

**Proposed Clarifier Remedy Decision
Solvay USA Inc., Silver Bow Plant, Butte, Montana
Pursuant to Administrative Order
EPA ID No. MTD 057 558 546**

Introduction

The U.S. Environmental Protection Agency (EPA) is issuing this document to explain the basis for our decision to propose the remedy described herein for certain wastes presently being stored at the closed Solvay USA Inc. (formerly known as Rhodia Inc. (Solvay)) elemental phosphorus processing plant in Silver Bow, Montana (Facility). Solvay has proposed this remedy as part of its obligation to address certain wastes at the Facility identified in an administrative order issued by the EPA, pursuant to section 7003 of the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. § 6973, as amended in December 2000 (7003 Order). The EPA is proposing this remedy after consultation with the Montana Department of Environmental Quality (DEQ).

This decision document is issued as part of our public participation responsibilities under RCRA. A forty-five (45) calendar day public comment period will extend from September 13, 2016, through close of business on October 27, 2016. All persons wishing to comment on the proposed remedy must do so during this time. Also, be advised that a public comment period on the EPA's proposed designation of a Corrective Action Management Unit (CAMU) will run concurrently with the public comment period for the Clarifier Remedy decision. The EPA will hold a public meeting on September 27, 2016, to discuss the remedy decisions and provide an opportunity for public comment. The meeting will be held at 6pm in the cafeteria at the Ramsay Public School, 3 Russell Street, Ramsay, Montana. The EPA will consider all information submitted during the public comment period and, as a result, may modify this decision.

The 7003 Order required Rhodia Inc., and subsequently its corporate successor Solvay, to evaluate alternatives for closure of an existing waste management unit known as the clarifier. The clarifier is a 100-foot diameter open-topped concrete tank-like structure that holds approximately 500,000 gallons of phosphorus-bearing sludge. According to available information, the clarifier primarily contains sludge generated during production of elemental phosphorus. The materials in the clarifier are referred to as "clarifier sludge."

Solvay evaluated closure alternatives for permanent disposition of the clarifier sludge. The alternatives presented in the Supplemental Waste Plan dated October 2015 (Waste Plan) are:

- (1) Enhanced RCRA Cap;
- (2) On-site Phosphorus Recovery using the Mud Still Process; and

(3) Off-site Incineration.

Solvay has proposed on-site phosphorus recovery using the Mud Still Process as the preferred remedy for the clarifier sludge. The EPA concludes that this on-site phosphorus recovery (hereafter called the Clarifier Remedy) should be proposed. This decision document describes the Clarifier Remedy, and summarizes the other remedy alternatives evaluated by Solvay, the EPA and the DEQ.

Public Record Availability

Information in this decision document has been summarized from several reports and supporting documents. The complete public record, including these documents, is available for review at the Montana Tech University Library, Butte, Montana, during normal business hours. Referenced reports and supporting documents are also available electronically at <https://www.epa.gov/mt>.

Opportunities for Public Involvement

The EPA is seeking public comment on the proposed Clarifier Remedy for the clarifier sludge. We invite the public to submit written and/or oral comments on the Clarifier Remedy. We also encourage the public to review documents related to this proposed decision to gain a more comprehensive understanding of the proposed remedy. The EPA will review all comments before issuing a final remedy decision. The EPA may modify the proposed remedy based on new information and/or comments received from the public.

The comment period begins September 13, 2016, and ends October 27, 2016. The EPA will hold a public meeting on the proposed decisions on September 27, 2016 to discuss the remedy decisions and provide an opportunity for public comment. The meeting will be held at 6pm in the cafeteria at the Ramsay Public School, Ramsay, Montana. Public comments may also be submitted to the EPA in writing, by the methods indicated below. Comments must be received by close of business October 27, 2016 and may be submitted either:

- By email to cosentini.christina@epa.gov,
- or, by mail to: Christina Cosentini
U.S. Environmental Protection Agency
1595 Wynkoop Street, 8P-R
Denver, CO 80202

Solvay Silver Bow Plant Background

The Facility was constructed in the early 1950s to produce elemental phosphorus. The crude phosphorus stored in the clarifier was a by-product of elemental phosphorus production. During the operating life of the Facility, much of the crude phosphorus by-product collected in the clarifier was further processed on-site to recover any remaining elemental phosphorus. In 1997, processing was terminated at the Facility and the crude phosphorus sludge remaining in the clarifier, and other locations around the Facility, could no longer be processed on-site.

