Appendix 8

Initial Closure Plan for the Facility

Initial Closure Plan and Closure Cost Estimate for the Rock Springs Phosphogypsum Stack System

J.R. Simplot Company
Rock Springs, Wyoming

March 25, 2020

Ardaman & Associates, Inc.

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This document contains financial and other information pertaining to plant operations, production rates and life expectancy. J.R. Simplot Company considers the enclosed information to be confidential and proprietary and requests that WDEQ and EPA maintain this document in a confidential file, not subject to release to the general public.

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Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

March 25, 2020
File Number 16-13- 0070B

J.R. Simplot Company
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Boise, Idaho 83707

Attention: Mr. Alan L. Prouty
Vice President, Environmental & Regulatory Affairs

Subject: Revised Initial Closure Plan and Closure Cost Estimate for the Rock Springs Phosphogypsum Stack System, J.R. Simplot Company, Rock Springs, Wyoming.

Gentlemen:

As requested, Ardaman & Associates, Inc. has prepared an initial closure plan and closure cost estimate for the current footprint and expected configuration of the existing phosphogypsum stack system at the J.R. Simplot Company, Rock Springs facility in Rock Springs, Wyoming assuming closure at the end of calendar year 2024, i.e., 5 years in the future, prior to constructing the next lateral expansion. The gypsum stack configuration utilized for the cost estimate contained herein includes the lined footprint of the existing gypsum storage compartments, associated perimeter process water conveyance ditches and the lined process return water pond and pump station. The closure design and cost estimates contained herein meet the requirements of Attachment D (Closure of Phosphogypsum Stacks/ Phosphogypsum Stack Systems/Components) to Appendix 1 of the proposed Consent Decree between the United States, the State of Wyoming, and the J.R. Simplot Company. Closure in 2024 is considered to represent the condition when the cost for closure, water management/treatment, and long-term care for the current lined footprint of the Rock Springs phosphogypsum stack system would be the most expensive.

The closure cost estimates, water management and long-term maintenance costs provided herein are based on recent experience with similar ongoing and completed projects in the Central Florida area, using recently updated 2018 construction cost unit rates and 2018 unit rates for long-term care. The estimated unit construction costs were compared to costs incurred for ongoing construction activities at other facilities and adjusted as necessary for site-specific construction cost information, and with a regional correction factor based on conventional cost estimating standards (2018 RS Means, Heavy Construction Cost Data). The closure cost estimates included in this report have been prepared and will be used as the basis for establishing proof of financial assurance, as required by the U.S. Department of Environmental Protection (EPA) based on recent negotiations with J.R. Simplot relative to the proposed consent decree. The estimated closure, water management and long-term maintenance costs contained in this report are based on December 2018 dollars.

Contained in this report is a general overview of the existing facility with a conceptual closure plan and schedule of closure. Also included is an estimate of closure construction costs, water management costs and long-term maintenance and operating costs for the closed phosphogypsum stack system, based on the existing facility footprint and expected 2024 configuration. In preparing this closure plan and related cost estimates, we have relied on information supplied by J.R. Simplot and made assumptions relative to plant operating schedules, production rates, adjacent land and facility uses, gypsum stack growth and management, etc. All of these assumptions are listed in Section 3 of this report. The assumptions were made for cost estimating purposes and are subject to change.

Relative to closure and post-closure water management, this plan deviates from the way treatment and consumption of process water is handled at phosphoric acid plants in wet climates. Because of the dry climate in Rock Springs, J.R. Simplot will be able to evaporate ponded and drainable process water at this facility. A portion of the process water will be partially evaporated and permanently retained in the lined phosphogypsum stack. The remaining drainage water will be treated using conventional limestone-lime neutralization. The treated water and treatment residue will be evaporated/stored in lined ponds constructed on top of the phosphogypsum stack. No treated water will be discharged into adjacent surface waters.

Utilization of this treatment and disposal method will require that completion of closure construction activities for portions of the existing facility be extended beyond the closure period that would be required for an unlined phosphogypsum stack system. However, because the Rock Springs phosphogypsum stack system was constructed above a 60-mil HDPE geomembrane bottom liner, the additional closure period will not increase the potential for groundwater discharges from the facility.

