

**TRANSITE PIPE REMOVAL
ACTION PLAN - REVISION 1**

YERINGTON MINE SITE

JULY 30, 2010

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LIST OF ACRONYMS AND ABBREVIATIONS

ACM	Asbestos-Containing Material	NVLAP	National Voluntary Laboratory Accreditation Program
AEC	Atomic Energy Commission	OSHA	Occupational Health and Safety Administration
ASHERA	Asbestos Hazard Emergency Response Act	OSL	Optically Stimulated Luminescence
AOC	Administrative Order on Consent	OSWER	Office of Solid Waste and Emergency Response
ARAR	Applicable or Relevant and Appropriate Requirement	OU	Operable Unit
ARC	Atlantic Richfield Company	PEL	Permissible Exposure Limit
Arimetco	Arimetco, Inc.	PLM	Polarized light Microscopy
ASTM	American Society of Testing and Materials	PPE	Personal Protective Equipment
BCL	Background Concentration Limits	PQL	Practical Quantitation Limit
CAS	Comprehensive Asbestos Survey	QA/QC	Quality Assurance/Quality Control
CFR	Code of Federal Regulations	QAPP	Quality Assurance Project Plan
CCZ	Contamination Control Zone	RACM	Regulated Asbestos-Containing Material
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	RAP	Removal Action Plan
DPM	Disintegrations Per Minute	RCA	Radiological Control Area
EPA	Environmental Protection Agency	RWA	Regulated Work Area
ESI	Environmental Standards Inc	Site	Yerington Mine Site
FRM	Federal Reference Method	SAP	Supplemental Analysis Plan
GPS	Global Positioning System	SOW	Scope of Work
HA	Homogeneous-Area	TENORM	Technologically Enhanced Naturally Occurring Radioactive Materials
HASP	Health and Safety Plan	TLD	Thermo-Luminescent Dosimeters
HDPE	High-Density Polyethylene	TDR	Time Domain Reflectometry
HEPA	High-Efficiency Particulate Air	TSEA	Task Safety and Environmental Analyses
H & S	Health and Safety	VLT	Vat Leach Tailings
HSSE	Health Safety Security Environment	WAAS	Wide Area Augmentation System
ICP-MS	Inductively Coupled Plasma – Mass Spectrometer	WRA	Work Risk Assessment
JSA	Job Safety Analyses	%	percent
MCL	Maximum Contaminant Level	bgs	below ground surface
MDD	Maximum Dry Density	cm ²	square centimeters
MDL	Method Detection Limit	cpm	counts per minute
MS/MSD	Matrix Spike/Matrix Spike Duplicate	dpm	disintegrations per minute
MWMP	Meteoric Water Mobility Procedure	mg/kg	milligrams per kilogram
NAC	Nevada Administrative Code	mg/m ³	milligrams per cubic meter
NDEP	Nevada Department of Environmental Protection	mph	miles per hour
NEA	Negative Exposure Assessment	pCi/g	picoCuries per gram
NESHAP	National Emission Standards for Hazardous Air Pollutants	µR/hr	micro Roentgens per hour
NRS	Nevada Revised Statutes	µrem	micro-rem

SECTION 1.0 INTRODUCTION

Atlantic Richfield Company (ARC) has prepared this revised Transite Pipe Removal Action Plan (revised RAP) for the Yerington Mine Site (Site) pursuant to the Administrative Order on Consent (AOC) and associated Scope of Work (SOW)¹. The AOC/SOW was issued to ARC by the U.S. Environmental Protection Agency - Region 9 (EPA) on April 21, 2009 and became effective May 1, 2009. The Site is located approximately one-half mile west of the City of Yerington in Lyon County, Nevada (Figure 1-1).

This revised RAP contains information that was presented in the *Draft Transite Pipe Removal Action Plan* dated January 8, 2010 (Brown and Caldwell, 2010a) and additional data resulting from the implementation of field radiological measurements and laboratory analyses of scale samples described in the *Supplemental Analysis Plan (SAP) for the Transite Pipe Removal Action* dated April 23, 2010 (Brown and Caldwell 2010b). The draft SAP was approved by the EPA on May 27, 2010 but was not finalized to include EPA comments. This revised RAP includes the revised SAP and associated responses to EPA comments (Appendix A), and describes a removal action approach that differs from the approach presented in the January 8, 2010 draft RAP based on the supplemental scale data collected by ARC with EPA oversight.

As agreed to with EPA, removal action decisions for on- or off-Site disposal will be based on the presence or absence of pipe scale or sediment, based on visual inspections of pipe sections, and the ability to remove such materials from the pipe via limited decontamination activities (e.g., brushing of pipe interiors and scale/sediment removal by gravity). The removal action will be performed for transite pipe and associated materials located on portions of the Site that can safely be accessed by equipment capable of lifting and transporting pipe materials.

¹ Administrative Order on Consent and Settlement Agreement for Removal Action and Past Response Costs, Anaconda Copper Mine, Yerington Nevada; U.S. EPA Region IX; CERCLA Docket No. 09-2009-0010.

Transite pipe occurs within five of the eight Operable Units (OUs; Figure 1-2) on the Site identified by the EPA, as indicated below:

- Site-Wide Groundwater (OU-1)
- Pit Lake (OU-2)
- Process Areas (OU-3) - contains transite pipe
- Evaporation Ponds and Sulfide Tailings (OU-4) - contains transite pipe
- Waste Rock Areas (OU-5) - contains transite pipe
- Oxide Tailings Areas (OU-6) - contains transite pipe
- Wabuska Drain (OU-7)
- Arimetco Facilities (OU-8) - contains transite pipe

Additional transite pipe that may be found at a later date that can be safely accessed will be managed in a similar manner as described in this revised RAP.

1.1 Waste Materials and Management

Transite pipe is constructed of asbestos containing materials (ACM) that typically contains above one percent (1%) asbestos, which is regulated as a potentially hazardous material by EPA and the Occupational Health and Safety Administration (OSHA). Depending on their physical characteristics, friable pipe sections may be characterized as regulated ACM (RACM). As described in the Work Plan, transite pipe and associated materials that can be safely accessed by construction equipment (e.g., fork lift and rubber-tired haul trucks) will be placed in the on-Site landfill cell located within the Sulfide Tailings Area or shipped for off-Site disposal to the US Ecology facility in Grand View, Idaho (authorized to accept CERCLA wastes pursuant to 40 CFR 300.440). Localized occurrences of scale within transite pipe sections contain technologically enhanced naturally-occurring radioactive materials (TENORM). Nevada Administrative Code (NAC) Section 459.184 exempts naturally occurring radioactive materials which contain less than 5 picoCuries per gram (pCi/g) of radium-226 from the provisions of NAC 459.180 to 459.314 inclusive.

Transite pipe with bulk radiochemical concentrations above 5 pCi/g of radium-226 were designated as 'mixed asbestos-TENORM waste' in the draft RAP. However, as used herein, mixed asbestos-TENORM waste is defined as transite pipe and associated materials that will be shipped off-Site to the US Ecology facility. If possible, ARC plans to ship the mixed asbestos-TENORM waste along with TENORM-impacted soils from the Process Areas to be excavated as part of a separate removal action *Draft Process Areas Radiological Materials Removal Action Plan* dated July 6, 2010 (Brown and Caldwell, 2010c). The timing of this combined shipment is uncertain until a contractor is procured to perform the removal actions, and ARC plans to discuss this approach with EPA when the contractor's schedules are finalized.

1.2 Document Organization

Section 2.0 of this revised RAP describes the activities that were performed in September 2009 and June 2010 to characterize transite pipe materials. Appendix A-1 contains the revised SAP and associated responses to EPA comments on the draft SAP. Photographs of survey and sample locations are provided in Appendices A-2 and A-3. Field logs are provided in Appendix B. Section 3.0 describes the asbestos analytical results (Appendix C). Section 3.0 also summarizes the comprehensive asbestos survey (CAS) and inspection report, provided as Appendix D.

Radiometric survey and radiochemical analytical results are summarized in Section 4.0, and Appendix E presents the radiochemical analytical data. Results from the leachate testing of transite pipe scale, as described in the revised SAP, using the Meteoric Water Mobility Procedure (MWMP) are also provided in Section 4.0 and Appendix F provides the MWMP data. Section 4.0 also compares radiometric survey and laboratory radiochemical data, and the method to identify potential mixed asbestos-TENORM waste that exceeds the Site-specific Applicable or Relevant and Appropriate Requirement (ARAR) of 5 pCi/g of radium-226. Section 5.0 presents the updated plan for the removal action, based on the results of the SAP, including information for the on-Site landfill (Appendix G) and an updated project schedule (Appendix H). Section 6.0 includes the health and safety requirements for the removal action, and a Work Risk Assessment is provided in Appendix I. Section 7.0 lists the references cited in this revised RAP.

SECTION 2.0 CHARACTERIZATION ACTIVITIES

Initial transite pipe characterization activities were implemented in September 2009 in accordance with the inspection and sampling plan presented in the *Transite Pipe Removal Action Work Plan - Revision 1* (Work Plan) dated August 19, 2009 (Brown and Caldwell, 2009a). The following field activities were performed to identify, quantify and classify transite pipe and associated materials that occur on the Site:

- Comprehensive asbestos survey (CAS);
- Collection of 58 samples for asbestos analysis;
- Collection of 26 samples for radiochemical analysis; and
- Completion of the radiometric survey.

These field activities were supplemented by scale sampling and laboratory analyses described in the draft SAP (Brown and Caldwell, 2010b), which was subsequently revised (Appendix A-1) to include:

- Collection of 7 scale/sediment samples for MWMP analysis;
- Collection of 29 scale/sediment samples for radiochemical analysis; and
- Completion of additional radiometric surveys.

Characterization activities were performed within each homogenous area (HA) for the geographically based occurrences of transite pipe on the Site. The following HAs, depicted in Figures 2-1 through 2-5, were previously identified in the Work Plan (no modifications to the HAs resulted from the 2009 or 2010 characterization activities):

- HA-1 includes the lay-down area with scattered lengths of transite pipe located in the Waste Rock Area northeast of the open pit.

- HA-2 includes the majority of transite pipe on the Site, with intact and continuous pipeline lengths in the W-3 Waste Rock Area. One segment extends from the Slot Pond around the northeastern portion of the W-3 Waste Rock Area to Burch Drive, following the fence line. A second segment originates close to the southwest corner of the W-3 Waste Rock Area and continues generally north to Burch Drive, where it meets the first segment and the two segments join. A third segment continues along the north side of Burch Drive to the southeast corner of the Process Areas.
- HA-3 includes intact and continuous pipeline lengths and scattered transite pipe materials within the Process Areas.
- HA-4 includes scattered transite pipe materials as well as pipe sections within the Radiological Control Area (RCA) portion of the process areas that, based on previous investigations, exhibit elevated radiometric readings.
- HA-5 includes intact and continuous pipeline lengths along the calcine ditch and scattered transite pipe materials within the Oxide and southern Sulfide Tailings Areas.
- HA-6 includes scattered transite pipe in the northern Sulfide Tailings Area.
- HA-7 includes transite pipe from the north edge of the Anaconda unlined evaporation pond and isolated scattered pipe in the area of the Weed heights sewage ponds.

2.1 Transite Pipe Descriptions

The majority of transite pipe observed at the Site consists of intact pipe runs, primarily in HA-2 with shorter run lengths in HA-3. The remaining occurrences consists of isolated, scattered sticks of pipe, stacked piles of intact pipe and scattered, broken pieces of pipe. Typically, transite pipe consists of 13-foot lengths that range from 8 to 24 inches in outside diameter. The pipe was observed to be light gray in color, with some lengths colored light-brown to red (most likely due to weathering), and some of the pipe contained a blue or green-colored liner. Scale was observed on the interiors of select pipe occurrences. Some exposed pipe ends were observed to contain sediment (i.e., ore beneficiation solutions residue) or soil (possibly wind-blown).

Other observed potential ACM includes concrete, clay and asphaltic-containing tar adhered to metal pipe. The metal pipe located within HA-1, HA-5, HA-6 and HA-7 appeared to have an asphaltic coating with a fibrous media-binder. Clay pipe was found in HA-7, and unused concrete pipe and stockpiled, sewer pipe was found in HA-4. More detailed information regarding the occurrence and character of transite pipe on the Site can be found in Appendices A, B and D.

2.2 Sample Collection Procedures

The Work Plan sampling procedures consisted of chipping off the edges of the pipe, collecting broken pieces of pipe and breaking existing pieces of broken pipe. Collected samples included the entire pipe thickness, from interior to exterior wall. In a few locations, where pipe scale was evident and not easily removed, the scale was included in the sample. Sampling was conducted by using amended water/wet methods for picking up the broken pieces of pipe. For the sampling activities described in the draft SAP, samples were collected in a manner designed to only select the scale and/or sediment inside of the pipe. Where the scale was not easily separable from the pipe wall, or the pipe wall was significantly degraded, the collected sample included degraded pipe wall material.

A hand-operated sprayer was used to apply a water-based wetting agent/surfactant to the area that was sampled. When destructive sampling was required, the procedure consisted of chipping off the edges of the pipe using a chisel and sledge hammer, with the portion of pipe to be sampled wetted prior to collection using the water-based wetting agent/surfactant to limit dust generation. Following sample collection, a spray-on encapsulant was applied to the exposed portion of the pipe to seal in any asbestos fibers generated during sampling. Sample locations, type of characterization performed and pipe descriptions (e.g., material of construction, presence of liner and approximate pipe diameter) are presented in Table 2-1 for the sampling performed during the Work Plan and in Table 2-2 for the SAP. Appendices A-2 and A-3 provide representative photographs of the pipe samples and locations, and Appendix B includes copies of field notes recorded in the field log books for both sampling activities.

ACM, MWMP, radiochemical and MWMP sampling locations, and radiometric survey reading locations were collected and logged using a Trimble Geo XT handheld Global Positioning System (GPS) unit with an accuracy of one meter or less. The GPS has an integrated receiver that uses Wide Area Augmentation System (WAAS) correction messages to improve GPS accuracy. The sample and survey point locations are shown in Figures 2-2 through 2-5.

For Quality Assurance/Quality Control (QA/QC) purposes, duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples were collected from both asbestos and radiochemical sample locations. No MWMP duplicate samples were collected due to the small number of samples and the difficulty of obtaining sufficient sample material for a duplicate sample. Duplicate samples of the transite pipe wall section collected in the field could not be homogenized due to the nature of the material being sampled. Therefore, differences were observed in analytical results between the original and duplicate samples. In these cases, the highest analytical values have been reported as a conservative approach to the transite pipe characterization. Scale/sediment duplicate samples collected pursuant to the SAP were homogenized.

