration for the entire project exceeds the risk-based air threshold.

## 4.0 Documentation

- (A) All of the following sampling and analytical documentation shall be maintained during a project and available for Department review upon request. This documentation need not be submitted to CDPHE unless requested or as required in a project specific plan.
  - 1) Documentation of bulk, soil, and ash samples shall include:
    - a. A description of the material being sampled including friability.
      - i. For samples collected for characterization purposes also include an estimate of the quantity of visible suspected RACS present.
      - ii. For samples of ash, also include a brief description of the ash layer, and any associated identifiable debris.
    - b. Name of person collecting the sample(s).
    - c. Date and time of sample collection.
    - d. Location of sample collection (a map, drawing, or diagram showing sample locations in relation to the work area and surrounding area).
    - e. The boundary/limits that are represented by the collected sample.
    - f. Chain of custody documentation.
    - g. Laboratory analysis reports.
    - h. Log of characterized homogeneous bulk materials including material descriptions, photographic documentation, and asbestos content.
  - 2) Documentation of air samples shall include:
    - a. Name of person collecting the sample(s).
    - b. Date and time(s) of sample collection.
    - c. Locations of air sample collection.
    - d. Any relocation of air samples.
    - e. A map, drawing, or diagram showing air sample locations (initial and relocations) in relation to the work area and the surrounding area.
    - f. Chain of custody documentation.
    - g. Laboratory analysis reports.
    - h. Explanation of any air sample malfunctions and any voided air samples.
    - i. Risk based air threshold concentration calculations.

- j. Air sample data (flow rates, time of sampling, volumes, calibration method, etc.).
- k. Wind speed measurements.
- I. Prevailing wind directions.
- m. Wind shut down events.
- n. Observations of visible emissions and responses.

## 5.0 Deviations from Sampling and Analysis Procedures

(A) Deviation from this sampling and analysis appendix shall only be allowed upon consultation with, review by, and approval from, the Department.