This report has been prepared in accordance with generally accepted geotechnical engineering practices for the exclusive use of the J.R. Simplot Company, for specific application to the above referenced project. No other warranty, expressed or implied, is made.

It has been a pleasure assisting you with this project and we look forward to assisting you with the detailed closure plan and closure permit application in due time. If you have any questions about this report or would like to discuss the proposed closure plan or cost estimates in greater detail, please do not hesitate to contact us.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.
Certificate of Authorization No. E-0013

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BEJ/JEG/ed

cc:

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Section 1

1.1 Site Location

The phosphogypsum stack system for the J.R. Simplot Company, Rock Springs fertilizer complex is located approximately 4.5 miles southeast of Rock Springs, Wyoming (see Figure 1). The facility occupies portions of Sections 8, 9, 16 and 17 of Township 18 North, Range 104 West in Sweetwater County, Wyoming. The site location, superimposed on a reproduction of the United States Geological Survey quadrangle map of Rock Springs, Wyoming, is shown in Figure 1.

1.2 Background

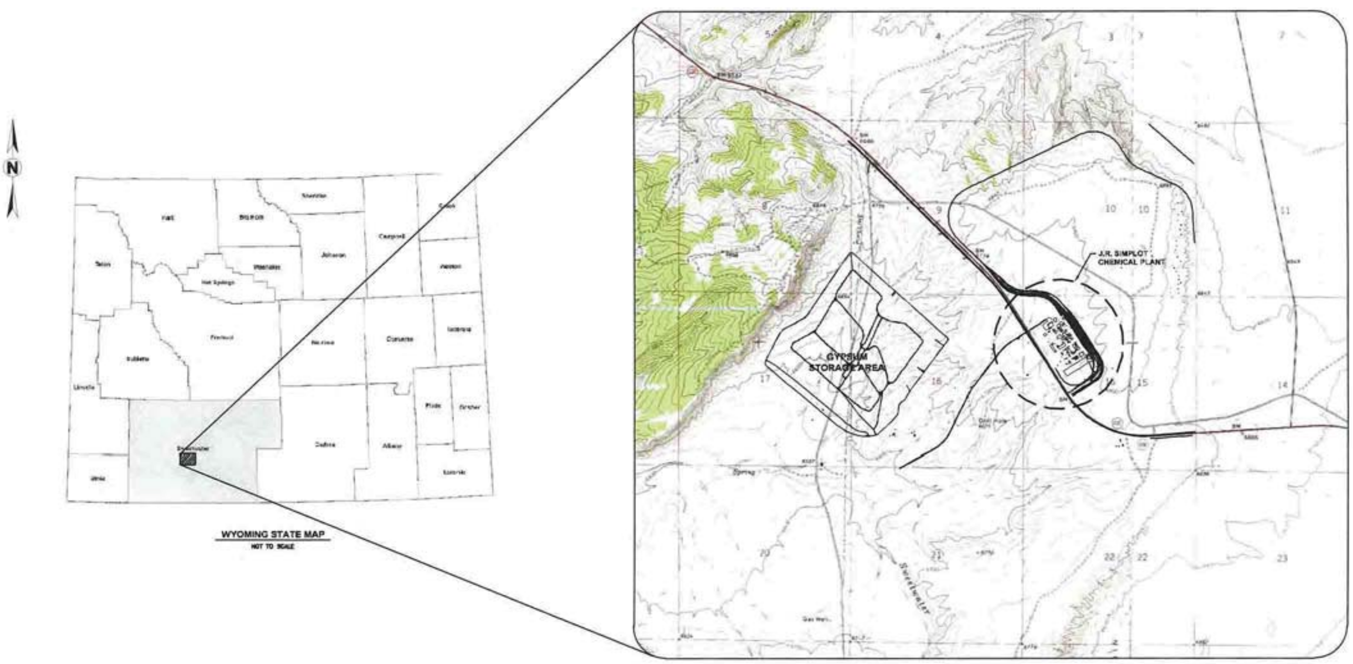
Operation of the phosphogypsum stack system at the Rock Springs Phosphate Fertilizer Complex began in 1986. The entire footprint of the phosphogypsum stack system has been provided with a 60-mil HDPE geomembrane bottom liner that was installed in phases as the size of the gypsum storage area increased with time. The total lined area at this time and at the assumed time of terminal closure covers just over 420 acres. The phosphogypsum stack is operated using wet stacking techniques wherein gypsum slurry is pumped at approximately 30 to 32 percent solids to sedimentation compartments (cells) located on top of the stack, where the solids are allowed to settle, and the clarified process water is decanted and pumped back to the phosphoric acid plant for reuse. The gypsum stack is raised by the upstream method of construction using rim ditch techniques for hydraulic distribution of the gypsum slurry around the perimeter of the various sedimentation compartments. Figure 2 shows the present configuration of the Rock Springs facility. As noted, the storage area is currently divided into seven separate cells, five of which (Cells 1 through 5) are located on the main body of the gypsum stack, while the other two (Cells 6 and 7) are within the footprint of the most recently lined expansion area, located on the east side of the original gypsum stack footprint (relative to the Plant coordinate system). Figures 3 and 4 provide topographic maps of the Rock Springs facility and phosphogypsum stack system.

