REMANDED SMELTING WASTES

Technical Background Document

Office of Solid Waste
U.S. Environmental Protection Agency

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In 1990, the American Mining Congress (AMC) brought suit against EPA challenging the listing of six smelting wastes associated with the primary aluminum, copper, lead, zinc, and ferroalloy industries (see *American Mining Congress v. EPA, 907 F.2d 1179, D.C. Cir., 1990)*). The Court upheld the listing of one of the wastes, but vacated and remanded to EPA the listing of the remaining five wastes, finding that the record and factual basis for the listings were inadequate. Having completed further study in 1995, EPA is considering that it will not re-list the five remanded wastes as listed wastes. Because of changes in the nature of the wastes generated and the manner in which they are managed, the Agency is considering that it will, instead, regulate any of these wastes that continue to be generated according to their hazardous characteristics, if any. This report discusses the history of Agency actions with regard to these smelting wastes, industrial smelting processes and waste management procedures, and provides a factual basis for considering a no-list decision.

1.0 Background

On May 19 and July 16 of 1980, EPA identified 85 industrial process wastes as hazardous wastes and approximately 400 chemicals as hazardous wastes if they are discarded. Among those wastes listed, EPA listed as hazardous eight wastestreams generated from primary metal smelting:

Waste Code	**Hazardous Waste**
K064	Acid plant blowdown slurry/sludge resulting from the thickening of blowdown slurry from primary copper production.
K065	Surface impoundment solids contained in and dredged from surface impoundments at primary lead smelting facilities.
K066	Sludge from treatment of process wastewater and/or acid plant blowdown from primary zinc production.
K067	Electrolytic anode slimes/sludges from primary zinc production.
K068	Cadmium plant leach residue (from oxide) from primary zinc production.
K088	Spent potliners from primary aluminum reduction.
K090	Emission control dust or sludge from ferrochromium-silicon production.
K091	Emission control dust or sludge from ferrochromium production.

(Exhibit 1 summarizes the history of the smelting waste listings.)

Exhibit 1

History of the Listing of Wastes Associated with Primary Metal Smelting

May 19, 1980/July 16, 1980	--	The Agency lists as hazardous eight waste streams associated with primary metal smelting.
November 19, 1980	--	The Agency suspends the listing of the eight waste streams associated with smelting as hazardous wastes in accordance with the Bevill Amendment.
August 21, 1985	--	In response to a suit for failure to submit a Report to Congress and make statutorily required regulatory determinations (*Concerned Citizens of Adamstown v. EPA*), EPA agrees in a settlement that it will propose a narrower interpretation of the scope of the Mining Waste Exclusion.
October 2, 1985	--	In accordance with the new proposed interpretation of the Mining Waste Exclusion, EPA proposes to relist six of the eight waste streams from primary metal smelting. The Agency does not relist two residues based upon a reevaluation of these materials.
October 9, 1986	--	EPA withdraws the reinterpretation and relisting proposal pending further study (required under RCRA Section 8002).
July 29, 1988	--	In *Environmental Defense Fund (EDF) v. EPA*, the Court orders the Agency to re-list the six wastes. EDF had argued that the withdrawal of the listings was arbitrary and capricious.
September 13, 1988	--	EPA promulgates the listings of the six smelter wastes.
July 10, 1990	--	In *American Mining Congress v. EPA*, the Court remands five of the six waste listings to the Agency, ruling that EPA provided insufficient evidence to re-list the wastes. The Court upholds only the listing of one waste associated with primary aluminum smelting (waste K088).
1990/1991	--	The Agency reviews previously collected data on the five waste streams and further investigates the wastes to make a proper listing decision.
1995	--	The Agency proposes a no-list determination on the five smelting wastes.

EPA chose to list these wastes after considering the listing criteria in 40 CFR 261.11(a)(3) (concentration of toxic constituents in the waste, ability of the toxicants to migrate from the waste, degree to which the toxic constituents bioaccumulate in ecosystems, plausible types of improper management, volumes of waste generated, etc.).

1.1 Exclusion of Mining Wastes from RCRA Regulation

In October of 1980, Congress amended RCRA to exclude "solid waste from the extraction, beneficiation, and processing of ores and minerals" from regulation as hazardous waste under Subtitle C of RCRA, pending further study (as part of the so-called "Bevill Amendment"). EPA interpreted this new Mining Waste Exclusion to include "solid waste from the exploration, mining, milling, smelting, and refining of ores and minerals". (45 FR 76618, November 19, 1980). EPA also suspended the listing of the eight wastestreams listed above to be consistent with this interpretation of the amendment. The Exclusion was intended to be temporary, pending completion of and public reaction to Reports to Congress required by RCRA §8002(f) and (p). These studies were to be completed by 1983.

