PYROBITUMENS, MINERAL WAXES, AND NATURAL ASPHALTS

A. Commodity Summary

Bituminous materials comprise a group of hydrocarbons including pyrobitumens, mineral waxes, and asphalts. Pyrobitumens are mined predominately in Utah and are used in rubber, paints, varnishes, and insulating and waterproofing compounds.

Mineral waxes are not present in the United States as a natural substance, and therefore, must be extracted from lignite or cannel coal. Although coal exists in many parts of the United States, the only known production of mineral waxes from coal occurs in California. The use of this extraction product, known as "Montan Wax," is limited to paints, wood fillers, floor polish, rubber mixtures, and candles.

In the United States, naturally occurring asphalt (gilsonite) is found in commercial quantities only in eastern Utah and western Colorado. There are three types of naturally occurring asphalt: native asphalt (bitumen), lake asphalt, and rock asphalt.[1] Asphalts have a variety of uses including paving, flooring, roofing, and waterproofing. American Gilsonite in Bonanza, Utah is the world's largest producer and exporter of gilsonite (natural asphalt). The only other producer of natural asphalt is Ziegler Chemical and Mineral Corporation, also in Utah.

B. Generalized Process Description

1. Discussion of Typical Production Processes

The production processes associated with the production of pyrobitumens, mineral waxes, and natural asphalts are limited to a few simple operations, including extraction, grinding, blending, and packaging. Exhibits 1 through 3 present simplified process flow diagrams for the production of pyrobitumens, mineral waxes, and natural asphalts. The production processes and wastes associated with each mineral commodity are discussed below.

2. Generalized Process Flow Diagram

Pyrobitumens

As shown in Exhibit 1, the production process for pyrobitumens consists of cracking in a still, recondensing, and grading. Due to the low cost and availability of petroleum refining substitutes, the production of pyrobitumens appears to be low.

Mineral Waxes

As shown in Exhibit 2, mineral wax processing consists of solvent extraction from lignite or cannel coal. Cannel coals yield a material that contains 60 to 90 percent light yellow or brown waxy substances. The crude wax is refined by extracting, typically with a mixture of benzene and methanols. Distilling the solvent leaves a wax too darkly colored to be used without added refining. Acid mixtures are used to oxidize and remove the dark materials, leaving a series of bleached waxes.[2] The extraction product is

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[1] "Asphalt," Kirk-Othmer Encyclopedia of Chemical Technology, 4th ed., Vol. III, 1992, pp. 689-724.

[2] "Lignite," Kirk-Othmer Encyclopedia of Chemical Technology, 4th ed., Vol. XV, 1995, p. 316.

EXHIBIT 1

PYROBITUMEN PRODUCTION

Graphic Not Available.

Source: 1988 Final Draft Summary Report of Mineral Industry Processing Wastes. 1988.

EXHIBIT 2

MINERAL WAX PRODUCTION

Graphic Not Available.

Source: 1988 Final Draft Summary Report of Mineral Industry Processing Wastes, 1988.

EXHIBIT 3

NATURAL ASPHALT PRODUCTION

Graphic Not Available.

Source: 1988 Final Draft Summary Report of Mineral Industry Processing Wastes, 1988.

known as "Montan Wax." Extraction solvents used in the production of mineral waxes may be listed in 40 CFR 261 Subpart D.[3]

Natural Asphalts

American Gilsonite operates a 110 ktpy facility in Bonanza, Utah. Mine development begins with the boring of shafts. The shafts are equipped with steel inserts that are comprised of four pipes equally spaced around the perimeter of the shaft. Once a shaft is bored, inserts are lowered into the borehole. As each section is lowered into the shaft the next section is lined up with it, and the two are welded together at the surface. This procedure is repeated until the inserts line the shaft from top to bottom. When a mine is worked out the liner assembly is pulled and reused. Hand-held pneumatic chipping hammers with moilpoint bits are used to break out the ore. Broken ore flows by gravity to the toe of the sloping face at the floor of the drift. From there it is airlifted to the surface through a pipe. When air lifted ore reaches the surface it enters a baghouse. The larger pieces drop first, and the rest is collected in filter bags. All solids are discharged into elevated storage bins and are then transferred by truck to a processing plant.

American Gilsonite's plant consists of concrete storage silos, truck receiving bins, a vibrating bed dryer, pulverizing machinery, and packaging equipment. Pneumatic conveying systems and sophisticated dust control equipment are state-of-the-art and allow for the handling of gilsonite in large quantities. Before entering the processing plant, gilsonite ore is segregated by grade in receiving bins. From these bins the ore is processed through a vibrating bed dryer, where excess moisture is removed. It is then passed over a double-deck screen, where it is classified according to particle size for storage in silos. From the silos, ore is fed to product bins from which it is either loaded directly as bulk product, fed to a bagging machine, or fed to a pulverizer. Pulverized product is segregated into product bins from which it can be loaded directly as bulk product or packaged at a second bagging machine.[4]

3. Identification/Discussion of Novel (or otherwise distinct) Process(es)

None identified.