The bottom elevation of the existing stack ranges from a low of about 6,580 feet (NGVD) beneath the west side of the original gypsum stacking area to a high of about 6,700 feet (NGVD) beneath the lined expansion area (Cells 6 and 7) on the east side of the site. Relative to surveyed spot elevations obtained in November 2018, the elevations of the perimeter gypsum dikes on top of the main body of the gypsum stack vary from 6,790 to 6,785 feet (NGVD), respectively, on the west side of Areas 1 and 2 and more on the order of 6,775 to 6,770 feet (NGVD) on the south and north sides of Areas 4 and 5. Elevations of the perimeter gypsum dikes in the lined expansion area are in the range of 6,715 to 6720 feet (NGVD), respectively, on the east and south sides of Area 6 and generally in the range of 6,725 to 6,720 feet (NGVD) on the east and north walls of Area 7.

The surface elevation in Cell 3 is similar to the elevation in Cell 5 but it is assumed that this area is in the process of being raised and will be joined with Cell 2 prior to the commencement of closure construction activities. Decanted process water from the stack currently flows by gravity through a perimeter ditch system to an existing lined process water surge pond and return water pump station located just south of the southwest corner of the gypsum stack. Return water is pumped from this pond back to the plant for reuse.

Based on seepage and stability analyses performed in prior years (see Ardaman report titled: "Engineering Evaluation and Recommendations for Proposed Gypsum Stack Expansion, SF

Phosphates Limited Company, Rock Springs, Wyoming", May 2001), seepage collection drains have been installed at vertical intervals around portions of the exterior walls of the gypsum stack. The primary purpose of these drains is to provide seepage control needed to improve the overall stability of the exterior slopes of the gypsum stack as the stack height increases with time. The seepage control provided by these drains has also allowed J.R. Simplot to cover and grass select portions of the gypsum stack side slopes in advance of final closure. In that regard, the closure plan presented herein assumes that approximately 43 acres of the existing side slope area have already been reclaimed and are not included in the final closure cost estimate.



WYOMING STATE MAP
NOT TO SCALE

TOWNSHIP: 18N
RANGE: 104W
OBTAINED FROM: USGS QUAD MAP:
ROCK SPRINGS, WYOMING
(PHOTO INSPECTED 1968, REVISED 1978)

SITE VICINITY MAP
SCALE: 1" = 2000'

SITE LOCATION MAP

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

J.R. SIMPLOT COMPANY
CLOSURE COST ESTIMATES
ROCK SPRINGS, WYOMING

DRAWN BY:	RDC	CHECKED BY: WAS	DATE:	04/05/19	
FILE NO: 16-13-0070B	APPROVED BY:			FIGURE:	1

N

0 400 800
SCALE:— 1"=800'