Table 2-1. Pipe Characterization Sample Summary							
Location	Asbestos Sample	Rad Sample	Rad Survey	Pipe Description			Comment
				Material	Lined/ Unlined	Approx Outside Diameter Inches	
HA-1 Laydown Area at East End of Pit							
HA-1-01	x	x	x	Transite	L	16	Pipe not in original position. Intact and appeared to be unused. Other end of pipe was saw-cut.
HA-1-02	x		x	Transite	L	8	Intact and appeared to be unused.
HA-1-03	x		x	Transite	L	10	Mostly intact. Some broken shards of pipe in the sampling area.
HA-1-04	x		x	Transite	U	NR	Sample taken from broken piece of pipe collar.
HA-1-05	x	x	x	Transite	U	8	Pipe appeared to be used.
HA-1-06	x		x	Transite	U	8	Inside of pipe contained ~1/8 inch of scale.
HA-1-07		x	x	Transite	NR	10	Scale & sediment included in sample.
HA-1-08-MET	x		x	Coated Metal	U	12	Metal pipe ~40% is bent and crushed. ~50% of pipe is covered with black, asphaltic material.
HA-1-09-MET	x			Coated Metal	U	12	Metal pipe ~40% is bent and crushed. ~50% of pipe is covered with black, asphaltic material.
HA-1-10-MET	x			Coated Metal	U	12	Metal pipe ~40% is bent and crushed. ~50% of pipe is covered with black, asphaltic material.
HA-1-R8			x	Transite	NR	NR	
HA-1-R9			x	Transite	NR	NR	
HA-1-R10			x	Transite	NR	NR	
HA-1-R11			x	Transite	NR	NR	
HA-1-R12			x	Transite	NR	NR	Unused unlined pipe.
HA-2 W-3 Waste Rock Area							
HA-2-01	x	x	x	Transite	L	14	Weathered pipe. Broken pieces of pipe inside. Broken collars nearby. Sample taken from broken piece of pipe.
HA-2-02	x		x	Transite	L	14	Pipe-run. Appeared to be used. No significant scaling inside of pipe.

Table 2-1. Pipe Characterization Sample Summary							
Location	Asbestos Sample	Rad Sample	Rad Survey	Pipe Description			Comment
				Material	Lined/ Unlined	Approx Outside Diameter Inches	
HA-2 W-3 Waste Rock Area – Continued							
HA-2-03	x	x	x	Transite	L	14	Sample chipped from disconnected pipe. Pipe end showed slight disintegration of white material with finger pressure.
HA-2-04	x		x	Transite	L	12	No visible scaling or sediment inside pipe. Pipe is weathered. Sample collected from end of pipe run.
HA-2-05	x	x	x	Transite	L	12	Pipe end showed slight disintegration of white-colored material with finger pressure. No scaling in pipe.
HA-2-06	x		x	Transite	L	NR	Sample taken from pile of broken pieces (broken pieces range from 1/8"-10"). No visible sediment or scaling in pipe.
HA-2-07	x	x	x	Transite	L	12	Pipe exists underground except for 1' above grade that was sampled. Weathered and intact. Sediment inside pipe.
HA-2-08		x	x	Transite	L	12	No scaling. Some sediment inside that appeared to be from rainwater deposition.
HA-2-09		x	x	Transite	L	12	No scaling. Some sediment inside that appeared to be from rainwater deposition.
HA-2-10	x	x	x	Transite	L	12	No scaling. Broken pieces in area. Pipe end showed slight disintegration of white material with finger pressure.
HA-2-11	x		x	Transite	NR	NR	Shards of broken collar.
HA-2-R20			x	Transite	NR	NR	
HA-2-R21			x	Transite	NR	NR	
HA-2-R22			x	Transite	NR	NR	
HA-2-R23			x	Transite	NR	NR	
HA-2-R24			x	Transite	NR	NR	
HA-2-R25			x	Transite	NR	NR	
HA-2-R26			x	Transite	NR	NR	
HA-2-R27			x	Transite	NR	NR	
HA-2-R28			x	Transite	NR	NR	
HA-2-R29			x	Transite	NR	NR	
HA-2-R30			x	Transite	NR	NR	
HA-2-R31			x	Transite	NR	NR	
HA-2-R32			x	Transite	NR	NR	
HA-2-R33			x	Transite	NR	NR	
HA-2-R34			x	Transite	NR	NR	
HA-2-R35			x	Transite	NR	NR	
HA-2-R36			x	Transite	NR	NR	
HA-2-R37			x	Transite	NR	NR	
HA-2-R38			x	Transite	NR	NR	
HA-2-R39			x	Transite	NR	NR	
HA-2-R40			x	Transite	NR	NR	
HA-2-R41			x	Transite	NR	NR	
HA-2-R42			x	Transite	NR	NR	
HA-2-R43			x	Transite	NR	NR	
HA-2-R44			x	Transite	NR	NR	
HA-2-R45			x	Transite	NR	NR	
HA-2-R46			x	Transite	NR	NR	
HA-2-R47			x	Transite	NR	NR	

Table 2-1. Pipe Characterization Sample Summary							
Location	Asbestos Sample	Rad Sample	Rad Survey	Pipe Description			Comment
				Material	Lined/ Unlined	Approx Outside Diameter Inches	
HA-3 Process Areas							
HA-3-01	x	x	x	Transite	L	12	No scaling in pipe. Sample from chipping off end of pipe run.
HA-3-01-FD	x		x	Transite	L	12	No scaling in pipe. Sample from chipping off end of pipe run.
HA-3-02	x		x	Transite	L	24	Pipe is broken in this area.
HA-3-03	x	x	x	Transite	NR	8	Pipe is very deteriorated. Part of pipe is below grade.
HA-3-03-FD		x	x	Transite	NR	8	Pipe is very deteriorated. Part of pipe is below grade.
HA-3-04	x	x	x	Transite	U	18	No scaling, some sediment in pipe. Pipe exists in a concrete base. Sample chipped off pipe.
HA-3-04-FD	x		x	Transite	U	18	No scaling, some sediment in pipe. Pipe exists in a concrete base. Sample chipped off pipe.
HA-3-05	x		x	Transite	L	24	Four-stick pipe run. No scaling. Pipe full of sediment, which also occurs around the pipe.
HA-3-R48			x	Transite	NR	NR	
HA-3-R49			x	Transite	NR	NR	
HA-3-R50			x	Transite	NR	NR	
HA-3-R51			x	Transite	NR	NR	
HA-3-R52			x	Transite	NR	NR	
HA-3-R53			x	Transite	NR	NR	
HA-3-R54			x	Transite	NR	NR	
HA-4 Radiological Control Area (RCA)							
HA-4-01	x	x	x	Transite	NR	14	Pipe is heavily scaled. Outside of pipe is weathered. Scale ranges from 3/8"-1".
HA-4-02	x	x	x	Transite	NR	14	Pipe is heavily scaled. Outside of pipe is weathered. Scale ranges from 3/8"-1".
HA-4-02-FD		x	x	Transite	NR	14	Pipe is heavily scaled. Outside of pipe is weathered. Scale ranges from 3/8"-1".
HA-4-03	x	x	x	Transite	L	10	Isolated stick of pipe. Heavily weathered. Broken pieces of pipe scattered throughout the area.
HA-4-04	x	x	x	Transite	L	24	Mostly intact pipe. Some broken pieces of pipe in the area. No scaling.
HA-4-05	x		x	Transite	NR	14	Weathered pipe with scale inside. Broken ends not crushable with finger pressure. Sample taken from broken
HA-4-06	x	x	x	Concrete	U	12	Concrete pipe, most likely unused sewer pipe. Appears to have been stockpiled in this area.
HA-4-07	x		x	Concrete	U	12	Concrete pipe, most likely unused sewer pipe. Appears to have been stockpiled in this area.
HA-4-08	x		x	Concrete	U	12	Concrete pipe, most likely unused sewer pipe. Appears to have been stockpiled in this area.
HA-4-R1			x	Transite	NR	NR	
HA-4-R2			x	Transite	NR	NR	
HA-4-R3			x	Transite	NR	NR	
HA-4-R4			x	Transite	NR	NR	
HA-4-R5			x	Transite	NR	NR	
HA-4-R6			x	Transite	NR	NR	
HA-4-R7			x	Transite	NR	NR	

Table 2-1. Pipe Characterization Sample Summary							
Location	Asbestos Sample	Rad Sample	Rad Survey	Pipe Description			Comment
				Material	Lined/ Unlined	Approx Outside Diameter Inches	
HA-4 Radiological Control Area (RCA) - Continued							
RCA Pipe #1			x	Transite	NR	NR	
RCA Pipe #2			x	Transite	NR	NR	
RCA Pipe #3			x	Transite	NR	NR	
RCA Pipe #4			x	Transite	NR	NR	
RCA Pipe #5			x	Transite	NR	NR	
RCA Pipe #6			x	Transite	NR	NR	
RCA Pipe #7			x	Transite	NR	NR	
RCA Pipe #8			x	Transite	NR	NR	
RCA Pipe #9			x	Transite	NR	NR	
RCA Pipe #10			x	Transite	NR	NR	
RCA Pipe #11			x	Transite	NR	NR	
HA-5 Oxide Tails/South Sulfide Tails							
HA-5-01	x		x	Transite	L	8	One isolated stick of pipe. Sample taken from broken piece of pipe near the pipe stick.
HA-5-02	x	x	x	Transite	L	8	Contains sediment. No scaling. Sample taken from broken piece nearby. Outside of pipe shows greenish coloration.
HA-5-02-FD	x		x	Transite	L	8	Contains sediment. No scaling. Sample taken from broken piece nearby. Outside of pipe shows greenish coloration.
HA-5-03-MET	x		x	Coated Metal	U	12	No visible scaling inside pipe. Metal pipe contains asphaltic coating with fibrous media-binder.
HA-5-03-MET-FD	x		x	Coated Metal	U	12	No visible scaling inside pipe. Metal pipe contains asphaltic coating with fibrous media-binder.
HA-5-04	x	x	x	Transite	L	8	No scaling visible in pipe. Sample area is a separated bend in the pipe run.
HA-5-04-FD	x	x	x	Transite	L	8	No scaling visible in pipe. Sample area is a separated bend in the pipe run.
HA-5-05	x			Transite	L	NR	Sample from small shard.
HA-5-06	x		x	Transite	L	8	Sample taken from separation in pipe run.
HA-5-R55			x	Coated Metal	NR	NR	
HA-6 North Sulfide Tailings							
HA-6-01	x		x	Transite	NR	16	Weathered stick of isolated pipe.
HA-6-02	x	x	x	Transite	L	16	Weathered stick of isolated pipe. Some sediment in pipe. Appears to have been relocated to this area.
HA-6-03	x		x	Transite	L	16	Weathered pipe. Four sticks of pipe in this area.
HA-6-04-MET	x		x	Coated Metal	U	16	Metal pipe contains asphaltic coating with fibrous media-binder.
HA-6-05-MET	x		x	Coated Metal	U	16	Metal pipe contains asphaltic coating with fibrous media-binder.
HA-6-06-MET	x		x	Coated Metal	U	16	Metal pipe contains asphaltic coating with fibrous media-binder.
HA-6-R16			x	Transite	NR	NR	
HA-6-R17			x	Transite	NR	NR	
HA-6-R18			x	Transite	NR	NR	
HA-6-R19			x	Transite	NR	NR	

Table 2-1. Pipe Characterization Sample Summary							
Location	Asbestos Sample	Rad Sample	Rad Survey	Pipe Description			Comment
				Material	Lined/Unlined	Approx Outside Diameter Inches	
HA-7 Evaporation Ponds							
HA-7-01	x		x	Clay	U	15	Clay pipe trending to the north. The majority of the pipe is below grade, under roadway.
HA-7-02	x	x	x	Transite	U	22	Pipe set in cement bottom. Bottom half encased in 24" of concrete. Heavily weathered. Full of sediment.
HA-7-03	x		x	Transite	U	22	Pipe set in cement bottom. Bottom half encased in 24" of concrete. Heavily weathered. Full of sediment.
HA-7-04	x	x	x	Transite	L	9	Weathered pipe. Contains scale inside. Runs north, below grade, under roadway.
HA-7-05	x		x	Transite	L	9	Weathered pipe. Contains scale inside. Runs north, below grade, under roadway.
HA-7-06	x		x	Transite	L	9	Weathered pipe. Contains scale inside. Runs north, below grade, under roadway.
HA-7-07	x		x	Transite	U	22	Pipe set in cement bottom. Bottom half encased in 24" of concrete. Heavily weathered. Full of sediment.
HA-7-08-MET	x		x	Coated Metal	U	24	Metal pipe with asphaltic material coating on less than 50% of pipe.
HA-7-09-MET	x			Coated Metal	U	24	Metal pipe with asphaltic material coating on less than 50% of pipe.
HA-7-10-MET	x			Coated Metal	U	24	Metal pipe with asphaltic material coating on less than 50% of pipe.
HA-7-R15			x	Transite	NR	NR	

Note: L - Lined pipe, U - Unlined pipe and NR - Not recorded

Table 2-2. Transite Pipe Scale/Sediment Characterization Sample Summary							
Location	MWMP Sample	Rad Sample	Rad Survey	Pipe Description			Comment
				Material	Lined/Unlined	Approx Outside Diameter Inches	
HA-1 Laydown Area at East End of Pit							
S-1	x	x	x	Transite	L	18	Sample combination of scale and sandy sediment.
S-2		x	x	Transite	U	8	Sample combination of scale and degraded pipe wall
S-3		x	x	Transite	L	8	Scale adhered to entire pipe wall interior.
S-4		x	x	Transite	U	12	Sample composed of silty/sandy sediment.
S-5		x	x	Transite	U	8	Sample combination of scale and degraded pipe wall
S-6	x	x	x	Transite	L	8	Scale is chalky and low density. MWMP sample collected at opposite end of pipe.
HA-2 W-3 Waste Rock Area							
S-7		x	x	Transite	U	12	Scale adhered to entire pipe wall interior. Majority of sample is pipe wall.
HA-2-03			x	Transite	NR	NR	Insufficient material to sample.

