SUPPLEMENTAL
SCALE SAMPLING AND ANALYSIS PLAN
TRANSITE PIPE REMOVAL ACTION

YERINGTON MINE SITE

REVISION 1

JULY 30, 2010

PREPARED FOR:

Atlantic Richfield Company
4 CENTERPOINTE DRIVE
LA PALMA, CALIFORNIA 90623

PREPARED BY:

Brown AND Caldwell

3264 Goni Rd, Suite 153
Carson City, Nevada 89706
(775) 883-4118

AND

FOXFIRE SCIENTIFIC INC

4621 S. Cooper Street #131-332
Arlington, Texas 76016
(877) 433-2029

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AOC	Administrative Order on Consent
ARAR	Applicable, Relevant and Appropriate Requirements
ARC	Atlantic Richfield Company
EPA	Environmental Protection Agency
HAs	Homogeneous-Area
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NDHHS	Nevada Department of Health and Human Services
QAPP	Quality Assurance Project Plan
RAP	Removal Action Plan
RCA	Radiological Control Area
SAP	Supplemental Analysis Plan
Site	Yerington Mine Site
SOW	Scope of Work
TENORM	Technologically-Enhanced Naturally Occurring Radioactive Materials
VLT	Vat Leach Tailings
UEP	Unlined Evaporation Pond
cm	Centimeters
g	Gram
pCi	Picocurie

SECTION 1.0
INTRODUCTION

Atlantic Richfield Company (ARC) has prepared this Supplemental Scale Sampling and Analysis Plan Revision 1 (revised SAP) dated July 30, 2010 as a supplement to the Transite Pipe Removal Action Work Plan Revision 1 (Work Plan) to support the removal of transite (i.e., concrete and asbestos) pipe at the Yerington Mine Site (Site). Based on comments provided by the U.S. Environmental Protection Agency – Region 9 (EPA) on the Draft Transite Pipe Removal Action Plan (RAP) dated January 8, 2010, ARC, EPA, the Nevada Division of Environmental Protection (NDEP) and the Nevada Department of Health and Human Services (NDHHS) conducted a technical meeting and Site visit on April 8 and 13, respectively, to discuss: 1) the approach to characterizing transite pipe with technologically enhanced naturally occurring radioactive materials (TENORM); and 2) the elements of this draft SAP.

Additional comments were provided to ARC on May 10, 2010 following the submittal of the draft SAP on April 23, 2010. The transite pipe removal action is required under the Administrative Order on Consent (AOC) and associated Scope of Work (SOW)[1] dated April 21, 2009 (effective May 1, 2009). Given that this revised SAP is a supplement to the Work Plan described above, it does not include the background information provided in the Work Plan.

This revised SAP is intended to provide additional field and laboratory data necessary to determine whether transite pipe with scale or sediment in individual pipe sections and long pipe runs exceeds the revised Site-specific applicable or relevant and appropriate requirement (ARAR) of 5 picoCuries per gram (pCi/g) of radium-226. It describes field and laboratory analytical activities that have already taken place pursuant to EPA approval of the draft SAP and EPA oversight during field activities.

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

The objective of this SAP is to provide additional field and laboratory data necessary to determine whether transite pipe with scale or sediment in individual pipe sections and long pipe runs exceeds the revised Site-specific applicable or relevant and appropriate requirement (ARAR) of 5 picoCuries per gram (pCi/g) of radium-226. The Site-specific ARAR of 5 pCi/g of radium-226 is based on Nevada Administrative Code (NAC) Section 459.184, which exempts TENORM containing less than 5 pCi/g of radium-226 from the provisions of NAC 459.180 to 459.314, inclusive. Off-Site disposal of transite pipe characterized as mixed asbestos-TENORM waste (i.e., above the Site-specific ARAR) will be required).

SECTION 2.0
SURVEYING AND SAMPLING PLAN

Upon EPA approval of this SAP, ARC will implement a radiochemical inspection and characterization (i.e., sampling and analysis) program to identify, quantify and classify transite pipe and associated materials that occur on the Site. As described above, pursuant to the NAC, point exceedances of 5 pCi/g of radium-226 are not a regulatory concern as long as the average concentrations of lengths of pipe used for the same purpose do not exceed 5 pCi/g of radium-226. Figures 2-1 and 2-2 depict the identified long pipe runs and other areas which contain disconnected pipes whose original location or use is not known. Within each long pipe run, locations at which to take surveys and samples were identified based on best professional judgment. These locations were selected based on observed occurrences of scale and at topographic low points where scale formation or sediment settling is more likely. Figures 2-1 and 2-2 also depict the locations selected for radiometric surveys and the collection of samples for radiometric analysis.