Due to the ignitability of elemental phosphorus, the 7003 Order required Rhodia Inc., and now its corporate successor Solvay, to undertake certain immediate and interim actions to address a number of wastes at the Facility that contained elemental phosphorus. With the exception of addressing the clarifier sludge, all actions for phosphorus-containing wastes have been completed. Details of the completed actions can be found in the Waste Plan.

The 7003 Order required installation of fencing and signs around the clarifier and other measures, including:

- installing an automatic water system that ensures a layer of water covers the surface of the clarifier sludge within the clarifier at all times;
- eliminating wildlife contact with the clarifier sludge by placing approximately 80,000 Bird Balls™ on the water to camouflage its surface; and
- installation of a continuous phosphine gas monitoring system around the clarifier.

Additionally, the 7003 Order required Solvay to evaluate alternatives for treatment and disposal of the clarifier contents. In fulfillment of the 7003 Order, the Supplemental Waste Plan (Barr, 2015) presented three alternatives for permanent disposition of the clarifier sludge. The three alternatives evaluated were 1) Enhanced RCRA Cap; (2) On-site Phosphorus Recovery through the Mud Still process; and (3) Off-site Incineration.

In April 2004, the EPA and Solvay entered into a corrective action order on consent issued pursuant to Section 3008(h) of RCRA (42 U.S.C. § 6928(h) (3008(h) Order). The 3008(h) Order requires Solvay to undertake comprehensive Facility-wide remedial investigations and complete appropriate clean-up actions. Solvay completed a RCRA Facility Investigation Report (RFI Report) (Barr, May 2013) that was approved by the EPA, after consultation with DEQ, on June 7, 2013. Solvay also conducted investigations prior to the RFI Report, which are summarized in a Current Conditions/Release Assessment Report (CCRA) (Barr 2006). Solvay has submitted a Human Health Risk Assessment and an Ecological Risk

Assessment currently under review by the EPA. Groundwater is currently being monitored site-wide for the presence of hazardous constituents, on a semi-annual basis.

Proposed Clarifier Remedy

The clarifier is a 100-foot diameter, open topped, in-ground tank-like structure with reinforced concrete walls. The clarifier is approximately 12-feet deep and contains approximately 500,000 gallons of clarifier sludge. The clarifier sludge consists of elemental phosphorus, water and solids, such as phosphate dust, coke dust, and silica dust. Several feet of water cover the surface of the clarifier sludge to prevent the elemental phosphorus from igniting when exposed to air.

The proposed treatment for the clarifier sludge is on-site recovery of elemental phosphorus (P₄) using a Mud Still Process. The proposed Mud Still will be constructed adjacent to the clarifier and will separate P₄ from the clarifier sludge, which then can be used as a product for industrial purposes. The phosphorus product will be transported to a Solvay production facility for use as a raw material. Solvay conducted three pilot scale studies to demonstrate that P₄ of usable quality could be recovered from the clarifier sludge using the Mud Still Process.

The Mud Still Process

Sludge from the clarifier will be removed using an excavator and then transferred from the excavator bucket into a metal skip equipped with a spill pan for secondary containment. The skip will be secured with a lid and taken to a staging area at the mud still.

The skip will be placed in the electric furnace compartment of the mud still, the lid removed, and the furnace compartment closed. The furnace will heat molten lead, which will act as the heat transfer medium and provide a seal for the skip. As the temperature of the furnace compartment rises, water within the skip will vaporize (at approximately 202 °F), followed by vaporization of white phosphorus (at approximately 503 °F), and conversion of some white phosphorus to red phosphorus. As the temperature continues to rise, the red phosphorus will be vaporized at approximately 730 °F. The furnace will be continuously purged with nitrogen to maintain the necessary reducing atmosphere, and to drive the water and phosphorus vapors through the mud still apparatus.