4. Beneficiation/Processing Boundaries

EPA established the criteria for determining which wastes arising from the various mineral production sectors come from mineral processing operations and which are from beneficiation activities in the September 1989 final rule (see 54 Fed. Reg. 36592, 36616 codified at 261.4(b)(7)). In essence, beneficiation operations typically serve to separate and concentrate the mineral values from waste material, remove impurities, or prepare the ore for further refinement. Beneficiation activities generally do not change the mineral values themselves other than by reducing (e.g., crushing or grinding), or enlarging (e.g., pelletizing or briquetting) particle size to facilitate processing. A chemical change in the mineral value does not typically occur in beneficiation.

Mineral processing operations, in contrast, generally follow beneficiation and serve to change the concentrated mineral value into a more useful chemical form. This is often done by using heat (e.g., smelting) or chemical reactions (e.g., acid digestion, chlorination) to change the chemical composition of the mineral. In contrast to beneficiation operations, processing activities often destroy the physical and chemical structure of the incoming ore or mineral feedstock such that the materials leaving the operation do not closely resemble those that entered the operation. Typically, beneficiation wastes are earthen in character, whereas mineral processing wastes are derived from melting or chemical changes.

EPA approached the problem of determining which operations are beneficiation and which (if any) are processing in a step-wise fashion, beginning with relatively straightforward questions and proceeding into more detailed examination of unit operations, as necessary. To locate the beneficiation/processing "line" at a given facility within this mineral commodity sector, EPA reviewed the detailed process flow diagram(s), as well as information on ore type(s), the functional importance of each step in the production sequence, and waste generation points and quantities presented above in Section B.

Pyrobitumens

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[3] U.S. Environmental Protection Agency, Technical Background Document, Development of the Cost, Economic, and Small Business Impacts Arising from the Reinterpretation of the Bevill Exclusion for Mineral Processing Wastes, Office of Solid Waste, 1989, pp. A-9.

[4] Harry D. Lewis, "Gilsonite," from Industrial Minerals and Rocks, Society of Mining, Metallurgy, and Exploration, 1994, pp. 535-541.

EPA determined that for pyrobitumens, the beneficiation/processing line occurs when the pyrobitumens are thermally cracked in a still to produce a significantly altered material. Therefore, because EPA has determined that all operations following the initial "processing" step in the production sequence are also considered processing operations, irrespective of whether they involve only techniques otherwise defined as beneficiation, all solid wastes arising from any such operation(s) after the initial mineral processing operation are considered mineral processing wastes, rather than beneficiation wastes. EPA presents below the mineral processing waste streams generated after the beneficiation/processing line, along with associated information on waste generation rates, characteristics, and management practices for each of these waste streams.

Mineral Waxes and Natural Asphalts

Based on a review of the processes, there are no mineral processing operations involved in the production of mineral waxes or natural asphalts.

C. Process Waste Streams

1. Extraction/Beneficiation Wastes

Pyrobitumens

None identified.

Mineral Waxes

Probable wastes from the production of mineral waxes include **spent solvents** and **spent coal**.

Natural Asphalt

None identified.

2. Mineral Processing Wastes

Pyrobitumens

Still bottoms. Although no published information regarding waste generation rate or characteristics was found, we used the methodology outlined in Appendix A of this report to estimate a low, medium, and high annual waste generation rate of 2 metric tons/yr, 45,000 metric tons/yr, and 90,000 metric tons/yr, respectively. We used best engineering judgement to determine that this waste may exhibit the characteristic ignitability.

Waste catalyst. Although no published information regarding waste generation rate or characteristics was found, we used the methodology outlined in Appendix A of this report to estimate a low, medium, and high annual waste generation rate of 2 metric tons/yr, 10,000 metric tons/yr, and 20,000 metric tons/yr, respectively. We used best engineering judgement to determine that this waste may exhibit the characteristic of toxicity for cadmium and selenium. This waste may be recycled and is classified as a spent material.

Mineral Waxes

None identified.

Natural Asphalt

None identified.

D. Ancillary Hazardous Wastes

Ancillary hazardous wastes may be generated at on-site laboratories, and may include used chemicals and liquid samples. Other hazardous wastes may include spent solvents (e.g., petroleum naptha), acidic tank cleaning wastes, and polychlorinated biphenyls from electrical transformers and capacitors. Non-hazardous wastes may include tires from trucks and large machinery, sanitary sewage, waste oil (which may or may not be hazardous), and other lubricants.

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U.S. Environmental Protection Agency. "Bituminous Materials." From 1988 Final Draft Summary Report of Mineral Industry Processing Wastes. 1988. pp. 2-70 - 2-76.

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