2.1 Survey and Sample Locations

Subsequent to the April 13, 2010 Site visit, Brown and Caldwell (ARC's contractor) conducted a comprehensive inspection of the HAs to identify potential locations for interior scale samples and associated radiometric surveys. The following 29 locations, including re-sampling of scale in HA-1 and HA-4 (HA-4 contains the radiological control area or RCA) were identified and spray-painted based on observed occurrences of scale or sediment in open pipe sections or the potential for scale or sediment to accumulate in continuous pipe runs in topographically low sections:

<u>HA-1 (Used and new pipe laydown yard)</u>

S-1 – Observed fine grained white sediment in open end of single pipe length stockpiled in laydown area. Sediment is ~3-5 cm thick in the bottom portion of the pipe and <0.25 cm thick scale around the rest of the pipe interior. Lined pipe ~14" diameter.

S-2 – Interior portion of unlined transite pipe that appears rough and scale-like inside pipe, looks more like potentially impregnated asbestos pipe material rather than actual scale or sediment.
S-3 – Yellow scale coating on full interior surface of 12" lined pipe, coating is <0.25 cm thick. Yellow discoloration also occurs on the outside of pipe similar to what has been observed in the evaporation pond areas of the mine site.
S-4 – Two foot long section of unlined transite pipe attached to steel connector. A 2 cm thick accumulation of fine grained white/grey sediment was observed in the bottom of the pipe with little to no scale around the rest of the interior.
S-5 – Flaking interior of unlined transite pipe section that appears to be primarily degraded pipe material with potentially some whitish scale around entire pipe interior.
S-6 – A re-sample of the previously tested HA-1-07 location. White chalky scale coating entire pipe interior of lined transite pipe, ~0.5 cm thick.

HA-2 (Mostly continuous pipe runs around W-2 dump leach area)

S-7 – Open end of unlined 14" transite pipe with minor scale (<0.1 cm) and reddish discoloration of pipe interior. Located at southern end of dump leach pipe run where pipe was broken and moved for road access.
S-8 – Low section in dip along continuous pipe run with 2 parallel lines. Pipe will be dis-articulated to survey and possible sample collection.
S-9 – Low section in dip along continuous pipe run with 2 parallel lines. Pipe will be dis-articulated to survey and possible sample collection. Open end of pipe ~50 feet southeast does not show any scale material.
S-10 – Low section in dip along continuous pipe run with 2 parallel lines. Pipe will be dis-articulated to survey and possible sample collection. Location is next to pipe drain outlets.
S-11 – Open end of lined pipe at top of hill. There is a build-up of what appears to be swollen pipe material at the joint where ore beneficiation solutions impregnated into pipe.
S-12 – Low section in dip along continuous pipe run with 2 parallel lines located on north side of Burch Drive. Pipe will be dis-articulated to survey and possible sample collection. Location is next to pipe drain outlets.

HA-3 (Process Areas - east side)

S-13 – Open section of 8" diameter lined transite pipe that was likely used for discharge of sulfide plant waste water to the sulfide tailings. A thin ribbon of loose white sediment, ~2 cm thick, was observed along bottom of pipe, no other scale observed on pipe interior.
S-14 – Open end of continuous pipe run located near the dump leach surge pond. Pipe was likely used for transport of dump leach solution from W-2 dump leach to the surge pond. Buildup of white flaky sediment at pipe joint that appears to be potentially impregnated asbestos pipe material eroded from other parts of the pipe.
S-15 – Flat section of continuous pipe from same pipe run as previous sample location. Interior of pipe is not visible but nearby joint shows deterioration and possible impregnation with leach solution.

S-27 - Open section of 12" diameter lined transite pipe in middle of an ~100 ft long run that appears to have been used to discharge waste fluids to the southernmost portion of the sulfide tailings. A thin crust of white scale was observed.

S-28 - An ~100 ft long, 12" diameter lined transite pipe that had one section removed at some time in the past due to erosion of embankment. Pipe appears to have carried waste fluids to the sulfide tailings. No scale was observed in this pipe.

S-29 - A large 20" diameter transite pipe that is partially encased in a concrete base that carried waste fluids from the sulfide plant to the sulfide tailings. The interior of the pipe is partially eroded along the bottom and exposes the concrete base in areas. A thin, flaky grey scale was observed lining the lower ½ of the pipe.

HA-4 (Process Areas RCA and Iron Launders)

S-16 – Open end of pipe length that appears to have been disturbed from pipe run parallel to iron launders that may have carried pregnant solution to the iron launders. A thin white chalky scale is observed in portions of the pipe interior with loose white flakey material along bottom of pipe that may be similar scale knocked loose from other parts of the pipe. Pipe scale is <0.1 cm thick.

S-17 – Open end of pipe located in concrete trench box adjacent to RCA, pipe has demonstrated high radiological readings during previous investigations. Pipe interior appears highly degraded by solutions.