IMAGE DATE: JUNE 24, 2017
SOURCE: GOOGLE EARTH

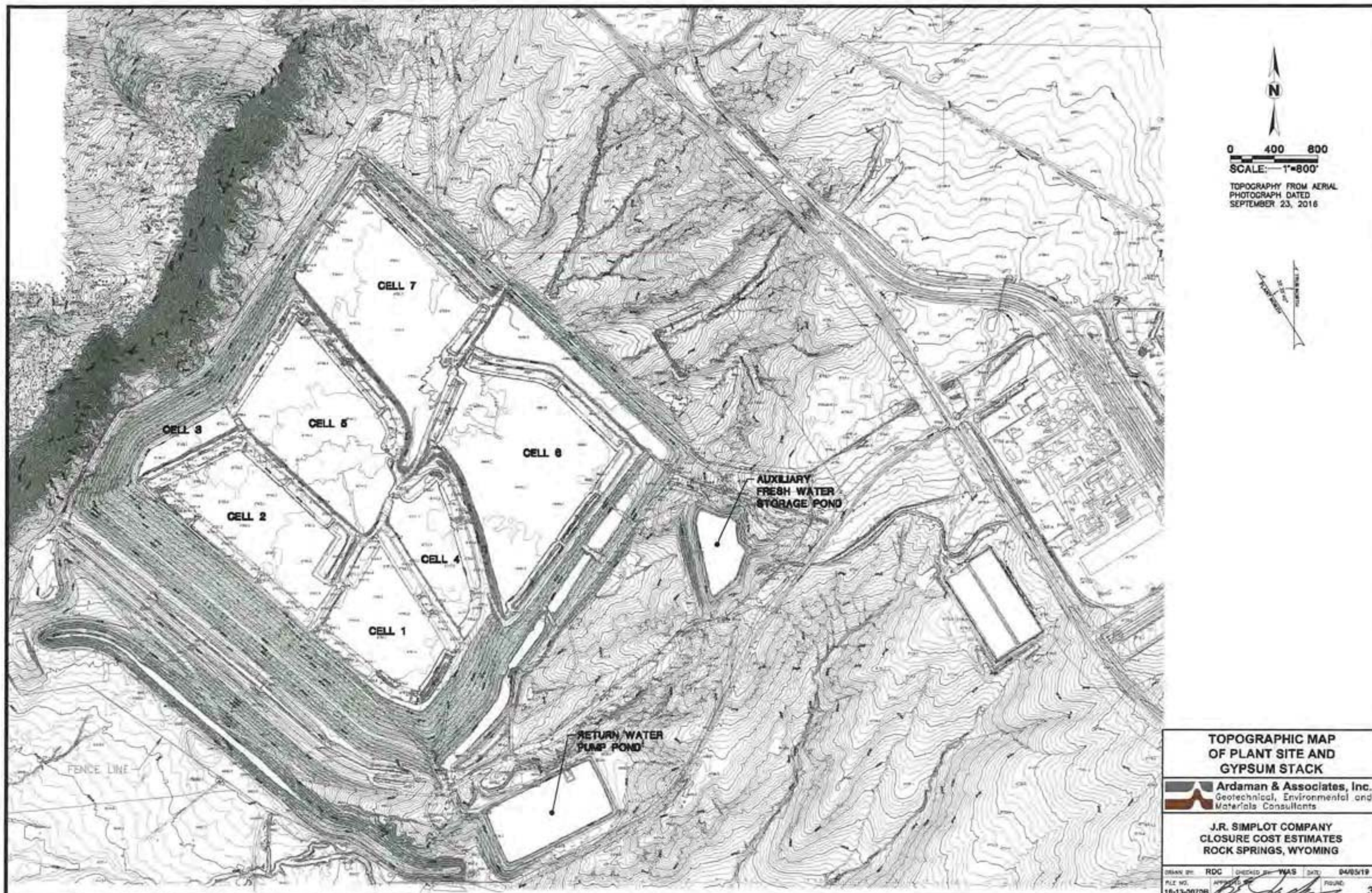
AERIAL PHOTOGRAPH OF PHOSPHOGYPSUM STACK SYSTEM

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

J.R. SIMPLOT COMPANY
CLOSURE COST ESTIMATES
ROCK SPRINGS, WYOMING

DRAWN BY: RDC	CHECKED BY: WAS	DATE: 04/05/19
FILE NO. 16-13-0070B	APPROVED BY:	FIGURE: 2

T:\Corporate\16\16-13-0070B\SIMPLOT ROCK SPRINGS - CLOSURE COST ESTIMATE__CURRENT SHEET SET\2 AERIAL PHOTOGRAPH OF PHOSPHOGYPSUM STACK SYSTEM.dwg 4/05/2019 12:08:29 PM, richard.clemons



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0 400 800
SCALE: 1"=800'
TOPOGRAPHY FROM AERIAL PHOTOGRAPH DATED SEPTEMBER 23, 2016
CELL 7
CELL 5
CELL 3
CELL 6
CELL 2
CELL 4
CELL 1
AUXILIARY FRESH WATER STORAGE POND
RETURN WATER PUMP POND
FENCE LINE
TOPOGRAPHIC MAP OF PLANT SITE AND GYPSUM STACK
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants
J.R. SIMPLOT COMPANY
CLOSURE COST ESTIMATES
ROCK SPRINGS, WYOMING
DRAWN BY: RDC
CHECKED BY: WAS
DATE: 04/05/19
FILE NO. 16-13-0070B
APPROVED BY:
FIGURE: 3

N

0 300 600
SCALE: 1"=600'

TOPOGRAPHY FROM AERIAL PHOTOGRAPH DATED SEPTEMBER 23, 2016

TOPOGRAPHIC MAP OF STACK EXISTING GEOMETRY

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

J.R. SIMPLOT COMPANY
CLOSURE COST ESTIMATES
ROCK SPRINGS, WYOMING

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FILE NO. 16-13-0070B	APPROVED BY:			FIGURE:	4

Section 2

INITIAL CLOSURE PLAN AND SCHEDULE

2.1 Closure Schedule

Although J.R. Simplot intends to continue to operate the Rock Springs facility going forward, the closure plan and cost estimates presented herein are based on an assumed terminal gypsum stack geometry that is represented by the existing stack geometry, projected upward after five years of continued stack operation at a nominal P_2O_5 annual production rate of 440,000 tons per year, with an associated byproduct gypsum production rate of just under 2,250,000 tons per year. Closure in 2024, after disposal of an additional 11 million tons of phosphogypsum and prior to construction of the next lateral expansion, is considered to represent the condition when the cost for closure, water management/treatment, and long-term care for the current lined footprint of the Rock Springs phosphogypsum stack system would be the most expensive.