Table 2-2. Transite Pipe Scale/Sediment Characterization Sample Summary							
Location	MWMP Sample	Rad Sample	Rad Survey	Pipe Description			Comment
				Material	Lined/ Unlined	Approx Outside Diameter Inches	
HA-2 W-3 Waste Rock Area - Continued							
S-8a			x	Transite	NR	12	Insufficient material to sample.
S-8b			x	Transite	NR	12	Insufficient material to sample.
S-9a			x	Transite	NR	12	Diameter not recorded, noted diameter based on S-8a and S-8b on same pipe run. Insufficient material to sample.
S-9b			x	Transite	NR	12	Diameter not recorded, noted diameter based on S-8a and S-8b on same pipe run. Insufficient material to sample.
S-10a		x	x	Transite	NR	12	Diameter not recorded, noted diameter based on S-8a and S-8b on same pipe run.
S-10b	x	x	x	Transite	NR	12	Diameter not recorded, noted diameter based on S-8a and S-8b on same pipe run.
S-11		x	x	Transite	L	12	Sample consists of low-density fibrous material.
S-12a				Transite	NR	NR	Sample consists of fine brown sediment.
S-12b	x	x	x	Transite	NR	NR	Insufficient material to sample.
HA-3 Process Areas							
S-13		x	x	Transite	L	8	Sample consists of loose white scale.
S-14			x	Transite	NR	NR	Insufficient material to sample.
S-15	x	x	x	Transite	L	12	Significant liner degradation at joints. MWMP sample composited from both ends of pipe and additional joint 5 joints to the north..
S-DUP-1		x	x	Transite	L	12	Same location as S-15
S-27		x	x	Transite	L	12	Sample consists of fine white-grained sediment.
S-28			x	Transite	NR	NR	Insufficient material to sample.
S-29		x	x	Transite	U	18	Sample primarily degraded pipe wall.
HA-4 Radiological Control Area (RCA)							
S-16		x	x	Transite	L	8	Sample consists of white scale.
S-17		x	x	Transite	U	12	No distinguishable scale, sample consists of bluish-white degraded transite.
S-DUP-2		x	x	Transite	U	12	Same location as S-17.
S-18		x	x	Transite	NR	12	Sample consists of white blue-tinged scale and brown degraded transite.
S-19		x	x	Transite	U	12	Sample contains white scale and red-tinted degraded transite.
S-20		x	x	Transite	U	12	Sample contains white scale and red-tinted degraded transite.
HA-5 Oxide Tails/South Sulfide Tails							
S-21		x	x	Transite	L	8	Sample consists of fine light-grained tan material.
S-25	x	x	x	Coated Metal	U	12	Sample consists of light brown sediment.
S-26		x	x	Coated Metal	U	12	Sample consists of light brown sediment.
S-DUP-3		x	x	Coated Metal	U	12	Same location as S-26

Table 2-2. Transite Pipe Scale/Sediment Characterization Sample Summary							
Location	MWMP Sample	Rad Sample	Rad Survey	Pipe Description			Comment
				Material	Lined/ Unlined	Approx Outside Diameter Inches	
HA-6 North Sulfide Tailings							
S-22		x	x	Transite	U	12	Sample mostly VLT with coarse sand.
HA-7 Evaporation Ponds							
S-23		x	x	Transite	U	18	Sample consists of yellow scale mixed with degraded transite.
S-24	x	x	x	Transite	U	18	Sample consists of yellow scale mixed with red-tinted degraded transite.

Note: L - Lined pipe, U - Unlined pipe and NR - Not recorded

2.3 Asbestos Containing Material Sampling

Sampling of transite pipe in the HAs for asbestos analysis was performed by an Asbestos Hazard Emergency Response Act (AHERA) accredited inspector in accordance with OSHA 29 CR 1926.1101(b) Class III Work. Samples for asbestos analysis were collected according to AHERA protocol using the following criteria:

- For homogenous ACM less than 1,000 linear feet or square feet, a minimum of three (3) bulk samples were collected from each HA.
- For homogeneous ACM from 1,000 up to 5,000 linear feet or square feet, a minimum of five (5) bulk samples were collected from each HA.
- For homogenous ACM greater than 5,000 linear or square feet, a minimum of seven (7) bulk samples were collected from each HA.
- For lengths of wrapped metal pipe, or other construction material (e.g. concrete or clay), less than 100 linear feet, a minimum of three (3) samples were collected.
- For all other areas, a minimum of seven (7) samples of suspect-asbestos containing pipe were collected.

Transite pipe sections, and other pipe materials (when observed), were selected within each HA for asbestos sampling based on visual observations of pipe condition and accessibility. Samples for ACM, weighing approximately 5 grams each or one inch in diameter, were collected in double-bagged, Ziploc-type bags. The double-bagged samples were individually marked with unique sample identification numbers. The asbestos samples were documented on a chain-of-custody and were submitted to Asbestos TEM Laboratories, Inc. (Sparks, NV), a National

Voluntary Laboratory Accreditation Program (NVLAP) affiliated laboratory. The samples were analyzed using Polarized Light Microscopy (PLM) methods in accordance with EPA Method 600/R-93/116 or 600/M4-82-020 for the determination of asbestos fibers. Analytical results for the asbestos-containing transite pipe samples are discussed in Section 3.0.

2.4 Radiometric Survey and Radiochemical Sampling

The initial radiometric survey, and associated radiochemical sampling program, was performed in conjunction with the asbestos sampling program. The radiometric survey was conducted in order to confirm the presence or absence of mixed asbestos-TENORM waste that could occur as pipe scale and localized accumulations of sediment within the transite pipe. This sampling was designed to determine the bulk concentration of TENORM in the waste stream. Additional sampling conducted by the SAP was designed to determine the concentration of TENORM and specifically Ra-226 in the scale/sediment and/or degraded pipe wall material that had been impregnated by ore beneficiation solutions exclusive of the bulk undisturbed transite pipe wall matrix. Radiometric data and radiochemical analytical results are discussed in Section 4.0 and presented in Appendices B and E.

2.4.1 2009 Radiometric Survey and Radiochemical Sampling

This radiometric survey was initiated in HA-4 at known locations of isolated pipe segments with elevated radiometric readings where the interior of the pipe segments could be accessed by the survey instruments. Starting in HA-4 allowed for the potential calibration of gamma readings with radiochemical analytical data. The survey included gamma readings and mixed field readings (also referred to as gross alpha/beta readings).

Gamma readings were measured on the inside of the pipe and the outside of the pipe (both top and bottom). Alpha/beta readings were measured on the inside of the pipe only. Gamma radiation background readings were obtained at waist level and recorded once the instrument reading stabilized at distances of up to 25 feet from the pipe/ACM debris (i.e., a distance beyond the influence of the pipe or ACM debris).

The majority of the measurements were taken at intervals along the outside length of the pipe runs and, wherever possible, at potential debris/scale accumulation points within the pipe such as local low spots, valves, elbows, pipe joints and holes or breaks in intact pipe. Where pipe segments had terminated or disconnected, allowing access to the interior of the pipe, a gamma measurement was taken both inside and outside of the pipe and an alpha/beta measurement was taken inside of the pipe. In addition, both gamma and alpha/beta measurements were taken at asbestos and radiochemical sample locations.

Gamma readings were measured in micro Roentgens per hour ($\mu\text{R/hr}$) with a Ludlum model 2241-3 digital survey meter using a Ludlum model 44-2 NaI detector probe calibrated with radium-226, which has similar response characteristics as a tissue-equivalent meter (e.g., Bicon μrem meter) for NORM radiation exposure. Alpha/beta readings were measured in counts per minute (cpm) with a Ludlum model 2241-3 digital survey meter using a Ludlum model 44-9 G-M detector probe. Both detectors were factory calibrated on July 8, 2009 by Ludlum Measurement Inc. Response checks of the survey meters were conducted daily using the Cesium 137 source that is permanently affixed to the side of the Ludlum model 2241-3.

Samples for radiochemical analysis were initially collected in a manner suitable for determining radiochemical concentrations averaged over the entire pipe wall thickness (i.e., the sample included the entire pipe wall +/- scale deposits on the inner pipe wall). Samples were placed in double-bagged Ziploc-type bags (approximately 500 grams each), and were marked with a unique sample number.

Sample information was documented on chain-of-custody forms and the samples were submitted to TestAmerica Richland (Richland, WA). The samples were analyzed for Ra-226 and Ra-228 and for total uranium and total thorium in accordance with Method E901.1 (gamma spectroscopy) and EPA Method 6020 Inductively Coupled Plasma – Mass Spectrometer (ICP-MS), respectively.

Following the receipt of analytical results of the bulk radiochemical concentrations of the transite pipe, ARC determined that the collection of a limited number of scale samples from areas of elevated radiometric readings and radiochemical concentrations would: 1) support limited decontamination activity for loose scale in the transite pipe, described below in Sections 4.4 and 5.2; and 2) develop an upper concentration value expected for mixed asbestos-TENORM waste for transite pipe from HA-1 and HA-4. Three locations (HA-1-07, HA-4-01 and HA-4-02) where pipe scale was observed on the interior pipe walls were selected for discrete scale sampling because of the observed elevated radiometric readings and the radiochemical analytical results.

The three scale samples were collected on November 24, 2009, and submitted to TestAmerica for U and Th (EPA Method 6020) and Ra-226/228 (E901.1 gamma spectroscopy). The scale sample collected at location HA-1-07: 1) was observed to be a white, fine-grained scale with a 'chalky' consistency that was approximately 1/8-inch thick; and 2) contained little to no ACM, and was easily separated from the pipe (similar to the planned limited decontamination activity to be performed during the removal action). The 'scale' samples from HA-4-01 and -02 consisted of red-stained and flaky friable transite pipe material (i.e., RACM) collected from within the pipe interior that had been degraded by ore beneficiation solutions. These two samples likely contained some remnant asbestos.

2.4.2 2010 SAP Radiometric Survey and Radiochemical Sampling

Subsequent to the 2009 Work Plan characterization activities, additional sampling and surveying was conducted to separately characterize the nature of the scale and sediment within the transite pipes. Survey and sample locations were selected based on observed occurrences of scale and at topographic low points where scale formation or sediment settling would be more likely. At each of the selected locations, the pipe was (disarticulated, if necessary) and visually examined for any occurrence of scale or pipe wall impacted by ore beneficiation solutions. The portion of the pipe interior with the largest scale accumulation or thickest portion of impacted pipe wall was selected for sample collection. If there was no observed scale or impacted pipe wall, a sample was not collected at that location. However, a gamma survey was performed at that location.

A gamma survey was performed at each selected location with the gamma survey probe positioned inside the pipe interior adjoining the location selected for the sample collection if a sample was collected. If no sample was collected, then the survey measurement was taken on the bottom portion of the interior pipe wall. The survey measurements were made with a Ludlum Model 44-2 NaI probe connected to a Ludlum Model 2241 series meter. The meter was configured to take a 60-second count and was factory calibrated on September 11, 2009 by Ludlum Measurement Inc. A response check of the survey meter was conducted daily using the Cesium 137 source that is permanently affixed to the side of the Ludlum model 2241-3.

A high-density polyethylene jig attached to the probe facilitated a consistent source-to-detector geometry such that the jig was positioned in contact with the pipe at the chosen location to maintain a constant separation distance of approximately 1 cm between the pipe wall and the probe. The probe was positioned with the centerline of the probe parallel to the centerline of the pipe. A 60-second count was taken at each location and recorded. Near each surveying location, local comparison 60-second counts were performed in the vicinity of the pipe to evaluate the impact of local variations in gamma radiation count rates upon the values measured inside the pipe sections. In addition, the exposure rates in micro Roentgens per hour ($\mu\text{R/hr}$) both inside the pipe and at the local comparison location were recorded.

Samples for radiochemical analysis were collected at each location where there was sufficient material to sample. The samples were collected in a manner designed to determine the concentration of TENORM and specifically Ra-226 in the scale/sediment and/or degraded pipe wall material that had been impregnated by ore beneficiation solutions exclusive of the bulk undisturbed transite pipe wall matrix. Samples were placed in double-bagged Ziploc-type bags (approximately 500 grams each), and were individually marked with a unique sample number. The samples were documented on a chain-of-custody form and were submitted to Eberline Services (located in Oak Ridge, Tennessee) and analyzed for Ra-226 and Ra-228 in accordance with Method E901.1 (gamma spectroscopy).

2.5 Inaccessible Pipe

Pipe locations deemed inaccessible for health and safety reasons were not subjected to characterization in 2009 or 2010. Inaccessible pipe locations encountered during the characterization activities include the following (all or most of the pipe in HA-1, -4 and -6 are accessible; with the exception of HA-1, all HAs contain some pipe that is partially buried):

- Three runs of pipe in HA-2, located north of the slot heap leach pad that run generally north-south and terminate off of the edge of a high wall. Approximately 1,600 feet appears to be inaccessible between the two heaps, including about 200 feet located near the edge of a high wall and about 100 feet in a culvert under Burch Drive. Also, the pipe runs buried on the north site of W-3, near Burch Drive.
- Approximately 100 feet of pipe in HA-3 located in below-ground vaults (northwest portion of HA-3, and an estimated 200 feet of pipe used as a culvert (a continuation of visible pipe three feet below grade).
- Scattered sticks and broken pieces of pipe in HA-4, located within the below-grade storage vault.
- Approximately 200 feet in HA-5 being used as culverts between berms. Also in HA-5, near the oxide tailings, the end of a pipe is visible at the toe of the slope that may represent an isolated pipe segment or the termination of a pipe run.
- Approximately 100 feet of pipe located in the berm within the unlined evaporation pond, about two feet below grade.

2.6 EPA Oversight

EPA provided oversight of the sampling activities and radiometric survey during implementation of the Work Plan work activities by having contracted personnel from CH2MHill on Site for two days. Ms. Ilke Dinkleman observed the asbestos and radiochemical sample collection activities as well as the radiological survey on September 27 and 28, 2009. During the SAP field work on June 2 and 3, 2010, EPA oversight was provided by Mr. Tom Dunkelman.

SECTION 3.0
ASBESTOS ANALYTICAL DATA

3.1 Analytical Results

As described in Section 2.1, 58 asbestos samples were shipped to Asbestos TEM Laboratories, Inc. (Sparks, NV), an NVLAP-affiliated laboratory. The samples were analyzed using Polarized Light Microscopy in accordance with EPA Method 600/R-93/116 or 600/M4-82-020 for the determination of asbestos fibers. The asbestos analytical laboratory reports are presented in Appendix C.

Asbestos contents greater than 1% were present in all cement transite pipe sampled during the characterization event. Asbestos contents greater than 1% were also present in two of the three coated metal pipes that were analyzed from HA-6 (HA-6-05-MET and HA-6-06-MET). Asbestos was not detected in the remaining coated metal pipes analyzed from HA-1, HA-5 and HA-7. In addition, asbestos was not detected in the clay pipe encountered in HA-7 or in the concrete pipe encountered in HA-4. Table 3-1 lists all sample locations, asbestos analytical results and pipe material type for the asbestos characterization.

Data Verification was completed to confirm that all submitted analyses were completed by the methods requested. The complete set of asbestos data has been uploaded to the project database.