S-18 – Open end of south end of pipe run adjacent to iron launder. Pipe interior appears to be unlined or moderately degraded pipe material possibly with some thin (<0.1 cm) scale or sediment coating on pipe wall. There is sediment in bottom of pipe but it appears to be mixed gravel/VLT material that likely washed in after pipe was taken out of service (VLT will not be included in the scale sample).

S-19 – A re-sample of the previously tested HA-4-02 location, with a thin red scale coating on interior wall of transite pipe.

S-20 – A re-sample of the previously tested HA-4-01 location. Highly degraded and impregnated pipe material with some possible scale coating on pipe wall.

HA-5 (South sulfide tailings and southeast oxide tailings/calcine ditch locations)

S-21 – Continuous length of 8" transite pipe on top of sulfide tails located in a low area. Pipe will be dis-articulated to survey and possible sample collection.

S-25 – Wrapped steel pipe located in calcine ditch area that is half-full of yellow/beige fine grained sandy sediment. This pipe may have transported waste water from the iron launder or other portion of the plant to the unlined evaporation pond.

S-26 – Same pipe run as previous location. Wrapped steel pipe located in calcine ditch area that is half-full of yellow/beige fine grained sandy sediment.

HA-6 (North sulfide tailings area)

S-22 – Single length of pipe that has ~3-5 cm of yellow sandy sediment on bottom of pipe, sediment appears to be sulfide tailings material or evaporation pond sediment. Unable to tell origin or use of pipe.

HA-7 (Unlined Evaporation Pond)

S-23 – Large diameter (~20") transite pipe appears to have been an overflow outlet for the UEP. The pipe interior and exterior is coated with reddish/yellow scale and/or sediment ~0.5 cm thick.

S-24 – Same location and origin as previous sample from different length of pipe.

These supplemental scale samples will be subject to the gamma survey and radiochemical analyses described in Section 2.2. A subset of these samples will be submitted for meteoric water mobility leaching procedure (MWMP) and are limited to locations where sufficient sample volume can be collected.

2.2 Gamma Surveys and Sample Collection

As described above, select locations at topographically low sections of long pipe runs will be broken apart 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, if present, will be selected for sample collection. If there is no observed scale or impacted pipe wall, then a sample will not be collected. However a gamma survey will still be performed at that location.

A gamma survey will be performed at each of the locations listed above. The gamma survey probe will be positioned inside the pipe interior adjoining the location selected for the sample collection if a sample is to be collected. If no sample is to be collected, then the survey measurement will be taken on the bottom portion of the interior pipe wall. The survey measurements will be made with a Ludlum Model 44-2 NaI probe connected to a Ludlum Model 2241 series meter. The meter will be calibrated in units of counts per minute or otherwise configured to take a 60 second count. A jig will be attached to the probe to facilitate a consistent source-to-detector geometry such that the jig is 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 will be held with the centerline of the probe parallel to the centerline of the pipe. A 60-second count will be taken at each location and recorded.

Near each surveying location, local comparison 60-second counts will be 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. The locations at which to make the local comparison value counts will be determined in the field based upon the best professional judgment of the health physicist(s) in attendance, with concurrence of the EPA representative in the field.

Scale samples for radiochemical analyses and MWMP leachability testing will be collected at the selected locations where scale or transite pipe wall impacted by ore beneficiation solutions can be identified. Samples will be collected in a manner suitable for determining the radiochemical concentrations in the impacted portion of the interior pipe wall. Determination of the impacted portion of the interior pipe wall will be made based upon best professional judgment, with concurrence of the EPA representative in the field, during the sample collection. Samples collected may include:

- Samples of pure scale or sediment accumulation, especially in lined pipes;
- Scale mixed with portions of pipe wall that cannot be readily separated (i.e., degraded pipe wall which is presumed to have been impacted by ore beneficiation solutions); and
- Interior pipe wall which has been degraded, presumably by ore beneficiation solutions.

Radiochemical Analysis

Samples collected for radiochemical analyses will be analyzed for Ra-226, Ra-228, uranium, and thorium by the analytical methods identified in Table 2-1. The uranium and thorium concentrations may be based on the concentration of decay products with which they can be presumed to be in equilibrium. Samples will be submitted to Eberline Services (Oak Ridge, TN) for radiochemical analyses. Sample preparation, laboratory procedures and reporting limits will be consistent with the Quality Assurance Project Plan (QAPP, Revision 5; Environmental Standards, Inc. and Brown and Caldwell, 2009) for the Site to the extent practicable. Eberline Services is not part of the BP Global Contractor Lab Network (see Appendix C of the QAPP), but has been selected for this SAP due to their capability to prepare (grind and homogenize) and analyze radiochemical samples containing asbestos.