The proposed water management plan for this facility relies on evaporation of a significant portion of excess process water during the initial 13-year period following deactivation, after which all drainage water seeping from the phosphogypsum stack will be treated with limestone and lime, with the treated water and associated lime sludge stored and evaporated in lined ponds that will be constructed on top of the closed phosphogypsum stack. The phosphogypsum stack system will be closed in phases as expeditiously as practicable. A discussion of the proposed closure phases and approximate schedule for implementation of each phase is provided below.

2.2 Closure Design Concepts

2.2.1 Overview

The phosphogypsum stack system will be closed in general accordance with the criteria contained in Appendix 1.C. of the proposed consent decree between the United States and J.R. Simplot (Appendix 1.C.). In general, evaporation will be used in the first phase of closure to evaporate process water, while side slopes and other parts of the stack will begin final grading and placement of a cover. The top surface area of the stack that is used for evaporation of process water and not used for lined sludge/evaporation ponds, will be flushed with treated water before closure. The proposed closure will consist of providing a final cover over the entire surface of the gypsum stack and associated process water ponds that will meet the performance standards of Appendix 1.C.. In particular, the top gradient of the gypsum stack and pond surfaces will be provided with a relatively impervious HDPE liner and protective vegetated soil cover that will be graded to promote drainage and minimize ponding of rain water or snow melt runoff on top of the lined surface. The side slopes of the stack will be provided with a final vegetated soil cover as needed to promote rainfall runoff and evapotranspiration, while reducing infiltration and controlling erosion of the side slope cover.