Table 3-1. Asbestos Analytical Results			
Sample Location	Asbestos Type	Asbestos Result (%)	Pipe Material
HA-1 Laydown Area at East End of Pit			
HA-1-01	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-1-02	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-1-03	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-1-04	Chrysotile Crocidolite	10-20% 1-5%	Transite

Table 3-1. Asbestos Analytical Results			
Sample Location	Asbestos Type	Asbestos Result (%)	Pipe Material
HA-1 Laydown Area at East End of Pit - Continued			
HA-1-05	Chrysotile	20-30%	Transite
HA-1-06	Chrysotile	30-40%	Transite
HA-1-08-MET	None Detected		Coated Metal
HA-1-09-MET	None Detected		Coated Metal
HA-1-10-MET	None Detected		Coated Metal
HA-2 W-3 Waste Rock Area			
HA-2-01	Chrysotile	10-20%	Transite
	Crocidolite	1-5%	
HA-2-02	Chrysotile	10-20%	Transite
	Crocidolite	5-10%	
HA-2-03	Chrysotile	10-20%	Transite
	Crocidolite	5-10%	
HA-2-04	Chrysotile	10-20%	Transite
	Crocidolite	5-10%	
HA-2-05	Chrysotile	10-20%	Transite
	Crocidolite	5-10%	
HA-2-06	Chrysotile	10-20%	Transite
	Crocidolite	5-10%	
HA-2-07	Chrysotile	10-20%	Transite
	Crocidolite	5-10%	
HA-2-10	Chrysotile	10-20%	Transite
	Crocidolite	5-10%	
HA-2-11	Chrysotile	10-20%	Transite
	Crocidolite	5-10%	
HA-3 Process Areas			
HA-3-01	Chrysotile	10-20%	Transite
	Crocidolite	5-10%	
HA-3-01-FD	Chrysotile	10-20%	Transite
	Crocidolite	5-10%	
HA-3-02	Chrysotile	10-20%	Transite
	Crocidolite	5-10%	
HA-3-03	Chrysotile	10-20%	Transite
	Crocidolite	1-5%	
HA-3-04	Chrysotile	10-20%	Transite
	Crocidolite	1-5%	
HA-3-04-FD	Chrysotile	10-20%	Transite
	Crocidolite	1-5%	
HA-3-05	Chrysotile	10-20%	Transite
	Crocidolite	1-5%	
HA-4 Radiological Control Area (RCA)			
HA-4-01	Chrysotile	10-20%	Transite
	Crocidolite	1-5%	

Table 3-1. Asbestos Analytical Results			
Sample Location	Asbestos Type	Asbestos Result (%)	Pipe Material
HA-4 Radiological Control Area (RCA) – Continued			
HA-4-02	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-4-03	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-4-04	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-4-05	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-4-06	None Detected		Concrete
HA-4-07	None Detected		Concrete
HA-4-08	None Detected		Concrete
HA-5 Oxide Tails/South Sulfide Tails			
HA-5-01	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-5-02	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-5-02-FD	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-5-03-MET	None Detected		Coated Metal
HA-5-03-MET-FD	None Detected		Coated Metal
HA-5-04	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-5-04-FD	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-5-05	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-5-06	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-6 North Sulfide Tailings			
HA-6-01	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-6-02	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-6-03	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-6-04-MET	None Detected		Coated Metal
HA-6-05-MET	Chrysotile	30-40%	Coated Metal
HA-6-06-MET	Chrysotile	50-60%	Coated Metal
HA-7 Evaporation Ponds			
HA-7-01	None Detected		Clay
HA-7-02	Chrysotile Crocidolite	20-30% 1-5%	Transite

Table 3-1. Asbestos Analytical Results			
Sample Location	Asbestos Type	Asbestos Result (%)	Pipe Material
HA-7 Evaporation Ponds – Continued			
HA-7-03	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-7-04	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-7-05	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-7-06	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-7-07	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-7-08 MET	None Detected		Coated Metal
HA-7-09 MET	None Detected		Coated Metal
HA-7-10 MET	None Detected		Coated Metal

3.2 CAS Summary

According to the results of the laboratory analyses, the transite pipe and asphaltic-wrapped metal pipe located on the Site contain greater than 1% asbestos. Positive identification of ACM means that the quantity of asbestos in the samples were detected by the laboratory in concentrations exceeding the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulatory threshold of greater than one percent (1%) asbestos by weight. The CAS indicates the following:

- Transite pipe on the Site is classified as CAT II non-friable ACM that has been locally degraded and has the potential to degrade (i.e., become crumbled, pulverized or reduced to a powder) during the removal action. The disturbance of these materials during removal is regulated under the NESHAP regulation and by OSHA.
- The asphaltic-coated metal pipe on site is classified as CAT II non-friable ACM that has been locally degraded and has the potential to degrade (i.e., become crumbled, pulverized or reduced to a powder) during the removal action. The disturbance of these materials during removal is regulated under the NESHAP regulation and by OSHA.

Based on the CAS finding and conclusions reached, ARC recommends that all transite pipe and associated materials be classified as RACM, and that the following elements be implemented for the transite pipe removal action:

- A NESHAP notification form will be completed for the removal action, including the presence of RACM. The Asbestos Abatement Project Notification Form (i.e., NESHAP form) will be completed by the abatement contractor and submitted to the Nevada Division of Industrial Relations, Occupational Safety and Health Administration, Northern District Office in accordance with the regulatory requirements. During the removal action, the ACM is to be handled, removed and disposed in accordance with § 61.140 et seq.
- The disturbance of RACM by the removal action is classified by OSHA as Class II asbestos work, and will require compliance with applicable sections of § 29 Code of Federal Regulations (CFR) 1926.1101 (i.e., certified asbestos worker required).
- RACM will be sprayed with amended water and/or an encapsulant prior to transportation to the proposed on-Site landfill. Particular attention will be given to broken or damaged areas of the pipe. Broken pieces of pipe will be sprayed with amended water, encapsulated and placed in bags prior to transportation to the landfill. A licensed asbestos abatement contractor will be retained to perform the abatement of the ACM in accordance with § 61.140 et seq. and § 29 CFR 1926.1101 et seq.
- A Negative Exposure Assessment to assess the release of asbestos fibers during abatement will be conducted by a Certified Industrial Hygienist

The CAS Inspection Report, prepared by an AHERA-accredited inspector, is presented in Appendix D. The CAS Inspection Report does not address the occurrence of mixed asbestos-TENORM waste, as defined in Section 1.1 of this revised RAP.

SECTION 4.0

TRANSITE PIPE CHARACTERIZATION RESULTS

During the initial transite pipe characterization activities performed in 2009, radiometric survey and laboratory analytical results from consistently indicated 'near-background' values for the bulk radiochemical concentrations in transite pipe and associated materials within all HAs with the exception of localized pipe sections in HA-1 and HA-4. However, sampling conducted specifically of the scale/sediment in the pipe sections pursuant to the SAP indicated that some of the scale/sediment does contain elevated levels of radiochemicals. Radiometric survey and radiochemical analytical results are provided in Appendix E.

Radiological characterization data collected during Work Plan implementation was determined to not be usable for segregating the transite pipe for on- or off-site disposal due to methods used to collect the bulk samples. However, these data can be used to characterize the waste for shipment to the US Ecology facility in Grand View, Idaho. Pursuant to the SAP, ARC collected additional data in the form of controlled-geometry radiation gamma surveys and scale/sediment-specific samples suitable for designating individual pipe sections for on- or off-Site disposal. This section of the revised RAP also provides conclusions and recommendations for the dispositioning of transite pipe during the removal action based on the results of visual inspections and pipe decontamination activities.

4.1 Radiological Survey Results

In 2009, gamma and mixed-field (alpha/beta/gamma) surveys were performed during the Work Plan field work. These results were subsequently supplanted by the surveys performed by the SAP. The results are provided in Appendix E but are not discussed further in this section. In 2010, the SAP-related gamma surveys were performed with results recorded both as exposure rates and as 60-second scalar counts.

Measurements were taken of both the pipe interior and in the vicinity of the pipe (local comparison measurements) to evaluate the influence of radiochemicals external to the pipe section on measurements inside the pipe. The 60-second counts of the pipe interiors ranged from 2,547 to 329,629, corresponding to exposure rates ranging from 11 to 1,600 $\mu\text{R/hr}$. Local comparison 60-second counts ranged from 3,230 to 497,522 corresponding to exposure rates ranging from 14 to 2,400 $\mu\text{R/hr}$. Most pipe interior measurements were similar to, or less than, the corresponding local comparison measurements (the exceptions to this being locations in HA-4 and location S-6).

Gamma surveys performed in 2010 were recorded both as exposure rates and as 60-second scalar counts. Measurements were taken of both the pipe interior and in the vicinity of the pipe (local comparison measurements) to evaluate the influence of radiochemicals external to the pipe section on measurements inside the pipe. The 60-second counts of the pipe interiors ranged from 2,547 to 329,629, corresponding to exposure rates ranging from 11 to 1,600 $\mu\text{R/hr}$. Local comparison 60-second counts ranged from 3,230 to 497,522 corresponding to exposure rates ranging from 14 to 2,400 $\mu\text{R/hr}$. Most pipe interior measurements were similar to, or less than, the corresponding local comparison measurements (the exceptions to this being locations in HA-4 and location S-6).

4.2 Analytical Laboratory Results

Radiochemical analytical lab results for bulk and scale samples collected in 2009 and 2010 are presented below, along with MWMP leachate data from a subset of the 2010 scale samples.

4.2.1 2009 Samples

The bulk concentration samples for transite pipe and associated waste materials were analyzed for radium-226 and radium-228 by gamma spectroscopy (γ -spec; EPA Method E901.1) and for total uranium and total thorium by ICP-MS (Method SW6020). The gamma spectroscopy analytical method provides results for all gamma-emitting radiochemicals including radium-226 and radium-228. Radium-226 and radium-228 values were determined via gamma spectroscopy

are based on the concentrations of decay products in equilibrium with radium-226 and radium-228. In addition, values for thorium-232, uranium-234, and uranium-238 were reported by the analytical laboratory (most samples did not have quantifiable concentrations of uranium-235).

The analytical laboratory (TestAmerica-Richland, Washington) did not grind and homogenize the transite pipe bulk concentration samples before digestion and analysis to protect lab personnel from possible exposure to airborne asbestos fibers. Because the ICP-MS analytical method required a half-gram sample aliquot for analysis, lab personnel selected a representative 0.5 gram piece from the submitted 500 gram sample. Because the extraction of such a small aliquot from a non-homogenized sample has the potential to not be completely representative of the total sample, total thorium and uranium results reported by the ICP-MS method may not be as representative of the bulk concentration of total thorium and uranium as γ -spec analytical results.

The γ -spec analytical method used aliquots of approximately 200 milliliters, equivalent to about 200 grams. The aliquots for the γ -spec analyses were also obtained without grinding and homogenization, but were composed of multiple pieces of transite pipe materials that represented the entire pipe thickness including scale and sediment found within the pipe interior. The approximate 200-gram aliquots were obtained by breaking the sample into multiple small pieces, blending those pieces in the sample container and manually selecting pieces from the sample container to represent the range of observed materials from the pipe exterior and interior. The larger sample size and method of selection of the sample aliquot produced a more representative sample for γ -spec analysis than the 0.5 gram sample submitted for ICP-MS analysis.

As a result, concentrations of gamma-emitting radiochemicals (e.g., thorium-232 and uranium-238) analyzed by the γ -spec method are more reliable for decision making than samples analyzed by the ICP-MS method. Due to the more reliable representativeness of the sample aliquot for gamma spectroscopy analyses, the γ -spec results are the data values reported for thorium and uranium concentrations in this revised RAP, unless otherwise specified.

Although not discussed further in this section, analytical results from the ICP-MS analyses are provided in Appendix E. Table 4-1 summarizes the bulk radiochemical analytical results, which are also provided in Appendix E. The radiochemical data summarized in Table 4-1 will be used to establish bulk concentrations for manifesting of transite pipe waste that is shipped off-Site.

Table 4-1. Bulk Radiochemical Results				
	U-238 pCi/g	U-238 mg/kg	Ra-226 pCi/g	Ra-228 pCi/g
Maximum	116	352	95.4	599
Minimum	0.33	0.985	0.328	0.158
Mean	5.2	15.8	4.35	24.44
Median	0.53	1.60	0.47	0.36

As described above, three scale samples were collected from transite pipe bulk concentration sample locations with the most elevated radiometric readings to: develop an upper concentration value expected for mixed asbestos-TENORM waste for transite pipe from HA-1 and HA-4. Table 4-2 presents the analytical results of the three scale samples for comparison to the bulk concentration sample results presented in Table 4-3. Table 4-4 summarizes the radiological survey and radiochemical analytical results which are also provided in Appendix G.

Table 4-2. Scale Sample Radiochemical Results						
Location	Th-232 pCi/g	U-238 pCi/g	Ra-226 pCi/g	Ra-228 pCi/g	Th-232 pCi/g (ICP- MS)	U-238 pCi/g (ICP- MS)
HA-1-07	817	194	155	881	545	1,240
HA-4-01	ND	2.13	2.31	1.16	0.89	3.56
HA-4-02	78.5	22.3	19.8	81.6	33.1	65.7

Table 4-3. Bulk Radiochemical Concentrations at Scale Sampling Locations				
Location	Th-232 pCi/g	U-238 pCi/g	Ra-226 pCi/g	Ra-228 pCi/g
HA-1-07	610	116	95.4	599
HA-4-01	ND	0.43	0.511	0.494
HA-4-02	0.198	0.373	0.328	0.273
HA-4-02-FD	23.4	7.04	6.39	24.9

4.2.2 2010 Samples

Scale/sediment samples collecting during the SAP field work were analyzed for radium-226 and radium-228 by gamma spectroscopy (γ -spec; EPA Method E901.1). The gamma spectroscopy analytical method provides results for all gamma-emitting radiochemicals including radium-226 and radium-228. Table 4-4 summarizes the radiological survey and radiochemical analytical results for radium-226 and radium-228, which are also provided in Appendix E. Background concentration limits (BCLs) for Sub-Area A-2, as presented in the *Background Soils Data Summary Report - Revision 1* (Brown and Caldwell, 2009b), are also provided in Table 4-4 for comparison to the scale/sediment data.

Scatter plots of the interior 60-second count rates relative to the Ra-226 concentrations are provided in Figure 4-1a and 4-1b. The radiochemical data summarized in Table 4-4 indicate that: 1) almost half (13 of 29) the results for Ra-226 concentrations are consistent with background levels measured in off-Site alluvial soils; and 2) 11 results exceeded the 5 pCi/g State of Nevada exemption level. The scatter plots show that there is no reliable correlation between the measured 60-second counts and the Ra-226 concentrations.