1.2 Development of a Narrower Interpretation of the Mining Waste Exclusion

In 1984, EPA was sued for failing to submit the Reports to Congress and make the required regulatory determinations by the statutory deadline (*Concerned Citizens of Adamstown v. EPA* No. 84-3041). In responding to this lawsuit, the Agency explained that it planned to both complete the first Report to Congress and propose and complete a narrower interpretation of the scope of the Mining Waste Exclusion that would encompass fewer wastes by September 30, 1986. The Court agreed to this approach and schedule.

EPA proposed this narrower interpretation of the Mining Waste Exclusion and accordingly proposed to re-list six of the eight wastestreams from primary metal smelting as hazardous in October of 1985. In the proposed rule, EPA emphasized that the decision to re-list the six wastes was based solely on the interpretation of the Bevill Amendment and **not** on a reevaluation of their hazard (see 50 FR 40292).

EPA chose not to re-list two of the original eight wastestreams (electrolytic anode slimes/sludges -- K067, and cadmium plant leach residue -- K068, from primary zinc production) because it found that industry was routinely recycling these residues in an environmentally sound manner. The Agency cited data collected by the American Mining Congress (AMC) that indicated that all facilities that produce these wastes recycle 100 percent of the material. Furthermore, the AMC survey indicated that a large percentage of the waste is recycled immediately. Of the waste that is stored prior to recycling, EPA found that it is stored for a maximum of 30 days in a manner that minimizes loss. Thus, the Agency determined that these materials are "more commodity-like than waste-like" and therefore did not propose to re-list them as hazardous wastes.

Of the remaining wastestreams, only one (K065 -- surface impoundment solids from lead smelting) was routinely reclaimed by industry. The Agency found, however, that this waste is only recycled after it has been stored for long periods of time. Furthermore, the Agency found that industry generally did not store the waste in an environmentally protective manner to minimize any losses. Because the sludges are managed in a "waste-like" manner, even though they might eventually be reclaimed, the Agency proposed to re-list these wastes as hazardous.

1.3 Reversion to the 1980 Interpretation of the Mining Waste Exclusion

The Agency was not able to finalize the narrower interpretation of the Mining Waste Exclusion because it did not first establish criteria to distinguish excluded from non-excluded wastes. Given the time constraint of the Court-ordered deadline for final action, EPA was unable to develop these criteria. As a consequence, the Agency withdrew its proposal on October 9, 1986 (51 FR 36233). As the Agency reverted to its 1980 interpretation of the Exclusion, it also withdrew its proposal to re-list the six wastes from primary metal smelting.

1.4 Court Challenges to the Broad Interpretation

Following the Agency's decision to withdraw its proposed waste listings, the Environmental Defense Fund (EDF) sued EPA (*Environmental Defense Fund v. EPA*, 852 F.2d 1316 (D.C. Cir, 1988)) on the basis that its withdrawal of the 1985 proposal was arbitrary and capricious. The Court, ruling in the favor of EDF in August of 1988, ordered the Agency to re-list the six hazardous metal smelting wastes within a 30-day period and reduce the scope of the Mining Waste Exclusion as it applies to mineral processing wastes. The Agency re-listed the six wastestreams on September 13, 1988.

1.5 Court Challenges to the Re-Listing

Shortly following the re-listing in 1988, AMC challenged the Agency's actions in court (see *American Mining Congress v. EPA, 907 F.2d 1179, D.C. Cir., 1990)*). AMC argued that the Agency used inadequate data to re-list the wastes. In July 1990, the Court upheld the Agency's decision to re-list waste number K088 -- spent potliners from primary aluminum reduction. It ruled against the Agency's decision to list the five remaining wastestreams, however, and ordered EPA to further investigate the wastestreams, as needed, to make a proper listing decision.

After a thorough review of existing data on the composition and management of these wastes, the Agency has determined that most of the data used in the 1985 re-listing are out-of-date and as a consequence, the rationale for some of the original listings is no longer valid. Accordingly, the Agency has re-investigated the wastestreams to update and expand the data base needed to make proper listing decisions. The remainder of this document discusses

Agency findings from this investigation and the basis for considering its no-list decision for the five wastes.

2.0 Industry Overview

The Agency reviewed past and current waste generator and waste management practices in making its listing decisions. This review was based on information collected from the mineral processing industry, communications with waste regulators, and from site visits conducted by the Agency. The following sections summarize the Agency's findings. Additional details on the information presented in these sections may be found in the Appendices at the end of this document and in the docket.