Considering continued gypsum stacking operations for a 5-year operation period, at a nominal P_2O_5 annual production rate of 440,000 tons per year and an associated byproduct gypsum production rate of just under 2,250,000 tons per year and an average sedimented gypsum dry density of 65 lb/ft^3, the predicted average top elevation of the sedimentation ponds on the west side of the phosphogypsum stack (Cells 1 and 2 on Figure 2) will be just over 6,790 feet, NGVD. The top elevations will drop down from west to east in 10-foot increment to an average top elevation of just over 6,770 feet in Cells 6 and 7 on the east side of the stack. The predicted geometry in 2024 is shown in Figure 5.

Closure design concepts for the existing phosphogypsum stack system are illustrated on Figures 6 through 10, with their associated details presented in Figures 11 through 24. The assumed dimensions of the phosphogypsum stack system at the time of closure (i.e., prior to regrading), and used as the basis of the closure cost estimate presented herein, is tabulated below:

Closure Component	Estimated Area at Time of Closure (acres)
Total Lined Footprint*	420
Gypsum Stack Footprint	320
Final Top Area	205
Gypsum Side Slope Area	145
Return Water Surge Pond	15
*Includes 15 Acre Return Water Surge Pond	

2.2.2 Long-Term Care Plan

The long-term care plan includes the following elements:

- Surface water management: surface water runoff from the top of the closed phosphogypsum stack will be directed inboard by perimeter dikes to low points for controlled release through decant spillways and piping systems to the base of the stack. Section 2.4.3 describes the details of the management of surface water. Figure 10 presents the anticipated final geometry and conceptual surface water management plan of the gypsum stack after closure. Conceptual details of the proposed slope and toe ditch swales are illustrated on Figures 11 through 21. Costs associated with surface water management are shown in Table 3.1. This includes the costs for grading, and cover for the gypsum stack surfaces including swales.

- Seepage/leachate control: after final closure of the gypsum stack top ponds, seepage rates will diminish with time (see Figure 25). The reduced seepage flow will be collected in the existing surge pond and return water pump station and will be periodically treated/neutralized with limestone and lime. The treated water and lime sludge solids will be evaporated and stored in designated lined storage ponds on top of the closed gypsum stack. The seepage rate treated/neutralized after Year 12 is plotted as a function of time after closure in Figure 26. Costs associated with treatment of the leachate are described in section 3.3 and costs are shown in Table 3.3.

- Other activities associated with long-term care include groundwater monitoring, wildlife control, security, and land surface care. The facility already has a fence around the perimeter of the gypsum stack to act as a deterrent for both human and wildlife access. Also, the facility already uses propane cannons as a way of discouraging birds from using the return pond. Costs associated with these activities are found in Table 3.4.

2.2.3 Management of Treatment Solids

Lined ponds will be built on top of the gypsum stack and will be used for treated water evaporation and lime sludge storage. These ponds will eventually be closed by dewatering, drying and stabilization of the sedimented solids to the degree necessary to facilitate placement of a 1-foot thick, vegetated soil cover. Further discussion on the management of treatment solids is found on pages 2-8, 2-10, 2-13 and Table 3.1 (cost information).

2.3 **Process Water Management During Closure**

The closure schedule for the Rock Springs phosphogypsum stack system will be dictated to a certain extent by the need to store and manage/treat existing process water inventories during the closure period. Primary factors include the process water inventory at the time of plant shutdown, available storage capacity within the process water containment system, post-shutdown water balance, process water seepage rates from the closed phosphogypsum stack and the ability to transfer and manage/treat water volumes throughout the closure period.