Location	Interior Exposure Rate uR/hr	Interior 60-second count	Exterior Exposure Rate uR/hr	Exterior 60-second count	Ra-226 pCi/g	Ra-228 pCi/g
S-1	16	3536	15	3230	1.67	1.34
S-2	15	3127	18	4158	1.07	0.673
S-3	14	3000	16	3681	3.05	9.68
S-4	13	3016	16	3705	3.67	1.93
S-5	11	2547	18	3886	1.15	0.167
S-6	203	43469	27	5427	237	1080
S-7	15	2976	15	3568	14.6	101
S-8a	13	2810	14	3641	NA ^a	NA ^a
S-8b	14	3128	14	3641	NA ^a	NA ^a
S-9a	15	3132	19	3933	NA ^a	NA ^a
S-9b	13	2990	19	3933	NA ^a	NA ^a
S-10a	15	3337	17	3859	1.02	3.09

Location	Interior Exposure Rate uR/hr	Interior 60-second count	Exterior Exposure Rate uR/hr	Exterior 60-second count	Ra-226 pCi/g	Ra-228 pCi/g
S-10b	16	4053	17	3859	1.82	3.07
S-11	16	3458	16	3491	1.1	1.33
S-12a	17	3752	17	3607	5.91	2.45
S-13	16	3941	19	4399	75.2	135
S-14	19	4253	21	4891	NA ^a	NA ^a
S-15	15	3305	20	4391	1.36	1.81
S-15 FD	15	3305	20	4391	0.772	1.97
S-16	28	6157	39	8069	54.5	234
S-17	610	129387	255	54336	90.9	2.02
S-17 FD	610	129387	255	54336	171	1.91
S-18	18	4028	23	5096	0.728	0.373
S-19	1600	329629	2400	497522	39.6	120
S-20	255	51519	185	37853	2.36	1.13
S-21	20	4310	19	4158	43.7	42.6
S-22	15	3188	17	4127	1.72	1.55
S-23	20	4638	41	8641	2.78	6.32
S-24	25	5534	29	7021	1.84	9.61
S-25	18	4183	26	5385	11.7	2.12
S-26	15	3703	25	5589	3.41	1.1
S-26 FD	15	3703	25	5589	3.59	0.931
S-27	18	3956	18	3899	23.6	102
S-28	15	3330	18	3969	NA ^a	NA ^a
S-29	14	3327	17	3857	1.66	1.49
HA-2-03	17	3637	23	5249	NA ^a	NA ^a
BCL	NA	NA	NA	NA	2.44	2.13

^a No sample was taken at these locations.

4.2.3 MWMP Sampling Results

EPA requested that scale/sediment samples be collected to determine the leaching characteristics of the scale/sediment. Table 4-5 provides the MWMP leachate analytical results. The samples collected for MWMP leachate testing were sent to Sierra Environmental Monitoring in Sparks, Nevada. Collected leachate was then sent to the Test America - Irvine and - Richland labs for chemical analyses. The leachate chemical data are compared to EPA maximum contaminant levels (MCLs) in Table 4-5. These data characterize potential leachate chemistry, assuming that meteoric water that infiltrates through the landfill cover could come into contact with the pipe

scale, which is located within the flat-lying pipe sections placed in the on-Site landfill cell. The leachate chemical data presented in Table 4-5 are not intended for use in designating transite pipe sections for on- or off-Site disposal.

Table 4-5. MWMP Sampling Results									
Analyte (dissolved)	Units	MCL	S-1 MWMP	S-6 MWMP	S-10b MWMP	S-12a MWMP	S-15 MWMP	S-24 MWMP	S-25 MWMP
Aluminum	mg/L		0.067	940	28000	<0.2 U	6100	690	0.21 J
Antimony	mg/L	0.006	0.014 J	0.089	<0.03 U	0.004 J	0.032 J	<0.03 U	<0.006 U
Arsenic	mg/L	0.01	<0.009 U	0.016	3.3	0.013	0.46	<0.09 U	<0.018 U
Barium	mg/L	2	0.340	1.10	<0.03 U	0.26	0.58	0.13	0.16
Beryllium	mg/L	0.004	<0.001 U	0.046	2	<0.0005 U	0.54	0.1	<0.002 U
Boron	mg/L		0.700	4.40	<100 U	0.82	2.1 J	5.5	0.66
Cadmium	mg/L	0.005	<0.001 U	0.021	0.38	0.0021 J	0.14	0.13	<0.002 U
Calcium	mg/L		130	320	600	620	330	430	460
Cobalt	mg/L		0.002 J	1.8	57	0.089	13	7	0.3
Copper	mg/L	1.3	1.30	130	20000	2.9	430	300	52
Chromium	mg/L	0.1	0.014 J	0.55	12	<0.0045 U	5.1	0.21	<0.018 U
Iron	mg/L		0.064	35	11000	<0.075 U	1200	5.4	<0.075 U
Lead	mg/L	0.015	<0.002 U	0.04	<0.02 U	<0.001 U	<0.01 U	<0.02 U	<0.004 U
Lithium	mg/L		<0.03 U	<0.75 U	<150 U	<0.15 U	<3 U	<0.6 U	<0.15 U
Magnesium	mg/L		9.10	500	23000	380	5300	2100	130
Manganese	mg/L		0.400	30	610	16	170	140	13
Mercury	mg/L	0.002	0.0002 J	0.0026	0.55	0.0087	0.62	0.00026	0.0013
Molybdenum	mg/L		0.150	0.094	0.15 J	0.036	0.046 J	<0.02 U	<0.004 U
Nickel	mg/L		0.010 J	1.3	32	0.06	14	6.7	0.15
Phosphorous	mg/L		0.350	18.0	1100	1.3	190	3.2	0.23
Potassium	mg/L		43.0	130	<1800 U	55	<37 U	<7.4 U	43
Selenium	mg/L	0.05	0.074	0.98	3.8	0.13	0.56	0.72	0.11
Silica	mg/L		24.0	1000	210 J	29	1700	64	75
Silver	mg/L		<0.0001 U	<0.001 U	<0.01 U	<0.0005 U	0.005 J	<0.01 U	<0.002 U
Sodium	mg/L		150	260	4600	250	490	2200	250
Strontium	mg/L		0.750	7.0	<25 U	3.3	<0.5 U	0.67	2.7
Thallium	mg/L	0.002	<0.002 U	<0.002 U	<0.02 U	<0.001 U	<0.01 U	0.023 J	<0.004 U
Tin	mg/L		<0.012 U	<0.3 U	<60 U	<0.06 U	0.46 J	<0.24 U	<0.06 U
Titanium	mg/L		<0.002 U	2.0	13 J	<0.01 U	8.8	<0.04 U	<0.01 U
Uranium	mg/L	0.03	0.042	150	38	0.092	10	3.7	<0.004 U
Vanadium	mg/L		<0.008 U	1.1	4.9	0.0043 J	0.23	<0.08 U	<0.016 U
Zinc	mg/L		0.059 J	9.3	73	0.18	32	22	0.65

Note: Bolded result indicates analytes and sample results that exceed EPA Primary Drinking Water Maximum Contaminant Levels (MCL)

4.3 Data Quality Summary

This revised RAP only includes a data quality summary for the original samples collected pursuant to the Work Plan (Brown and Caldwell, 2009a). Verification and/or validation results for the chemical data collected pursuant to the SAP are not currently available. Such results can be provided to EPA when they become available.

A total of 23 primary and three field duplicate solid matrix samples were collected and analyzed to determine bulk concentrations of transite pipe and associated waste materials during the Work Plan. Overall, data meet the Work Plan data quality objectives with only 5 analytical results rejected. However, the use of this data is limited to characterization of the bulk concentration in transite pipe sections being sent for off-site disposal. Table 4-6 summarizes the number of samples analyzed by each method and the number of results that were qualified for each method for bulk concentration samples.

Method	Parameter	Samples Analyzed (P+FD)	Analytes per sample	Number of results				Completeness	
				Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL ⁺	Percent usable	Percent quantitative*
E160.3	Percent Moisture	23+3	1	26	0	0	0	100%	100%
E901.1	Radium-226, -228	23+3	2	52	0	4	35	100%	92.3%
E901.1	Thorium-232	23+3	1	26	4	2	N/A	84.6%	84.6%
E901.1	Uranium-234, -238	23+3	2	52	0	4	N/A	100%	100%
SW6020	Total Thorium and Uranium	23+3	2	52	0	52	1	100%	0.0%

Notes: Estimations due solely to results <PQL do not affect the calculated completeness
⁺ The QAPP does not have PQLs for thorium and uranium isotopes by Method E901.1
 Calculations do not include any required field or laboratory QC samples, except field duplicates.
 P = primary samples
 FD = field duplicate samples

The reasons for data qualification are:

- Matrix spike recoveries for total uranium and total thorium were outside of the control limits resulting in the qualification of all total uranium and total thorium results as estimated (J).
- Sample aliquots for total uranium and total thorium may not be completely representative of the bulk sample due to aliquot selection without complete sample homogenization.

As described above, three samples of pipe scale were collected to assess the upper range of possible TENORM concentrations associated with the transite pipe. Table 4-7 summarizes the number of samples analyzed by each method and the number of results that were qualified for each method for the pipe scale samples.

Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Number of results				Completeness	
				Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL ⁺	Percent usable	Percent quantitative*
E901.1	Radium-226, -228	3+1	2	8	1	0	0	87.5%	87.5%
E901.1	Thorium-232	3+1	1	4	1	0	N/A	75%	75%
E901.1	Uranium-234, -238	3+1	2	8	0	0	N/A	100%	100%
SW6020	Total Thorium and Uranium	3+1	2	8	0	0	1	100%	0.0%

Notes: * Estimations due solely to results <PQL do not affect the calculated completeness

⁺ The QAPP does not have PQLs for thorium and uranium isotopes by Method E901.1

A total of 26 primary and three field duplicate solid matrix samples were collected and analyzed to determine radiochemical concentrations of scale/sediment during the SAP. An additional seven samples were collected to perform MWMP leachate testing of the scale/sediment. As stated above, this revised RAP is being submitted prior to completion of the data quality review process for the SAP sampling, and the data quality summary for these data will be provided.

4.4 Conclusions and Recommendations

Review of the radiological survey and radiochemical analysis indicated that there is no useful correlation of gamma survey results to radiochemical concentrations (e.g., the Site-specific ARAR of 5pCi/g of Ra-226). Based on a comparison of the scale/sediment analytical results with the bulk concentration results, Ra-226 concentrations, and TENORM in general, present in the pipes is concentrated in the scale or sediment, and the pipe itself has radiochemical concentrations less than or equal to background levels. Because laboratory analyses would be required to define scale or sediment occurrences with concentrations greater than 5 pCi/g of radium-226, which is time-consuming and impractical for the removal action, EPA and ARC have agreed to designate pipe sections for on- or off-Site disposal using the conservative assumption that any scale or sediment in the pipe sections is above the ARAR. Therefore, those pipe sections with scale or sediment that cannot be removed by limited decontamination methods (i.e., brushing and gravity), will be shipped off-Site to the US Ecology facility.

During the removal action, pipe sections and, if practicable, RACM debris will be visually inspected and subject to possible limited decontamination by the removal of interior scale. ARC plans to perform limited decontamination by emptying pipes of loose scale and sediment by gravity and/or sweeping the pipe interior with a non-metallic pipe-cleaning brush. For example, a Casey's Brush Model 406086 stiff-filament polypropylene brush with an 8-inch nominal diameter and 6-inch axial brush length or equivalent would be used to sweep loose or loosely-adhered scale/sediment out of an 8-inch interior diameter pipe. For specific pipe segments that appear to have such loose materials, this step would be performed in a manner that will minimize the potential to generate RACM or other waste streams (e.g. aqueous waste). Pipe interior materials collected during this limited decontamination procedure will be: 1) controlled during removal to prevent the potential spread of contamination; and 2) appropriately packaged, sampled and stored for subsequent disposal (i.e., these materials will not be placed in the unlined off-Site landfill cell under any circumstances).

Pipe sections from which the scale/sediment cannot be removed will be: 1) classified as mixed asbestos-TENORM waste that is above the Site-specific ARAR; and 2) placed in a staging area for subsequent disposal at the US Ecology facility in Grand View, Idaho. The steps described above have been designed to ensure that transite pipe and debris to be disposed of in the on-Site landfill will contain less than 5 pCi/g Radium 226. The percentage of transite pipe and debris on the Site that does not meet the field criteria for on-Site disposal is estimated at 15 percent. As indicated above, it is ARC's intention to ship this material off-Site at the same time as the soils being excavated during the Process Areas Radiological Materials Removal Action, pending further discussions with EPA when contractor schedules become available.

SECTION 5.0 PLANNED REMOVAL ACTION ACTIVITIES

Based on the results of the characterization data and recommended pipe designation approach and limited decontamination procedures described in Section 4.4, the transite pipe removal action activities listed below will be conducted by a contractor with the appropriate technical and health and safety credentials to perform the work. Once ARC's contractor procurement process is completed, the following removal action activities will be conducted:

- Roadway Improvements and Landfill Construction
- Field Decontamination
- Landfill Operations and Dust Control Measures
- Air Quality Monitoring
- Institutional Controls for Pipe Left in Place
- Landfill Closure

As part of the procurement process for qualified bidders, a Site visit will be conducted to review the overall project area illustrated in Figure 5-1 and to assess potential Site-specific health and safety (H&S) or technical concerns (e.g., areas of buried transite pipe or locations adjacent to steep slopes and poorly maintained or unsafe access roads). Such transite pipe occurrences will require field judgments by the selected contractor(s) and ARC to determine if pipe can safely be removed, or if the pipe will need to remain in place with appropriate institutional controls. In addition, road improvements to access or convey the transite pipe will be evaluated during the Site visit. Transite pipe materials associated with mixed asbestos-TENORM waste will also be reviewed with the contractor(s) to assess potential worker health and safety concerns.

As previously described in this revised RAP, ARC intends to conduct limited decontamination of the transite pipe with TENORM in the form of sediment or scale. As described in Section 4.0, emptying of loose scale and sediment from pipe segments by gravity and sweeping of the interior

pipe walls with pipe cleaning brushes will be performed for pipe segments containing scale/sediment that is not firmly attached in a manner deemed to be safe by the Project Safety Manager. ARC plans to manage all loose scale and sediment derived from this limited decontamination activity as mixed asbestos-TENORM waste (i.e., these materials will be shipped to the off-Site repository in Grand View, Idaho).

The selected contractor will complete the applicable notification forms to be submitted to EPA and the State of Nevada 10 working days prior to beginning the removal action, as required by 40 CFR § 61.145 et seq. Although permits are not required, per § 121(e) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), ARC will conduct the removal action in accordance with the substantive requirements of all applicable Federal and State regulations (e.g., Nevada regulations for Industrial Class III landfills). Prior to the removal action, ARC will discuss these requirements with EPA to ensure regulatory compliance.

5.1 Roadway Improvements and Landfill Construction

The selected contractor will provide roadway improvements to allow safe access to all transite pipe sections and debris areas by appropriate equipment. The pipe removal is anticipated to be performed by thumbed trackhoe, forklift and an approximate 5-ton truck (e.g. F-550). Road grading equipment will be required to establish safe access to select transite pipe locations. Planned haulage routes and traffic flow patterns are shown on Figure 5-2.