Table 2-1. Radiochemical Sample Analysis			
Analyte	**Analytical Method**	**Reporting Units**	**Reporting Limit**
Ra-226	EPA 901.1 Mod/HASL 300	pCi/g	1.0 pCi/g
Ra-228	EPA 901.1 Mod/HASL 300	pCi/g	1.0 pCi/g
Uranium, Total	EPA 901.1 Mod/HASL 300	pCi/g	1.0 pCi/g
Thorium, Total	EPA 901.1 Mod/HASL 300	pCi/g	1.0 pCi/g

Meteoric Water Mobility Procedure (MWMP) Leachability Test

The meteoric water mobility procedure (MWMP; ASTM E2242) is the industry-standard leaching test for mine waste materials (e.g., waste rock, spent ore; tailings) in Nevada, and best represents the pH of meteoric water at the Yerington Mine Site (Site). The MWMP consists of a single-pass column leach test conducted over a 24-hour period, using a sample leached with Type II reagent grade water that had been slightly acidified to simulate naturally occurring meteoric water in Nevada at a ratio of 1:1 (extraction fluid:sample). For small volume samples, as expected for the transite pipe scale samples, a modified procedure may be implemented using an agitated bottle roll in place of the column test.

The MWMP leaching procedure will be completed by Sierra Environmental Monitoring (SEM) Laboratories in Reno, NV. The leachate collected from each sample will be placed in preserved sample containers and submitted to TestAmerica's Irvine and Richland project labs for metals and radiochemical analysis identified in Table 2-2.

Table 2-2. MWMP Leachate Analyte List			
Analyte	**Method**	**Reporting Limit**	**Units**
Metals			
Aluminum	EPA 200.7	0.05	mg/L
Antimony	EPA 200.8	0.002	mg/L
Arsenic	EPA 200.8	0.001	mg/L
Barium	EPA 200.8	0.001	mg/L
Beryllium	EPA 200.8	0.0005	mg/L
Boron	EPA 200.7	0.05	mg/L
Cadmium	EPA 200.8	0.001	mg/L
Calcium	EPA 200.7	0.1	mg/L
Chromium	EPA 200.8	0.002	mg/L
Cobalt	EPA 200.8	0.001	mg/L
Copper	EPA 200.8	0.001	mg/L
Iron	EPA 200.7	0.04	mg/L
Lead	EPA 200.8	0.001	mg/L
Lithium	EPA 200.7	0.002	mg/L
Magnesium	EPA 200.7	0.02	mg/L
Manganese	EPA 200.8	0.001	mg/L
Mercury	EPA 245.1	0.0002	mg/L
Molybdenum	EPA 200.8	0.002	mg/L
Nickel	EPA 200.8	0.002	mg/L
Potassium	EPA 200.7	0.5	mg/L
Silver	EPA 200.8	0.001	mg/L
Sodium	EPA 200.7	0.5	mg/L
Strontium	EPA 200.7	0.02	mg/L
Thallium	EPA 200.8	0.001	mg/L
Tin	EPA 200.7	0.1	mg/L
Titanium	EPA 200.7	0.005	mg/L
Uranium, Total	EPA 200.8	0.001	mg/L
Vanadium	EPA 200.8	0.002	mg/L
Zinc	EPA 200.8	0.01	mg/L
Radiochemicals			
Radium-226	EPA 903.0	1	pCi/L
Radium-228	EPA 904.0	1	pCi/L

SECTION 3.0
DATA EVALUATION AND UPDATE OF REMOVAL ACTION PLAN

Upon completion of the surveying and receipt of the laboratory analytical results, the analytical and survey results will be statistically evaluated, with the objective of determining a gamma survey action level that can be used to reliably determine those pipe sections that contain scale or impacted portions of the interior pipe wall with less than 5 pCi/g of radium-226. Depending on the radiometric survey and laboratory analytical results, this action level may be determined by mathematical correlation of radium-226 concentrations with gamma count rate, by determination of an upper confidence limit associated with samples containing less than 5 pCi/g of radium-226, or by other quantitative method to be agreed upon by ARC and EPA. The decision related to on- or off-Site disposal for transite pipe sections will be based on the evaluation of the data collected for this SAP, and will be discussed in the RAP.

Based on the results of the field and laboratory results obtained from implementing this SAP, the draft RAP dated January 8, 2010 will be revised to replace the previous radiochemical concentrations evaluation based upon bulk concentrations of transite pipe samples. ARC anticipates the revised RAP will be submitted to EPA on or before July 30, 2010.

SECTION 3.0

REFERENCES

Environmental Standards, Inc. and Brown and Caldwell, 2009. *Quality Assurance Project Plan, Yerington Mine Site, Revision 5*. Prepared for Atlantic Richfield Company. May 20.