Unlike the humid subtropical climate in the southeastern U.S., where annual rainfall normally exceeds lake evaporation, the climate in the Rock Springs area is cold, semiarid, with evaporation rates far exceeding precipitation. The average rainfall near the Rock Spring plant is on the order of 8.4 inches per year, with lake or pond evaporation rates of 46.2 inches per year, equating to a net ponded area evaporation loss of about 37.8 inches per year. Given the high evaporation rates for this area, the proposed water management plan for the Rock Springs facility differs from those used in the humid subtropical climate of the Southeast U.S. During the first 13 years after the phosphoric acid plant ceases operations and the slopes of the phosphogypsum stack are being closed, any remaining ponded water as well as consolidation and drainage water seeping from the stack will be allowed to partially evaporate using pond or spray irrigation on top of the phosphogypsum stack and seep back into the stack, where it will be retained by surface water tension and adsorption in the phosphogypsum above the phreatic surface (water table) in the stack.

Construction of a treatment plant will begin on or before year 12. Drainage water seeping from the phosphogypsum stack will be neutralized with limestone and lime and then evaporated in lined sludge/evaporation ponds constructed on top of the closed phosphogypsum stack. This treatment (neutralization) will begin in year 13 of the closure along with continued partial evaporation of the drainage water. All gypsum stack drainage water (process water/leachate) will be treated in year 14. The sludge/evaporation ponds will ultimately be closed by dewatering, drying and stabilization of the sedimented solids, and placement of a 1-foot thick, vegetated soil cover.

The areas on top of the phosphogypsum stacks that are used for spray irrigation and evaporation and not used for lined sludge/evaporation ponds will be lined with 40-mil HDPE, covered with 2 feet of soil and planted in native vegetation. Prior to lining these areas, the upper one to two feet of phosphogypsum will be flushed with treated water. The depth of treated water applied will not be less than 4 inches over the entire surface to be covered.

2.3.1 Existing Process Water Inventories

The Rock Springs gypsum storage area has historically been operated with only limited process water inventories (see Figure 2). Clarified return water from the sedimentation ponds on top of the gypsum stack is decanted through various water level control structures into perimeter process water flow channels provided on the east and south sides of the gypsum stack, which, in turn, route the decanted process water back to a lined return water surge pond and pump station, located on the south side of Area 1 within the original gypsum stack footprint. Utilizing the October 2009 aerial photograph and topographic map, in conjunction with the other historical maps and information provided by J.R. Simplot personnel, the total volume of free process water contained within the existing lined facility (assuming proper pre-shutdown water management), including water contained on top of the phosphogypsum stack, in the lined perimeter flow channels and the return water pump pond will be on the order 100 acre-feet. This estimated volume is for ponded water only and does not include consolidation and drainage water that will seep out of the phosphogypsum stack over time. An estimate of the drainable pore volume within the gypsum stack is provided below.

2.3.2 Drainage Characteristics of Existing Gypsum Stack

The sedimented gypsum contained in the Rock Springs gypsum stack is for the most part fully saturated with process water entrained within the pores of the individual gypsum crystals or particles. After the plant and gypsum stack are shut down (i.e., no gypsum slurry or process water pumped to the top of the stack), the entrained water in the pore spaces of the sedimented gypsum will drain from the stack by gravity over a period of time. Since the gypsum storage area is provided with a 60-mil HDPE bottom liner, any water that drains from the stack with time will be collected in the existing or proposed seepage collection drains and/or in the existing perimeter flow channels at the toe of the stack. As the closed stack drains with time, the rate of seepage entering the seepage collection drains or perimeter flow channel will likewise diminish. The rate at which pore water drains from the stack is a key factor needed for development of a detailed water management plan at the time of final closure.

Gypsum stack consolidation and drainage rates used for the closure plan and schedule presented herein were estimated using a phosphogypsum stack seepage model developed on an Excel spreadsheet. The seepage model takes into consideration the varying height, geometry, initial and final density, hydraulic conductivity, and drainable porosity of the sedimented gypsum. Material properties used to develop the relationships needed for the drainage model were obtained from a previous engineering evaluation of the Rock Springs gypsum stack (see Ardaman report titled: “Engineering Evaluation and Recommendations for Proposed Gypsum Stack Expansion, SF Phosphates Limited Company, Rock Springs, Wyoming”, May 2001). The Excel spreadsheet was developed by Ardaman & Associates and reviewed by EPA and its consulting expert.