The CAS indicated that a portion of HA-2 appears to have restricted road access (i.e., a portion of an intact transite pipe string located along the north-central portion of the W-3 waste rock pile, between the waste rock pile and the former Anaconda dump leach area). A section of the pipe string in this area is underlain, or immediately adjacent to, a collapsed road. Based on a determination to be made by the Project Safety Manager and ARC, the roadway will either be repaired and the currently inaccessible pipe segments removed, or the pipe will be left in place.

ARC anticipates that access to the landfill cell from the HAs located both north and south of Burch Drive will occur via the primary access roads shown on Figure 5-2, with secondary access along berms within the sulfide tailings, which can be used with local minor improvements. The approximate one-acre cell is located within an approximate 100-acre 'landfill area' on private property within the southern portion of the sulfide tailings area, as shown in Figures 5-1 and 5-2. The landfill cell location is sufficiently close to an oxide (vat leach) tailings (VLT) borrow source (south borrow area) for access to additional fill and cover materials that may be needed.

Landfill CERCLA and State of Nevada Requirements

The on-Site landfill design, construction, operation and closure activities will fall under EPA jurisdiction in accordance with applicable State of Nevada substantive regulations and guidelines, which include: 1) Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-03, USEPA, 2/19/92; 2) Nevada Revised Statutes (NRS) 459.7024; 3) the substantive requirements of Nevada Administrative Code (NAC) Chapter 444.731 for a Class III Industrial landfill, with the exception of the 100-foot depth to groundwater requirement and vegetated closure cap; and 4) the Nevada Department of Environmental Protection (NDEP) Fact Sheet for Mine Site Landfills. These documents and regulations are provided in Appendix G-1. The landfill cell will be operated solely for the disposal of inert and asbestos-containing materials (i.e., all transite pipe and associated broken collars and loose debris recommended to be classified as RACM). Closure of the landfill cell will include signage that describes the nature of the type of waste within the cell.

Landfill Geotechnical Investigations

As described in the *Transite Pipe Removal Action Work Plan - Revision 1* (Brown and Caldwell 2009a), geotechnical investigations for potential landfill areas indicated relatively homogeneous sulfide tailings material characteristics (i.e., fine sand and silt, with very minor amounts of coarser sands and clays). Geotechnical data for the planned landfill cell are provided in Appendix G-2 of this revised RAP. VLT and sulfide tailings geotechnical data will be made available to the selected contractor.

The depth of sulfide tailings in the landfill cell area is sufficiently deep such that the base of the landfill cell will be constructed completely within the sulfide tails. The depth to groundwater is approximately 90 feet below ground surface (bgs). Exploratory trenching did not intercept groundwater or saturated tailings beneath the planned landfill cell.

Landfill Cell Design

The on-Site landfill to be constructed for the transite pipe removal action will be based on the design elements described below. As shown in Figure 5-3, cell dimensions at the existing surface are approximately 290 feet long, including access ramps, 148 feet wide and 7 feet deep (note the 4x vertical exaggeration on the east-west [AA] and north-south [BB] cross-sections). The dimensions at the base of the excavation (i.e., bottom footprint) are approximately 150 feet long by 90 feet wide. The transverse slopes are designed at 4H:1V to facilitate excavation and cover operation by tracked equipment. All other slopes are no less than 3:1.

The floor of the cell is designed with a half-percent average slope, with a sump collection area located at its northeast corner, and includes a 12-inch compacted VLT base to provide stable access for rubber tired equipment (this thickness may locally increase as a result of field conditions). Floor materials will be compacted to 95 percent maximum dry density American Society of Testing and Materials (MDD; ASTM D-698).

The landfill design includes two access ramps for trucks to enter, off-load RACM, and exit the cell without having to turn-around. The access and exit ramps are each designed with a 10 percent grade. Planned traffic patterns provide access into the cell from the west ramp for trucks to offload the waste, and the east ramp to be the exit ramp for empty trucks (Figure 5-2). The landfill cell design has been developed to optimize the range of transite pipe and associated materials listed in Table 5-1 (i.e., placing the largest diameter pipe, above 18 inches in diameter, in a single lift will allow the landfill cell to be constructed to the shallowest depth possible).

Table 5-1. Transite Pipe Length and Volume Estimates							
Homogeneous Area	8-10" Pipe	12-14" Pipe	16-18" Pipe	22" Pipe	24" Pipe	Sub-totals	Estimated Broken Pipe/Collars/Cubic Yard
Estimated Linear Feet Pipe – Piles							
HA-1	1,950	420	730	20		3,120	2
HA-2		150				150	10
HA-3	950	760	340		240	2,290	3
HA-4	100	770			30	900	5
HA-5		20				20	1
HA-6		100	180			280	1
HA-7	230	100	350	100		780	1
Sub total	3,230	2,320	1,600	120	270	7,540	23
Estimated Linear Feet Pipe - Pipe Runs							
HA-1							
HA-2		7,230				7,230	
HA-3	200	1,900	360	100		2,560	
HA-4	150	400				550	
HA-5		1,760				1,760	
HA-6		280				280	
HA-7		500				500	
Sub total	350	12,070	360	100		12,880	
Estimated Volumes							
Estimated Total (Linear Feet)	3,580	14,390	1,960	220	270	20,420	
Estimated Cubic Feet	17,970		2,455		1,080	21,505	
Estimated Cubic Yards	666		91		40	796	23
Estimated Total Cubic Yards							819

The landfill cell design provides for approximately 6,300 cubic yards of fill capacity (i.e., excavation volume), which will accommodate: 1) the estimated volumes of intact transite pipe, associated broken pieces and bagged materials summarized in Table 5-1; 2) the 12-inch VLT base layer; and 3) minimum 12-inch thick layers of fill materials to be placed between the transite pipe lifts. Previously excavated sulfide tailings will be used to create the 12-inch thick layers of fill material to be placed between individual waste layers on a daily basis, as shown in

Figure 5-4 (the 6-inch daily cover required by the NAC for landfilled RACM has been increased to 12 inches to accommodate compaction by tracked equipment). ARC anticipates that, during landfill operations, sulfide tailings fill materials will also fill in the spaces between individual pipe sections, broken pieces and bagged waste, which will stabilize their position within the waste layers. The majority of transite pipe occurs as intact sections of pipe with diameters that range from 8 to 24 inches. Larger diameter pipe sections (i.e., above 18 inches in diameter) will be placed as the basal waste layer in the cell (Figure 5-4). Details of the landfill cell are presented in Figure 5-5.

Excavated sulfide tailings will be stockpiled adjacent to the landfill cell for the alternating fill layers. VLT materials to be used for the landfill base and for the closure cap will be sourced from the oxide tailings area, located west of the landfill cell (Figure 5-1). In addition, VLT materials may be obtained from proximal berms and access roads within the sulfide tailings area.

5.2 Field Decontamination

As described in Section 4.4, the determination of whether to convey intact and broken transite pipe sections and areas of loose RACM debris to the on-Site landfill cell will be confirmed by visual inspections of the cleanness of the pipe interiors. Pipes may be cleaned prior to completion of the visual inspection. This cleaning will be performed by gravity draining and sweeping of the the pipe contents and/or brushing out the interior.

5.3 Landfill Operations and Dust Control Measures

The landfill cell will be constructed per the design information presented in Section 5.1 and contractor means and methods. The contractor will be obligated to perform dust control activities during construction and operation to limit the potential for fugitive dust. Anticipated dust control activities are described below.

Removal action-related landfill operations will begin with the collection of transite pipe, broken pieces and RACM debris from the seven HAs, beginning with HA-5 and HA-7 that contain the oversize pipe (i.e., greater than 18 inches in diameter). These oversize pipe segments will be placed in the first layer deposited on the VLT floor. All broken pieces or debris will be bagged or drummed prior to placement on the haul truck. All intact or broken pieces too large to be bagged or drummed will be sprayed with amended water and encapsulant spray prior to placement on the haul truck within each of the HAs.

No further amendments will be used prior to the placement of the RACM in the landfill cell unless intact pipe lengths are broken during transport, in which case encapsulant will be sprayed on broken edges of the pipe once placed in the landfill cell. Transite pipe will be positioned in the cell with the pipe lengths placed along both sides of, and parallel to, the east-west access road within the cell (Figure 5-4). Pipe sections will be placed at least 12-inches apart to accommodate the placement of fill materials. Bagged or drummed RACM (i.e., small broken pipe pieces and pipe collars), and other waste (e.g., coated metal pipe) will be placed along with intact pipe sections on the compacted VLT base or compacted layered fill (Figure 5-4). Subsequent layers of transite pipe and RACM debris will be filled in with, and covered by, sulfide tailings on a daily basis.

Placement of transite pipe within the landfill cell is designed to facilitate the use of trench compactors and manual tampers to compact the fill materials up to the spring line along the pipe lengths, and to the height of the pipe diameter between the pipe ends. As shown in Figure 5-5, a sheet of 60-mil textured HDPE will be placed with a 1-foot overlap over the pipe ends to aid in the distribution of soil loads along the pipe ends to mitigate soil settlement during compaction. The spacing between the pipe, perpendicular to their length, is also designed to facilitate standard pipe trench construction equipment to stabilize the pipe during backfill placement and compaction. Compaction will be performed to mitigate settlement and provide a working foundation for the next lift of pipe and fill materials.

Construction and operation of the landfill cell will: 1) use tracked excavation and vibratory steel drum compaction equipment and rubber-tired equipment; and 2) include geotechnical testing of VLT floor and fill layers. Geotechnical tests of sulfide tailings and VLT materials will include Index Tests for Gradation per ASTM C-136, Plasticity Index per ASTM D-4318, and Standard Proctor per ASTM D-698 per material type or change of material characteristics. Compaction tests using a nuclear gauge (per ASTM D-6398) will be performed on the compacted VLT floor and daily 12-inch covers at a frequency of one per 100 cubic yards of fill material or visible change of fill material type.

Compaction of fill over the top of each layer of pipe will be performed after the full 12-inch fill height has been achieved. At the end of each day of landfill operations, the waste materials placed in the landfill will be covered with sulfide tailings fill and sprayed with construction water to limit dust generation. During operations, the landfill cell will be subject to the following maintenance and control programs:

- The cell will be designated with a cell number, status (e.g., date open or date closed), removal action and waste type.
- Per NAC 444.976 (d), a daily cover will be placed over all RACM material placed in the landfill cell. ARC plans to increase the daily cover thickness from the required 6 inches to 12 inches to ensure that compaction activities will not adversely affect pipe integrity (i.e., avoid crushing during subsequent use of equipment in placing the next cell layer).
- Mitigation of potential dust generated during operations with construction water or palliatives, as appropriate, for the cell and associated fill material stockpiles. Vehicle speed will not exceed 25 mph on haul roads. Construction water will be sprayed from a water truck and dust palliatives will be applied to stockpiled sulfide tailings that may be exposed for the duration of the removal action. Palliatives are anticipated to be water-solvent mixtures applied by spraying from water trucks. Dust mitigation for cell closure will use VLT materials as the uppermost 12 inches of the cover, placed with tracked or rubber-tired equipment.
- Ambient conditions such as high winds, low relative humidity, high temperature, and long periods of no precipitation may generate or exacerbate fugitive dust. The removal action is expected to occur in late summer when one or more of these ambient conditions typically occur. Landfill operations will not be conducted during periods of high winds (i.e., greater than 25 mph).

- Compliance with applicable substantive State and Federal regulations (Appendix G-1).
- Requirements associated with ARC's health safety, security, environment (HSSE) requirements and the updated Site-specific health and safety plan (HASp; Brown and Caldwell, 2009c), as described in Section 6.0). Health and safety requirements include documentation of employee training and current refresher training certification, a medical surveillance program and documentation of employee medical monitoring, a comprehensive emergency response plan, and implementation of asbestos exposure monitoring. Personnel working with asbestos-TENORM mixed waste will include additional personal protective equipment (PPE).
- No burning, open flames or hot work demolition will be allowed.

5.4 Air Quality Monitoring

The objectives of the air quality monitoring to be conducted during the removal action are to:

- Evaluate the effectiveness of fugitive dust control measures (described in Section 5.3);
- Establish a notification procedure for when additional dust control measures or modifications to work practices may be necessary; and
- Document concentrations of chemicals at the perimeter of the Site.

A combination of project work area monitoring and site perimeter monitoring will be conducted to accomplish these objectives.

5.4.1 Area Air Monitoring

Air quality monitoring in the immediate area of landfill cell operations will be conducted to evaluate the effectiveness of fugitive dust control measures. Three temporary air monitoring stations (LF-1 through -3) will be located in typical upwind/downwind locations to the landfill cell, as shown in Figure 5-1. The rationale for these locations is summarized below.

- LF-1: located north of the HA-5 Sulfide/Oxide Tailings homogenous area along the primary access road to the landfill cell. This location monitors fugitive dust that may be generated from earthwork activities and hauling near the western portion of the Sulfide Tailings borrow area. This location also serves as a typical upwind location for both the landfill cell operations area and Sulfide Tailings borrow area.

- LF-2: located northeast of the landfill cell. This location monitors fugitive dust that may be generated from earthwork activities to construct the landfill, place transite pipe/daily cover, and close the landfill. This location also serves as a typical downwind location for the landfill cell operations area.
- LF-3: located east of the Sulfide Tailings borrow area along the access road to the borrow area. This location monitors fugitive dust that may be generated from earthwork activities and hauling near the eastern portion of the Sulfide Tailings borrow area. This location also serves as a typical downwind location for the Sulfide Tailings borrow area.

Each station will be equipped with a PM10 meter. The real-time PM10 meter will provide 15-minute measurements for 8 core hours of the construction day. The meter will be a Thermo Electron aDR-1200S Ambient Particulate Monitor (or equivalent) that features a tripod, a rechargeable battery pack, a real-time display, a data logger, a programmable PM10 Notification Level, and a visual/audible alarm system. Operation and calibration of the meter will be conducted per the manufacturer specifications. The monitors are calibrated at the factory prior to shipment and will be zeroed prior to each day of operation. The meter will be positioned approximately 2 meters above ground surface at each location. Data will be downloaded from the datalogger on a daily basis and the batteries will be recharged overnight. Data will be stored in the Site database and provided to EPA following data quality review on a weekly basis during the removal activity.

5.4.2 Notification Levels

The real-time monitoring with notification levels provides the Construction Manager with a real-time, numerical method of evaluating the effectiveness of fugitive dust control measures and the ability to quickly communicate to the contractor when the dust control measures need to be increased or when removal action activities need to be modified. Notification Levels for the field effort are provided in Table 5-2 along with the corresponding field responses and personnel notifications. Although the PM10 Notification Levels are based on a 15-minute average PM10 concentration beginning with 0.5 milligrams per cubic meter (mg/m^3), the visual/audible alarm system will be programmed for an instantaneous PM10 measurement of $0.5 \text{ mg}/\text{m}^3$ to indicate that construction activities may be generating excessive dust in a localized area.

