

US EPA ARCHIVE DOCUMENT

**Materials Characterization Paper**  
*In Support of the*  
**Proposed Rulemaking:**  
**Identification of Nonhazardous Secondary Materials That Are Solid Waste**  
**Purification Process Byproducts**

*March 18, 2010*

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**1. *Definition of Purification Process Byproducts***

Purification process byproducts are residual materials generated from production processes to isolate specific chemicals or compounds. These secondary materials are made up largely of organic compounds that have a high molecular weight but are only somewhat volatile. Due to these characteristics, purification process byproducts are combustible but generally not flammable (Raiders et al. 2009). Purification process byproducts may be generated from several different processes, including distillation, extraction, and evaporation (EIA 2000). This analysis addresses only purification process byproducts that: 1) have potential fuel value or can be re-used, and 2) are not considered hazardous under RCRA.

**2. *Annual Quantities of Purification Process Byproducts Generated and Used***

**(1) Sectors that generate purification process byproducts:**

- Purification process byproducts are generated from a variety of purification processes used by a number of industries. Such processes are employed in the production of processed food, beverages, petroleum products, chemicals, and several other products. Industries that generate these materials include the following, listed by NAICS code:
  - 311: Food Manufacturing
  - 312: Food and Beverage Manufacturing
  - 324: Petroleum Products Manufacturing
  - 325: Chemical Manufacturing (Census Bureau 2009).

This list of industries is not necessarily exhaustive, given that purification process byproducts are generated by a wide range of processes used in the production of a variety of goods.

**(2) Quantities and prices of purification process byproducts generated:**

- Due to the wide variety of purification process byproducts generated, it is difficult to characterize the quantity or prices of purification process byproducts generated in the U.S. Overall, U.S. industrial facilities generate approximately 7.6 billion tons of non-hazardous industrial solid waste each year, which suggests that these facilities generate less than 7.6 billion tons of purification process byproducts on an annual basis (EPA 2008).

- As indicated above, the petroleum products sector is among the many industries that generate purification process byproducts. While comprehensive information on the generation and management of the industry's purification process byproducts has not been identified, EPA conducted a survey in 1996 to evaluate the management of 15 petroleum refining residuals that the Agency was considering to list as hazardous wastes at the time. Exhibit 1 summarizes findings from the Agency's survey.

**Exhibit 1: Management of Select Petroleum Refinery Residues**

<i>Management Practice</i>	<i>Percentage</i>
<b>Total Disposed</b>	<b>29.69%</b>
Off-site Landfill	24.92%
On-site Landfill	3.88%
Other Disposal Onsite/Roadbed mixing	0.14%
Other	0.74%
<b>Total Discharged</b>	<b>14.42%</b>
Onsite Wastewater Treatment Facility	1.46%
POTW	0.58%
Surface Water (under NPDES)	10.99%
Offsite POTW	1.39%
<b>Total Recovered, Recycled, Reused, Regenerated</b>	<b>27.21%</b>
Metal Catalyst Reclamation/Regeneration	16.72%
Recycle to Processes (e.g., onsite recovery)	8.58%
Miscellaneous Onsite Recycling	1.92%
<b>Total Stored</b>	<b>0.16%</b>
Total Stored in Piles	0.16%
<b>Total Transferred</b>	<b>10.30%</b>
Transferred to Another Refinery	2.69%
Transferred for Direct Use as a Fuel or to Make Fuel	2.46%
Transfer with Coke Product or Other Refinery Product	3.33%
Other	1.82%
<b>Total Treated</b>	<b>18.21%</b>
Neutralization	10.12%
Onsite Boiler	2.33%
Onsite Industrial Furnace	2.91%
Onsite Land Treatment	2.51%
Other	0.35%
<b>Grand Total</b>	<b>100.00%</b>

(EPA 1996)

**(3) Trends in generation of purification process byproducts:**

- Information on trends in the generation of purification process byproducts is difficult to assemble given the range of products and management options. It is likely, however, that such trends will closely track production in those industries that generate purification process byproducts. These production trends are likely to vary by industry.

**3. *Uses of Purification Process Byproducts***

**(1) Combustion uses of purification process byproducts:**

- Purification process byproducts with sufficient calorific value can potentially be used as fuels in boilers, furnaces, and kilns. However, the combustion uses are likely to vary depending on the source of the residue.

**(2) Non-combustion uses of purification process byproducts:**

- Comprehensive information on non-combustion uses for purification process byproducts has not been identified. The usability of these materials for non-combustion applications, however, is likely to vary across different purification process byproducts and non-combustion use applications.

**4. *Management and Combustion Processes***

**(1) Types of units using purification process byproducts**

- Information on the types of units using purification process byproducts has not been identified, but industrial residues in general are used in a variety of combustion units, including liquid-fueled boilers and process heaters. (EPA 2004).

**(2) Sourcing of purification process byproducts:**

- Purification process byproducts originate at many different types of facilities (Raiders 2009). No information, however, has been identified on the collection and distribution of these materials.

**(3) Processing of purification process byproducts:**

- Information on the processing of purification process prior to their use has not been identified. It is likely, however, that processing requirements would vary across beneficial use applications and purification byproducts.

**(4) State regulatory status of purification process byproducts use:**

- At this stage, we have not identified any states that have specifically granted a beneficial use designation for the use of purification process byproducts as fuel, but we have not performed an exhaustive investigation of state activities and regulations.

5. *Commodity Composition and Impacts*

**(1) Composition of purification process byproducts:**

- The composition of purification process byproducts can vary across specific byproducts. As indicated above, however, they are typically high in organics, which makes them a useful non-hazardous fuel source (Raiders et al. 2009). The concentrations of other constituents are difficult to characterize because they depend on the specific purification process from which the material was generated.

**(2) Impacts of purification process byproduct use:**

- Benefits associated with the use of purification process byproducts as fuel include avoided risks associated with disposal, cost savings associated with avoided disposal and recovery of energy, and the avoided environmental impacts associated with production of energy from “virgin” non-renewable sources when purification process byproducts are used instead.
- The specific lifecycle impacts of purification process byproducts used as a fuel are not evaluated here because of uncertainties in lifecycle scenario development. For example, it is difficult to identify the fuel (Btu) value and emissions factors associated with a “typical” non-hazardous purification process byproduct that is suitable for fuel. In addition, purification process byproducts may substitute for a variety of fuels; the choice of fuel often depends on location specific-factors such as the location of the combustor in relation to fuel supplies, and on the design of the specific combustion unit. Avoided upstream impacts depend heavily on the specific fuel being displaced in the lifecycle scenario.

## References

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