The water and phosphorus vapors will flow into a stainless steel condenser where the vapors will be condensed to liquid water and liquid phosphorus. The liquid phosphorus will be removed from the condenser at the end of each batch and transferred to a collection tank. When sufficient volume of product phosphorus is accumulated, the contents of the

collection tank will be transferred to an International Standards Organization (ISO) specification container. The container will meet U.S. Department of Transportation (DOT) requirements for transporting elemental phosphorus. The containers will be hauled to a Solvay elemental phosphorus production facility.

The Mud Still Process will also produce solid residues containing phosphate ore, coke, silica and other inert materials. After completion of each batch, the mud still residues will be removed from the skip and transferred to containers for storage. Due to potentially leachable metals, this residue may be considered hazardous, or qualify as a hazardous waste. As part of our decision, the EPA will require characterization of the mud still residue during full-scale operation of the mud still to evaluate the potential need for treatment of the residue prior to final disposal.

Concurrently with this proposed Clarifier Remedy decision, the EPA is proposing to authorize the management of mud still residues on-site in a CAMU. After consultation with DEQ, the EPA is proposing to designate the clarifier as a CAMU for disposal of the mud still residues, as well as clarifier sludge that cannot be safely removed from the clarifier at the completion of the Mud Still Process. The EPA is notifying the public of our proposed CAMU designation under a separate notice. Design, closure standards, and post-closure care requirements for the CAMU are explained in that notice.

Other Clarifier Sludge Remedies Evaluated

As stated above, Solvay evaluated three remedies for the clarifier sludge. In addition to the Mud Still Process, capping the clarifier with clarifier sludge left in place and removal and transport of the clarifier sludge for off-site incineration were evaluated. While leaving the sludge in place and capping the clarifier arguably minimizes the likelihood of human exposure and reduces the likelihood of migration of the sludge contaminants, it is not considered an acceptable remedy alternative. Capping with waste left in place does nothing to reduce or minimize the volume of contaminants in, or the hazards posed by the clarifier sludge. Due to limited incineration capacity for phosphorous bearing waste, off-site incineration of the volume of sludge in the Clarifier would require over 20 years to complete and consequently is not considered an effective remedy alternative. Detailed analyses of the three remedy alternatives are available in the Waste Plan.

Supporting Documents to this Proposed Decision

Barr, 2006. Current Conditions/Release Assessment Report, Rhodia Silver Bow Plant, February 9, 2006.

Barr, 2013. RCRA Facility Investigation Report, Rhodia Silver Bow Plant, May 1, 2013.

Barr, 2015. Supplemental Waste Plan, Clarifier Materials, Silver Bow Plant, October 13, 2015.

EPA, 2016. Proposed Designation of a Corrective Action Management Unit, September 2016.

Franklin, 2007. Clarifier Waste Treatability Study; Phase 1 Report, August 2007.

Franklin, 2011. Clarifier Waste Treatability Study; Phase 2 Report, February 2011.

Franklin, 2012. Clarifier Waste treatability Study; Phase 3 Report, February 2012.

Public Participation

The EPA encourages the public to review the documents that are particularly relevant to this decision and submit written comments on the proposed Clarifier Remedy. The EPA will review all comments before issuing a final remedy decision. The EPA may modify the proposed remedy based on new information and/or comments from the public.

The public comment period begins on September 13, 2016, and ends on October 27, 2016. All persons wishing to comment on our proposal to designate this CAMU must do so during this time. The EPA will hold a public meeting on the proposed decisions on September 27, 2016 to discuss the remedy decisions and provide an opportunity for public comment. The meeting will be held at 6pm in the cafeteria at the Ramsay Public School, Ramsay, Montana. Public comments must be submitted to the EPA in writing, by the methods indicated below.

Comments must be received by close of business October 27, 2016, and may be submitted either:

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