



Environment

Submitted to:
USEPA Region 8
Denver, CO

Submitted by:
Atlantic Richfield Company
La Palma, CA
May 2016

Work Plan – Addendum 1

St. Louis Tunnel Hydraulic Controls
Interim Risk Reduction Measures

Rico-Argentine Mine Site – Rico Tunnels
Operable Unit OU01
Rico, Colorado



Environment

Submitted to:
USEPA Region 8
Denver, CO

Submitted by:
Atlantic Richfield Company
La Palma, CA
May 2016

Work Plan – Addendum 1

**St. Louis Tunnel Hydraulic Controls
Interim Risk Reduction Measures**

**Rico-Argentine Mine Site – Rico Tunnels
Operable Unit OU01
Rico, Colorado**

Prepared for: Atlantic Richfield Company

Prepared by: AECOM Technical Services, Inc.

May 16, 2016

Contents

Introduction.....	1
I. Site Description	1
II. Assessment of the Fluid Hazard	1
III. Failure Modes and Effects Analysis	1
IV. Description of the Work to be Performed	2
A. Key Expertise	2
B. Steps to Minimize Uncontrolled Release of Fluids	2
C. Major Uncertainties and Risks	4
D. Schedule.....	5

List of Figures

Figure III-1A - Routing of Debris Plug Breach Flows With No Interim Risk Reduction Measures

Figure IV-1A – Initial Ancillary Measures Plan

Figure IV-2A - Routing of Debris Plug Breach Flows With Initial Ancillary Measures Implemented

Figure IV-3A – Additional Ancillary Measures Plan

Introduction

This document supplements the Work Plan for proposed interim risk reduction measures to be implemented at the St. Louis Tunnel during the spring and summer of 2016 (AECOM, 2016)¹. The measures proposed herein are part of the ongoing response to the requirements of the U.S. Environmental Protection Agency (USEPA) Unilateral Administration Order (UAO) (USEPA, 2011a²) and Removal Action Work Plan (RAWP) (USEPA, 2011b³), specifically Subtask D2 of Task D, “Final Design of Adit Hydraulic Controls.” The Work Plan and this Addendum 1 together address all of the relevant topics outlined in an email from Steve Way/EPA to Tony Brown/AR(BP) dated April 1, 2016, Subject: Project Planning – Documentation 2016.

I. Site Description

No changes to the site description presented in the original Work Plan (AECOM, 2016) are included in this Addendum 1.

II. Assessment of the Fluid Hazard

No changes to the assessment of the fluid hazard in the original Work Plan are included in this Addendum 1.

III. Failure Modes and Effects Analysis

As discussed in Section III of the original Work Plan, the proposed primary interim risk reduction measures will provide very robust protection against debris plug breach and substantial mitigation of the downgradient effects with the Flow Control Structure (FCS) should a breach occur in spite of the relief well pumping system controls. However, full implementation of these interim measures is anticipated to take up to four months. During this implementation period the potential for failure of the debris plugs will remain to some degree. Although stringent risk mitigation measures will be implemented during implementation as summarized in Section IV.C of the original Work Plan, it is acknowledged that some

¹ AECOM. 2016. *Work Plan, St. Louis Tunnel Hydraulic Controls, Interim Risk Reduction Measures, Rico-Argentine Mine Site – Rico Tunnels Operable Unit OU01, Rico, Colorado*; Prepared for: Atlantic Richfield Company. May 11.

² USEPA, 2011a. *Unilateral Administrative Order for Removal Action (UAO)*, U.S. EPA Region 8, CERCLA Docket No. CERCLA-08 20011-0005, dated March 23.

³ USEPA, 2011b. *Removal Action Work Plan, Rico-Argentine Mine Site – Rico Tunnels Operable Unit OU01, Rico, Colorado* dated March 9.

risk will remain that debris failure could occur whether by inadvertent activities associated with the relief well drilling, start-up of the pumping system, construction of the FCS, or due to natural changes within the debris plugs completely unrelated to the planned work.