[redacted]

[redacted]

2.3.3 Process Water Evaporation

Considering an initial ponded area [redacted] for ponds on top of the gypsum stack and a net evaporation rate of 37.8 inches per year, it is theoretically possible to evaporate [redacted] provided that the ponds are kept fully ponded or fully surface wetted. Using water management techniques (recycling water collected in perimeter flow channels and the seepage collection drains back to the top of the stack to keep the uppermost compartments ponded and/or surface wet), all of the water that seeps from the stack and any remaining ponded water can be evaporated from the top gradient of the phosphogypsum stack. During the first 13 years after closure, the process water will be partially evaporated and allowed to seep back into the top of the stack where it will be retained by surface water tension in the phosphogypsum above the phreatic surface. After 13 years, water seeping from the stack will be neutralized using limestone to a pH of approximately 4 and then lime to a pH of approximately 7. The treated water and sludge will be pumped back to lined ponds constructed on top of the stack where the treated water will be evaporated.

The conceptual water management plan during closure is to maximize evaporation rates from the gypsum stack top ponds by initially recycling collected seepage and free water back to the top of the stack in such a manner as to keep the surface area fully ponded or surface wet. Irrigation piping will be used as needed to distribute the water over the top gradient of the stack when the volume of water collected from stack seepage is no longer enough to pond the entire top surface. During years 12 and 13, three of the existing top ponds will be lined to provide sufficient area (75 acres) to evaporate treated water and store lime residue from the treatment process. After year 13, process water evaporation from the remaining ponds will cease and the remaining top ponds will be graded as needed for proper drainage, lined with the rule-specified 40-mil liner, and capped with a 2-foot thick protective soil cover. The final geometry of the top gradient is shown on Figure 10.

The water balance and drainage model used to develop this closure plan indicates that the irrigation area required to evaporate all the stack seepage will reduce over time from 155 acres during the first 5 years to approximately 60 acres by the end of year 12. To distribute the partially evaporated water as evenly as possible over the top surface of the stack, the irrigation area will be maintained on the full 155 acres until year 11 by reducing the time the irrigation system is operated each day. Seepage rates should be reduced sufficiently by year 13 to allow all collected water to be adequately managed in the return water pond, without pumping any untreated water back to the top of the gypsum stack. The return water pump pond will need to remain in place for another 50 years or until all of the seepage water can be contained prior to treatment in a surge tank.

2.3.4 Environmental Considerations

The closure plan for the gypsum stack incorporates several features for additional protection of the environment.

<u>Fluoride Emissions</u>

During the closure process, one objective is that the phosphogypsum water will be managed so that fluoride atmospheric emissions will be no more than the emissions during plant operation. In general, fluoride emissions from a closed gypsum stack are expected to be lower than those in an operating stack for two reasons: the vapor pressure of fluoride gases will be reduced because the process water will be at a much lower temperature (and thus less likely to result in fugitive air emissions) and fluoride will be removed from the process water due to adsorption onto compounds in the gypsum stack or from the formation of solid calcium fluoride compounds in the gypsum stack.

Estimating fluoride emissions from phosphogypsum stacks has a number of technical challenges. Thus, measurement methodologies have limitations. Potential methods include spectroscopy techniques or a mass balance approach.

A mass balance model was reviewed by Simplot, EPA, and EPA's consulting expert. The recommended method of demonstration uses a monthly measurement (weather permitting) of the fluoride concentrations in the applied water and the water that accumulates during a 24-hour period in a shallow pan placed within the irrigation area. The measured concentrations can be used to compute [see Equation-1] the ratio of the mass of fluoride emitted during spray irrigation/evaporation to the mass of fluoride emitted from both solar and heat load evaporation during normal plant operations.

$$\text{[Eqn-1] Mass Ratio} = F_e A_e T_e / F_o A_o / 24,$$

where F_e is the dissolved fluoride concentration (mg/L) in the liquid accumulated in the pan