If a 15-minute measurement of PM10 equals or exceeds 0.5 mg/m³ at one or more stations, the contractor must notify the ARC Project Manager and implement additional dust control measures so that the following 15-minute measurement of PM10 falls below 0.5 mg/m³. If a PM10 measurement equals or exceeds 1.0 mg/m³, the EPA will be notified. If a PM10 measurement equals or exceeds 2.5 mg/m³ at one or more stations, work activity will be suspended until the cause of dust is determined and the appropriate dust control measures are implemented and/or work practices are modified.

Notification Level	Level 1	Level 2	Level 3
PM10 Concentration (15-min average)	0.5 mg/m ³	1.0 mg/m ³	2.5 mg/m ³
Construction Contractor Response	Increase fugitive dust control measures.	Increase fugitive dust control measures.	Stop work temporarily. Increase fugitive dust control measures and/or modify work practices.
Construction Manager Response	Visually monitor meter display to verify PM10 concentration falls below Level 1.	Visually monitor meter display to verify PM10 concentration falls below Level 1.	Meet with Construction Contractor to discuss additional measures and/or modified work practices. Visually monitor meter display to verify PM10 concentration falls below Level 2 and/or Gross Alpha/Beta fall below Level 3.
Personnel Notification	Construction Contractor, ARC Project Manager.	Construction Contractor, ARC and EPA Project Managers.	Construction Contractor, ARC and EPA Project Managers. Approval from ARC and EPA Project Managers is required to resume work.

5.4.3 Perimeter Air Monitoring

To document concentrations of chemicals at the perimeter of the Site during the removal action, three of the permanent perimeter air monitoring stations (AM-1, AM-4, and AM-5) used in the 3-year air quality monitoring program (Brown and Caldwell, 2009c) will be re-commissioned. These stations were selected because they are located upwind (AM-1) and downwind (AM-4 and AM-5) of the main area of activity along the direction of predominant wind direction at the Site (i.e., from southwest to northeast when wind velocity is greater than 10 mph). A combination of high volume air samplers, a continuous particulate monitor, and a meteorological station will be used as summarized in Table 5-3.

Table 5-3. Summary of Perimeter Monitoring Equipment and Operation		
Equipment	Station(s)	Operation
High Volume PM10 Air Sampler	AM-1, AM-4, and AM-5	Collect samples at all 3 stations: on 2 events prior to start of earthwork activities (background conditions), on 2 events during first week of full-scale operations (startup period); and weekly events thereafter (construction period). Additional samples collected if Notification Level 3 exceeded at any time.
Continuous Particulate Monitor	AM-1	Continuously measure PM10 concentration during construction activity.
Meteorological Monitoring	AM-1 and AM-6	Continuously measure 15-minute wind speed and direction during construction activity at AM-3 and AM-6. If any 15-minute average wind speed exceeds 25 mph at AM-3, temporarily stop work until wind speed falls below this level. Continually measure ambient temperature, relative humidity, barometric pressure, precipitation, and solar radiation at AM-6.

Each station will be equipped with a high volume air sampler that will collect a filter sample for analysis of PM10, sulfate, eight metals (aluminum, arsenic, cadmium, chromium, cobalt, copper, manganese, and nickel), and five radiochemicals (Gross Alpha, Ra-226, Ra-228, Th-228, and Th-230). The high volume air samplers will be the same as those used in the 3-year air quality monitoring program: the Tisch Environmental TE-6070D High Volume PM10 monitors with EPA Federal Reference Method (FRM) designation RFPS-0202-141. High volume samples will be collected before and during the removal action.

To establish background conditions, an 8-hour high volume sample will be collected from all three monitoring locations on two occasions prior to the start of earthwork activities. To evaluate concentrations of chemicals at the perimeter of the Site during the startup of the removal action, an 8-hour high volume sample will be collected from all three monitoring locations on two occasions during the first week of full-scale operations. For the remainder of the construction period (expected to be 2 to 3 weeks), an 8-hour high volume sample will be collected from all three monitoring locations on a weekly basis. The duration of these startup and weekly samples will coincide with the core daily construction activity, which is estimated to be between 8 and 10 hours, and sampling will be designated on random days during the construction week. Additional samples will be collected if Notification Level 3 is exceeded at any time.

Station AM-1 will also be equipped with a continuous particulate monitor capable of providing 15-minute PM10 measurements continuously throughout the construction activity. The real-time air sampler will be the same as that used in the 3-year air quality monitoring program: the Thermo Scientific TEOM Series 1400a Ambient Particulate Monitor with FRM designation EQPM-1090-079.

5.4.4 Meteorological Monitoring

Meteorological parameters will be monitored continuously during the removal action by using equipment at AM-1 and AM-6. Meteorological data will be used to interpret the perimeter air monitoring data and monitor wind speeds during the removal action. Wind sensors at AM-1 and AM-6 will provide continuous 15-minute average measurements of wind speed and direction. If any 15-minute average wind speed at AM-1 (the location closest to the removal action activity) exceeds 25 mph, the Construction Manager will notify the contractor to stop work temporarily until wind speed falls below this level. The meteorological station at AM-6 will also provide continuous measurements of ambient temperature, relative humidity, barometric pressure, precipitation, and solar radiation during the removal action.

5.4.5 Data Quality

To maintain consistency with the quality of ambient air data collected previously at the Site, the same quality control procedures will be followed as specified in the *Air Quality Monitoring Work Plan, Yerington Mine Site, Revision 2* (Brown and Caldwell, 2007) and the *Quality Assurance Project Plan, Revision 5* (ESI and Brown and Caldwell, 2009). The quality control procedures include:

- Standard operating procedures for equipment operation, maintenance, and calibration;
- Quarterly maintenance and calibration of high volume air samplers and the continuous particulate monitor;
- Semi-annual maintenance and calibration of all meteorological equipment;
- Filter blanks and field blanks for high volume air samples;

- Laboratory quality control samples consisting of method blanks, laboratory control samples, and laboratory duplicate samples as specified in the QAPP;
- Data verification, validation, and management; and
- Reporting to the EPA.

5.5 Institutional Controls for Pipe Left in Place

As described above, the procurement process for qualified bidders will involve a Site visit to determine potential Site-specific health and safety or technical concerns, particularly in areas where access to transite pipe appears limited or not possible (e.g., portions of HAs adjacent to the open pit, slightly buried by berms, associated with collapsed roadways, and within steep slopes associated with tailings or waste rock). Such areas will require field judgments to determine if transite pipe can be safely removed with the design of special procedures, or if the pipe will be left in place with appropriate institutional controls.

Criteria for leaving transite pipe in place include locations where: 1) it is unlikely that transite pipe will pose a potential inhalation risk for Site workers; and 2) worker health and safety, and equipment, may be at risk during the removal of pipe or associated RACM waste materials. Institutional controls for leaving pipe or associated RACM waste materials in place include:

1. ARC's authorization to work program to control access to areas with transite pipe. Work will not be authorized for any areas containing remnant transite pipe unless authorized or supervised by a licensed asbestos abatement contractor or AHERA certified inspector.
2. Inclusion of potential asbestos hazards in future Site orientations and H&S training to visitors and contractors working at the Site. Such training will be in accordance with comply with requirements under OSHA Construction Industry Standard for Asbestos (29 CFR § 1926.58) and OSHA General Industry Standard for Asbestos (29 CFR § 1910.1001). At a minimum, employees with the potential to come in contact with transite pipe will be provided an awareness level training in accordance with OSHA standards (29 CFR § 1926.1101(k)(9)(viii)(A-J)).
3. Implementation of emergency response procedures for ceasing work, securing the affected location, and notifying an abatement contractor when a potential fiber release episode has occurred.

The following practices will be implemented for Site workers with the potential to encounter transite pipe or associated RACM waste materials in place:

1. All employees and contractors should avoid damaging transite pipe in any manner including, but not limited to, striking cement pipe with equipment or performing maintenance and repair activities that may impact the cement pipe
2. All employees and contractors should report any evidence of dust or debris that might be sourced from the transite pipe left in place, and any observable change in the condition of the pipe. Employees and contractors should avoid disturbing the remnant pipe
3. Employees and contractors should not be allowed to clean up, remove or repair any transite pipe that remains on the Site unless they have training for handling RACM, as required by the OSHA in 29 CFR § 1926.1101.
4. Transite and (asbestos) wrapped metal pipe left in place and exposed to the atmosphere will be managed by: 1) GPS mapping for future reference for Site workers, contactors or other individuals that would need to access those areas; and 2) placing appropriate signage alerting Site workers, contactors or other individuals that such pipe is present.

5.6 Landfill Closure

The landfill cell will be capped with 30 inches of combined non-compacted tailings materials above existing grade, which will be composed of a lower 24-inch layer of mixed sulfide and oxide tailings and an upper 6-inch layer of VLT. The cover geometry includes 4:1 maximum side slopes with a five percent grade to limit cap erosion during precipitation events.

Following the removal action and placement of the landfill cell closure cap, ARC plans to implement a soil moisture monitoring program within and beneath the 30-inch closure cap to provide real-time soil moisture data at three depths in the upper 10 feet of the combined cap and underlying below-grade fill material within the landfill cell. Details of performance monitoring will be discussed with EPA in a technical meeting prior to implementation. Soil moisture monitoring will be accomplished through the installation of time domain reflectometry (TDR) probes installed in a vertical or inclined borehole. Initial calibration of the TDR probes will be performed by the collection of cap and landfill materials, and the submittal of these samples to a geotechnical lab for gravimetric soil moisture measurements (ASTM D2216). Depth-specific changes, if any, of soil moisture data from the monitoring system will be evaluated on a quarterly

and annual basis to: 1) assess the potential flux of meteoric water into the landfill cell; and/or 2) determine if any modifications to the cap soil moisture monitoring program should be implemented.

The closed landfill cell will be contained within the fenced and posted limits of restricted public access for the Site. Appropriate signage (e.g., as shown on Figure 5-4) will be posted at landfill area access road entrances listing the type of waste placed in the landfill. Specific language will be discussed with EPA prior to posting the signs.

5.7 Removal Action Schedule

An updated schedule for the transite pipe removal action is presented in Appendix H. A revised schedule for the management of mixed asbestos-TENORM waste, which may be affected by a concurrent or sequential removal action associated with radiological materials in the Process Areas, will be developed with EPA. The transite pipe being shipped for off-site disposal will be shipped with the materials from the radiological materials removal action in the Process Areas if possible; otherwise, it will be shipped upon completion of the removal action.

SECTION 6.0

HEALTH AND SAFETY REQUIREMENTS

All field activities will be conducted in accordance with the Site Health and Safety Plan (HASP; Brown and Caldwell, 2009d). The HASP identifies, evaluates and prescribes control measures for health and safety hazards, including radiological hazards, and describes emergency response procedures for the Site. HASP implementation and compliance is the responsibility of Brown and Caldwell, with ARC taking an oversight and compliance assurance role. Copies of the HASP are located at the Site and are available to all Site workers. The HASP includes site specific requirements and procedures including:

- Safety and health risk or hazard analysis;
- Employee training requirements;
- Personal protective equipment (PPE);
- Medical surveillance;
- Site control measures (including dust control);
- Decontamination procedures; and
- Emergency response.

6.1 Training

All Site workers and subcontractors will receive applicable training, as outlined in 29 CFR 1910.120(e), and as stated in the HASP. Site-specific training will be covered at the pre-entry briefing, with an initial Site tour and review of Site conditions and hazards. Records of pre-entry briefings will be maintained at the project site. Personnel entering restricted work areas will be trained to identify RACM and the hazards associated with asbestos in accordance with the OSHA Asbestos Standards (29 CFR 1910.1001 and 29 CFR 1926.1101) and state/local certification requirements. This training provides personnel with a better understanding of asbestos and the steps to be taken to protect themselves and the public. Planned training elements include:

- Persons responsible for site-safety;
- Site specific safety procedures;
- Site-specific safety and health hazards;
- Project and task specific work risk assessment and mitigation;
- Use of PPE;
- Decontamination procedures; and
- Emergency response procedures.

Other required training, depending on the particular activity or level of involvement, that will be completed prior to beginning work at the Site includes the following. Sub-contractors and Site workers will provide copies of the following certification records to the Project Safety Manager:

- OSHA 40-hour training with current 8-hour refresher,
- AHERA Asbestos Inspector, Supervisor or Worker,
- Respirator training and fit test certification.

6.2 Personal Protective Equipment

Minimum PPE requirements required for transite pipe removal action activities include:

- hard hat;
- safety glasses;
- steel-toe boots;
- long-sleeve shirts;
- high-visibility clothing or reflective vest;
- nitrile and/or leather work gloves (as needed);
- Tyvek coveralls (as needed); and
- half mask respirator with P100 cartridge (as needed).

Additional PPE may be required depending on the work task and may include, but is not limited to goggles, fall protection and/or hearing protection.

6.3 Asbestos Health and Safety Procedures

This section identifies the principle hazards associated with the tasks to be performed during the asbestos abatement and removal action, and establishes standard safety and health procedures for Site workers. Activities conducted by any subcontractors and their designees will be performed in accordance with the Site HASP, this revised RAP and applicable federal, state, and local regulations.

6.3.1 Responsibilities

Primary Contractor

The Project Manager will have overall responsibility for ensuring health and safety protection on the Site and for ensuring that all elements of the HASP are implemented during all phases of the daily on-Site activities of this project. The Project Safety Manager will oversee the health and safety of site work to ensure the requirements of the HASP are followed and will communicate with all parties when changes occur on-site or when conditions impacting the site occur concerning the response actions to be taken. Each contractor on the job will be responsible for:

- Preparing a subcontractor HASP specific for their scope of work (SOW);
- Having an on-Site supervisor who understands the SOW and associated health and safety issues, and who can manage and control the health and safety issues;
- Supplying personnel qualified to perform the SOW tasks that they are assigned;
- Communicating with the Project Safety Manager and other subcontractors when work conditions are identified that can impact health and safety on the job;
- Ensuring training of the Subcontractor's employees in the recognition, avoidance and control of chemical, biological and physical hazards present at the Site;
- Maintaining records for Subcontractor employees as required by this HASP (including but not limited to) medical, training and fit-test records;
- Providing daily health and safety briefings to their personnel;
- Providing specified PPE and associated training; and
- Ensuring that all subcontractors and suppliers comply with the Site HASP.