Breach modeling has been conducted to model the anticipated conditions of the tunnel flow, tunnel head and debris plug permeability during the drilling of the relief wells, installation and start-up of the pumping system and construction of the FCS in 2016. Modeling of breach flows during the implementation period is based on the following assumptions and parameters:

- Tunnel inflow is assumed as 870 gpm which is the estimated maximum average day flow during the period June through September, for the years 1951 to 2015.
- A flow of 870 gpm without relief well pumping and assuming debris plug behavior (permeability) remains the same as currently will result in an estimated head of 8868.6 feet in the St. Louis Tunnel at monitoring well BAH-01 accompanied by approximately 1.9 mgal of water in storage in the tunnel subject to release during a breach.
- Consistent with prior breach modeling, it is assumed that the debris plugs will breach over a period of 120 minutes.
- A conservative Manning's equation "n" of 0.03 is assumed to represent the roughness of the tunnel walls, roof and floor.
- Existing site topography and conveyance facilities and structures (channels, spillways and high-level outlet pipes) are included in the model.

Figure III-1A shows the modeled downgradient flows in the event of debris plug breach without any of the planned interim measures in place. As seen on Figure III-1A, it is estimated under existing conditions that approximately 4.7 cfs would discharge directly to the Dolores River through the EWD (former Pond 18). Substantially greater flows to the river would occur except that approximately 40 percent of the breach flows would enter the Phase 1 Solids Repository rather than continuing toward the EWD.

As described in Section IV below, further breach modeling has been performed with proposed initial ancillary measures in place, which will provide additional storage attenuation and detention of breach flows, resulting in further reduction of the risk of direct discharge to the Dolores River during the implementation period.

IV. Description of the Work to be Performed

A. Key Expertise

No changes in the Atlantic Richfield team implementing the work under the original Work Plan are proposed for the ancillary work planned under this Addendum 1.

B. Steps to Minimize Uncontrolled Release of Fluids

Prior to the commencement of drilling the relief wells as described in the original Work Plan, initial ancillary measures will be implemented to provide additional storage attenuation and detention capacity in the event of tunnel debris plug breach. These initial measures involve both construction and operations components as described below:

Initial Ancillary Measures Plan (see **Figure IV-1A**):

- Place and compact approximately two (2) feet of embankment fill along the existing Flood Dike forming the west side of the EWD (former Pond 18) and a spillway in the dike between the EWD biotreatment cell and Pond 15 with a capacity of up to 15 cfs to prevent debris plug breach flows from entering the Dolores River.
- Maintain Pond 15 in an empty state to provide storage attenuation and detention capacity in the event of a breach, including pumping of stormwater flow as necessary.
- Close and maintain closed the gates of the two existing high-level outlet pipes at Pond 15 to provide additional storage attenuation and detention capacity between their inverts and the invert of the overflow emergency spillway.
- Maintain the existing empty condition of the Phase 1 Solids Repository to allow its capacity to be partially utilized in the event of debris plug breach; evaluate measures to protect existing HDPE liner from damage and implement if / as needed.

Additional modeling was completed to identify and characterize the initial ancillary measures proposed above, which are to be completed prior to the anticipated four month implementation period for the primary interim measures. As shown on **Figure IV-2A**, these measures will mitigate to the degree feasible the risk of breach flows entering the Dolores River without the benefits associated with routing such releases through the remaining ponds system at the site with eventual discharge at Pond 5.