6.3.2 Asbestos Hazard Assessment and Controls

The primary chemical hazard that may be encountered during this project is asbestos. Therefore, the Project Safety Manager will ensure that all Site workers receive the required training concerning asbestos, such as asbestos awareness training. In addition, personnel who have the potential to disturb RACM will be trained concerning the procedures to be used and requirements for notifications in accordance with federal/state/local regulations. Personnel who handle RACM will: 1) have the required documented training and licenses; 2) have completed asbestos awareness training; and 3) be a licensed asbestos worker and/or supervisor. Training, medical and license documentation for each subcontractor employee will be verified by the Project Safety Manager prior to start of work.

Engineering Controls

Technically feasible engineering controls and/or other protective measures to protect the safety and health of all employees include:

- High-efficiency particulate air (HEPA) filtration devices to reduce dust levels;
- Vacuum cleaners equipped with HEPA filters;
- Fume extractors attached to HEPA filters for all hand-powered tools; and
- Other task-specific engineering controls as recommended by OSHA guidelines or as recommended by the Project Safety Manager.

Administrative Controls and Work Practices

Subcontractors will implement administrative controls and work practices as a secondary means of ensuring worker health and safety when engineering controls do not provide sufficient protection or are technically infeasible, such as the following:

- Ensuring all employees have current fit-test and training certifications;
- Implementing work practices that avoid generating dust whenever possible; and
- Requiring employees to implement decontamination procedures (washing hands, face, hair and neck upon leaving the work area and before eating, drinking or smoking).

Site Controls

Restricted work areas will be designated in the active work zone where only authorized personnel are allowed to enter while asbestos removal activities are being conducted. Persons entering the Regulated Work Area (RWA) will be trained in asbestos hazards and identification and will wear the required PPE (e.g. Tyvek coveralls and respirator). Persons leaving the regulated work area (RWA) will follow personal decontamination procedures including the removal of protective clothing layers.

6.3.3 Respiratory Protection Program

Respiratory protection is required whenever work is performed inside the RWA to protect the workers from exposures to contaminants, primarily asbestos, that may be present. Particulate filters that are HEPA or P100 will be required. The following respiratory equipment practices will be conveyed to all employees, and enforced by the Project Safety Manager:

- Personnel that need to wear respiratory protection will have a written respiratory protection program that meets OSHA requirements (29 CFR 1910.134), and will be fit-tested, medically qualified and trained to use respiratory protection.
- Procedures will be developed for handling, storing and maintaining respiratory protective equipment for on-Site use including the process for reporting and repairing/replacing defective equipment and the locations where respiratory equipment will be stored.
- Contractors will provide employees with adequate respiratory protection as required for each task (disposable dust masks are not considered adequate respiratory protection).
- A respirator of lesser protection than required for the task/activity may not be used, unless sufficient full-shift personal air monitoring of a representative 'worst-case' situation, or negative exposure assessment (NEA), has been conducted and approval has been obtained by the Project Safety Manager to support a downgrade in respiratory protection.
- Each employee will change his/her respirator filter as often as needed, and the Subcontractor will provide an adequate supply of approved filters.
- Contractors will ensure respiratory protection adequacy based on the results of personal air sampling (downgrades must be approved by the Project Safety Manager).
- If air sampling data indicate exposures that exceed one-half of the OSHA Permissible Exposure Limit (PEL), respiratory protection for affected employees will be upgraded.

Respirator Testing

Individuals will be required to be clean-shaven where the sealing areas of the respirator face piece contacts the face, and will be respirator fit-tested in accordance with 29 CFR 1910.134. Upon donning the respiratory device, or before entering any restricted work area, each respirator wearer will be required to perform a manual negative and positive-pressure test. Workers who fail the negative/positive pressure test because they are not clean shaven will be required to leave Site or shave on-Site immediately preceding entry into the work area.

Respirator Inspection, Sanitization, and Maintenance

All respirators will be cleaned, sanitized, inspected, assembled, and maintained ready for use on a daily basis. Each respirator will be stored in a clean and sanitary container. Prior to use, the wearer will inspect the respirator, including the valves, valve covers, nosepiece, straps, eyepiece (for fullface respirators), face piece and its snaps, cylinders, and canisters to insure that the respirator can be worn. The Subcontractor will provide initial training concerning the use of respirator equipment, but each employee will be responsible for cleaning, inspecting, maintaining, sanitizing, and storage of his/her respirator equipment.

If a respirator becomes chemically contaminated or malfunctions, the respirator will be replaced with a clean and sanitized respirator, and the contaminated/ defective respirator will be decontaminated and repaired before reuse, or tagged 'out of service' and disposed of. The respirator wearer will inspect the replacement respirator for defective parts and leaks and will be fit tested if the replacement respirator is of a different make, model or size than the original.

6.3.4 Asbestos Air Monitoring Plan

A qualified person will perform area air monitoring during the initial removal activities to evaluate exposures to asbestos within and outside of the work area. The evaluation will determine the effectiveness of control measures, requirements for upgrading or downgrading PPE, and the effectiveness of safe work practices. The subcontractors will be responsible for performing appropriate OSHA personal air monitoring on their workers.

Exposure Monitoring During Asbestos Removal

Two types of exposure monitoring will be conducted during the asbestos removal action, area sampling and OSHA personal monitoring. Area sampling is air monitoring that is conducted in and around the work area. Area monitoring will be conducted during all phases of the removal action, and is subject to different limits depending on the phase of work being performed. Air monitoring is an important control for asbestos work to ensure that no one is unexpectedly exposed to asbestos fibers in the surrounding area. A third-party contractor unaffiliated with the owner or asbestos removal contractor is required to take these samples. OSHA personal monitoring requires that a representative number of the workers performing each task during the removal action be monitored using a personal air monitor properly attached to their person. This third-party contractor will be required to develop the exposure monitoring plan and submit for ARC and EPA review and approval.

Requirements for Negative Exposure Assessment

NEAs may be performed to demonstrate that the work will not generate asbestos fibers in the air at levels exceeding the PEL. If performed, NEAs can be used to demonstrate that the asbestos abatement contractor does not need to comply with a number of regulatory requirements. However, this demonstration must be based on previous jobs with the same material, objective manufacturer data or an initial exposure assessment. NEAs may also be used to determine what level of respirator protection is needed.

6.4 Radiological Dose Assessments and Contamination Monitoring

Transite pipe removal activities performed in HA-1 or HA-4 (RCA), where elevated radiometric readings have been observed may involve the following monitoring: 1) worker external and internal exposure; and 2) monitor removable contaminant levels on equipment and personnel to minimize the spread of contaminants on or off the Site. These areas will be marked with exclusion flagging and signs, and Site workers will be required to wear additional PPE.

External Radiological Dose Assessment

External radiation dose monitoring will be performed on all Site workers working in or near the designated RCA and, if required, HA-1. Personal dosimeters, such as thermo-luminescent dosimeters (TLD), or optically stimulated luminescence (OSL) badges will be used to monitor cumulative radiation doses. Dosimeters will be submitted to a laboratory following completion of the work, or after a one-month period, whichever is shorter (replacement dosimeters should be worn until the work is completed). An electronic dosimeter may also be worn to provide a real-time reading of worker exposure levels to know if very high exposures are occurring during the course of the work, though these are considered to be less accurate and should not be used in place of the TLD/OSL. Analysis of the TLD/OSL badges or electronic dosimeters will be evaluated in the context of a to-be-established action level. Employees with exposure levels close to or greater than this action level will be removed from the work activity.

Internal Radiological Dose Assessment

A high volume sampler will be used to collect representative air samples once per each day that removal actions are performed in the RCA (and HA-1, if required) to determine airborne levels of radioactivity. The sample filters will be analyzed for total particulate mass as well as specific radioisotopes identified as occurring in the waste material to allow an estimate of internal radiation exposure. The air sample will be collected during the period of waste handling activities by placing a sample pump and filter on the downwind side of the work area at the border of the contamination control zone. Meteorological conditions during air sampling will be recorded to correlate these conditions with measured airborne concentrations.

Radiological Contamination Control Monitoring

A contamination control zone (CCZ) will be established around the RCA (and portions of HA-1, if required) to accommodate the removal action. Personnel and equipment within the CCZ will be monitored for surface radiological contamination prior to leaving the area using a survey meter with a probe suitable for measuring alpha/beta contamination that reads in disintegrations per minute (DPM). Release limits for NORM will be based on the release criteria for the State of

Nevada (personal correspondence with Eric Matus) and given in table 6-1. These limits are consistent with those used by the State of Texas for NORM (TAC 289.259(w)) and Regulatory Guide 1.86 (US AEC 1974) limits for uranium and uranium decay products. Fixed and removable contamination limits are based on measuring the fixed and removable contamination on 100 square centimeters of the surface of the object. The allowable average contamination is based on averaging the measured fixed contamination levels over 1 square meter.

Table 6-1. Acceptable Surface Contamination Levels			
Criteria	Average^a	Fixed	Removable
Limit	5,000 dpm/100cm ²	15,000 dpm/100cm ²	1,000 dpm/100cm ²

^a Average contamination is based on 1 square meter, or the entire object for smaller objects.

If surfaces show activity levels greater than those given in Table 6-1, they will be cleaned until the prescribed level is met. All disposable PPE worn in the CCZ must be removed upon exit, disposed of in plastic bags and stored in labeled 55-gallon drums to be evaluated and disposed of as investigation derived waste. Non-disposable PPE must meet the same release requirements as those defined above. The prescribed frequency of contamination control monitoring is summarized in Table 6-2. This frequency may be modified as additional data becomes available.

Table 6-2. Contamination Control Monitoring/Sampling Frequency	
Frequency^a	Location of Condition^a
Prior to Transfer	Of equipment and material from a Radiological Control Area.
Daily	At contamination area control points, change areas, or step-off pads when in use, or per shift in high use situations.
After	Clean up of a leak or spill of radioactive materials in previously uncontaminated areas.

Note: ^a Contamination surveys will be conducted in Radiological Buffer Areas established for the control of contamination and other areas with the potential for spread of contamination.

6.5 Landfill Construction and Management Health and Safety Procedures

The landfill for disposal of RACM waste will be constructed on site in the sulfide tailings area as described in Section 5.0. Health and safety issues related to landfill construction, waste hauling and landfill operation include ground disturbance, airborne dust and vehicle traffic. Because the planned disposal of transite pipe in the on-Site landfill cell does not include mixed asbestos-TENORM waste, which will be managed in a subsequent removal action phase, the following discussion is limited to the relocation of RACM to the landfill cell.

6.5.1 Ground Disturbance

Construction of the landfill cell includes excavation of sulfide tailings to the design configuration described in Section 5.0. While there is very little risk of encountering buried utilities in the sulfide tailings, ARC will conduct utility location activities and prepare a ground disturbance permit. The open excavation will be treated as a potential permit-required confined space until it can be verified that there are no inhalation or engulfment hazards. Once the excavation is large enough, air monitoring will be conducted to evaluate oxygen, carbon monoxide and hydrogen sulfide levels. The excavation will also be monitored to ensure that it is constructed to conform to the engineering design (i.e., no vertical walls that could collapse and engulf personnel or equipment). If both inhalation and engulfment hazards are determined to not exist, the excavation will be listed as a non-confined space. If conditions change through the construction and operation of the on-Site landfill, additional air monitoring may be implemented and confined space procedures may be required.

6.5.2 Dust Control and Air Monitoring

Generation of sulfide tailings dust during landfill cell construction, operation and closure will be monitored for potential exposure levels for both on-Site workers and off-Site receptors. Dust control procedures (e.g., wetting the surface of the sulfide tailings and access roads, or covering the access roads with gravel) will be implemented to minimize the amount of dust. Personal air pumps will be used to monitor individual breathing zones of Site workers.

High volume air samplers will be established around the perimeter of the landfill cell work area (not necessarily at the Site perimeter) to monitor dust that may travel to potential off-Site receptors. Air monitoring will be done daily for the first week of the landfill cell construction, and may be reduced in frequency if results show acceptable levels of fugitive dust emissions below regulatory levels. Collected air monitor samples will be analyzed for total particulates less than 10 microns (PM₁₀), asbestos fibers and select metals known to occur in the sulfide tailings.

6.5.3 Traffic Control

A traffic control plan will be established at the start of the removal action by the selected contractor to define access routes that trucks and equipment are allowed to use (or are excluded from), designated directions of travel, areas limited to one-way traffic, and traffic management procedures for areas with two-way traffic or intersections. All removal action-related traffic will be confined to the Site with the exception of mobilization to and from the site at the beginning and end of the removal action. Traffic control on public roadways will not be required.

6.6 Work Risk Assessment

Work Risk Assessment (WRA) is a risk management tool for the identification and ranking of hazards associated with all aspects of a specific job before and after implementation of risk controls and preventive actions. Control of the hazards can be accomplished by elimination or substitution of the task, isolation of Site workers from the hazard, use of engineering or administrative controls, and/or the use of PPE. The WRA for the removal action described in this revised RAP is provided in Appendix I. A summary of potential hazards associated with the removal action activities is provided in Table 6-3.

ARC will create Task Safety and Environmental Analyses (TSEAs) for the contractor to perform individual tasks that comprise the removal action. TSEAs are similar to job safety analyses (JSAs), but include potential risks to the environment. Comprehensive TSEAs will be completed for all field tasks required in this revised RAP before the work is initiated and will be developed

jointly by the field staff conducting the work and the Project Safety Manager. TSEAs will be kept at the Site at all times and will be reviewed by Site workers prior to, and throughout, the removal actions in order to identify new hazards or controls.

Table 6-3. Work Risk Assessment Summary	
Field Activities	Potential Hazards
Radiation survey of transite pipe	<ul style="list-style-type: none"> ▪ Driving hazards ▪ Walking, tripping, uneven ground surface ▪ Radiation exposure
RACM material sampling	<ul style="list-style-type: none"> ▪ Inhalation of asbestos fibers ▪ Skin contact or clothing contamination with fibers ▪ Hand injury from handling material ▪ Eye injury ▪ Contact with chemical residue ▪ Exposure to radioactive materials
Sampling or removal in the RCA	<ul style="list-style-type: none"> ▪ Radiation exposure ▪ Inhalation of alpha particles ▪ Tracking of contaminated materials to vehicle or other areas
Pipe removal and loading	<ul style="list-style-type: none"> ▪ Mobile equipment activity (all-terrain forklift) ▪ Material handling, hoisting ▪ Inhalation or skin contact with RACM, radiological or chemical residue ▪ Steep terrain, narrow roadways, limited access
Transport of pipe to on-site landfill and operation of the landfill	<ul style="list-style-type: none"> ▪ Driving hazards ▪ Limited access and maneuverability, backing in loading/unloading areas ▪ Steep hills and unprotected embankments ▪ Dispersal of RACM during transport
Construction, operation and closure of the on-Site landfill cell	<ul style="list-style-type: none"> ▪ Mobile equipment activity (all-terrain forklift) ▪ Material handling, hoisting ▪ Inhalation or skin contact with RACM, radiological or chemical residue ▪ Steep terrain, narrow roadways, limited access

SECTION 7.0

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