In conjunction with and/or following relief well drilling and construction of the FCS, additional ancillary measures will be implemented to protect existing water treatment and waste management infrastructure at the site (specifically the EWD, Pond 13 and the Phase 1 Solids Repository). Some of this work has been previously designed and remains to be constructed. The remaining work is still under further evaluation and will be designed to meet project needs. The additional ancillary measures are summarized as follows:

Additional Ancillary Measures Plan (see **Figure IV-3A**)

- Complete construction of previously designed stormwater improvements and grading associated with the EWD and the Phase 1 Solids Repository. Placement of the final two (2) feet of embankment fill on the crest of the Solids Repository starter dike would occur only after completion of the FCS. This will preserve the storage attenuation and detention benefits described previously until the primary interim risk reduction measures are fully implemented and operational.
- Design and construct improvements to capture stormwater entering the terrain trap above the FCS and convey it to existing stormwater improvements at the CWD.
- Perform minor grading if / as necessary to direct debris plug breach flows to completed stormwater capture and conveyance facilities based on continued modeling.
- Design and implement improvements to existing hydraulic structures at Pond 11 and interior pond dikes below Pond 11 if / as necessary to best manage debris plug breach flows through the lower ponds to discharge to the Dolores River at Pond 5.

Overall Sequence of Ancillary and Primary Measures Implementation

The following general sequence of construction of the initial and ancillary measures with the primary risk reduction measures described in the original Work Plan is as follows:

- Raise dike and install spillway at EWD
- Drill and case relief well RW-2a

- Install temporary diesel-driven pump and discharge hosing at RW-2a
- Drill and case relief well RW-2b
- Install Flow Control Structure (FCS) dewatering / outlet pipe together with pump station gravity piping and stormwater capture and conveyance structures within FCS footprint
- Construct pump station in parallel with FCS to the degree simultaneous operations and safety allow
- Complete stormwater capture and conveyance facilities to CWD / EWD and at Phase 1 Solids Repository
- Implement improvements to hydraulic structure at Pond 11 and interior dikes if / as needed at lower ponds

C. Major Uncertainties and Risks

As discussed in the original Work Plan, implementation of the primary interim risk reduction measures described therein involves uncertainties and risks. In addition to the seven (7) uncertainties and risks identified in the original Work Plan, the following risk has been identified and the planned mitigation measures to address that risk are summarized as follows:

- 8) Debris plug failure during drilling of relief wells, installation of the pumping system or construction of the FCS resulting in uncontrolled release of tunnel water before these primary interim risk reduction measures are fully in place
 - Continuously monitor heads in tunnel at AT-2 and BAH-01 and tunnel discharge at DR-3
 - Continue real-time vibration monitoring in terrain trap throughout all phases of interim measures construction
 - Conduct daily detailed inspections and documentation with digital photography and videography of visible conditions above the debris plugs and adjacent colluvial slopes in the terrain trap for any signs of developing instability (i.e., seepage, cracking, increased surficial raveling, slope deformation, etc.) and changes in the nature or point of discharge of tunnel water; inspections to be performed from safe vantages outside of terrain trap using high magnification binoculars with entry into the terrain trap only with special entry permit if determined critical
 - Utilize AT-2 as gravity or siphon relief well if / as needed
 - Discontinue drilling or pumping system installation if unanticipated changes in tunnel head, discharge flows or location, ground vibrations or instability within the terrain trap and debris plug area occur
 - Maintain Pond 15 and the Phase 1 Solids Repository empty throughout the implementation period of the interim measures; if stormwater from a large event is unavoidably routed to Pond 15, immediately pump out the detained stormwater following the event
 - Prior to initiating relief well drilling or FCS construction implement initial ancillary measures described in Section IV. B above
 - If a breach of the debris plugs occurs, immediately implement emergency response and notifications in accordance with the site Emergency Response Plan

We will continue to evaluate risk and potential mitigation throughout the remainder of design and during implementation.

Schedule

The initial ancillary measures described in Section IV. B above will be completed prior to initiating Relief Well Drilling currently scheduled for early June 2016 . The remainder of the ancillary measures will all be completed by the end of the 2016 construction season.

Figures

Figure III-1A – Routing of Debris Plug Breach Flows With No Interim Risk Reduction Measures



Figure IV-1A – Initial Ancillary Measures Plan



Figure IV-2A – Routing of Debris Plug Breach Flows With Initial Ancillary Measures Implemented



Figure IV-3A – Additional Ancillary Measures Plan