2.1 Description of Facilities Generating Wastes

The primary metal smelting industry has changed dramatically since the wastestreams were first listed in 1980. At that time, the primary metal smelter operators often stored and disposed of smelting wastes in unlined surface impoundments, threatening ground and surface water. Today, many of the facilities recycle wastes and/or treat them to reduce toxicity and other hazardous characteristics. Currently, there are fewer than 20 facilities that generate any of the listed wastes from primary metal smelting:

- **Copper:** There are eight operating primary copper smelters. Seven of the eight smelters generate acid plant blowdown. Of these seven facilities, three are located in Arizona, two are in New Mexico, one is in western Texas, and one is located in Utah.

- **Lead:** Lead is currently processed at a total of four facilities: two integrated smelter-refineries in Missouri (Glover and Herculaneum); a smelter in East Helena, Montana; and a refinery in Omaha, Nebraska. None of these facilities generate waste number K065 as originally listed. Some of these facilities do, however, generate acid plant blowdown and wastewater sludges. Process waters from the Missouri smelter-refineries are regularly discharged according to NPDES permit requirements.

- **Zinc:** Of the three[1] operating primary zinc smelting/refining facilities, two utilize an electrolytic process, and one uses a pyrometallurgical smelting process. The facilities are located in Pennsylvania, Tennessee, and Illinois. All three of the zinc plants generate sludge from the treatment of process wastewater and/or acid plant blowdown (wastestream K066).

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[1] ZCA has shut down the Bartlesville, Oklahoma smelter.

- **<u>Ferrochromium-Silicon</u>:** Ferrochromium-silicon alloy is no longer manufactured in the United States.[2] Accordingly, no facilities in the country currently generate emission control dust or sludge from ferrochromium-silicon production (wastestream K090).

- **<u>Ferrochromium</u>:** There is only one plant, located in South Carolina, that produces ferrochromium alloy. This facility generates emission control dust from the production of ferrochromium alloy (wastestream K091).

2.2 Description of Industrial Processes and Waste Management

Through its investigation of the primary metal smelting industries, the Agency has documented the following processes, waste generation points, and waste management practices.

<u>Acid plant blowdown slurry/sludge resulting from the thickening of blowdown slurry from primary copper production (K064).</u>

The smelting process involves the application of heat to a charge of copper ore concentrate, scrap, and flux, to fuse the ore and allow the separation of copper from iron and other impurities. In earlier operations, smelting would have been preceded by roasting to partially remove sulfur and volatile contaminants. Modern copper smelters generally have abandoned roasting as a separate step, and have combined this function with the smelting operation in the furnace. The smelter furnace produces two separate molten streams: Copper-iron-sulfide matte, and slag, as well as sulfur dioxide gas. The smelter slag, essentially a mixture of flux material, iron, and other impurities, is a RCRA special waste. The copper-iron-sulfide matte is sent on to converters, where a silica flux and compressed air or oxygen are used to remove the iron and sulfur, respectively, leaving blister copper that is about 99 percent copper. Iron combines with the silica to form converter slag, another component of the RCRA special waste, and the sulfur combines with oxygen to form sulfur dioxide gas. The blister copper produced by the converter is then cast into anodes for electrolytic refining. Electrolytic refining ultimately produces copper cathodes (relatively pure copper) for sale and/or direct use.

The sulfur dioxide gas produced as a byproduct of smelting and converting operations is collected to produce sulfuric acid (also a usable and/or saleable product). In a two-stage cleaning process, the impurities are removed from the gas stream. During the first stage, the gases are routed through baghouses to remove coarse entrained particulates. In the second stage, remaining entrained solids are removed through a wet scrubbing process. While facilities can recirculate most of the scrubber water, they usually purge (i.e., blow down) a

[2] ICF personal communication with John Papp, U.S. Bureau of Mines (March 1994) and with the last known producer of ferrochromium-silicon (SKW Alloys in Calvert City, KY), August 1994.

small percentage from the system to prevent buildup of solids and to minimize corrosion of the scrubber systems.

In the 1970s and early 1980s, it was common practice to neutralize this wastestream, precipitate the solids, and use thickeners as a method of separating a wet sludge that was then discarded as a waste. This sludge is the remanded K064 wastestream.

Industry management practices for managing acid plant blowdown have changed dramatically over the past decade. Today, three of the seven copper smelters that generate acid plant blowdown (ASARCO in Hayden, AZ; Cyprus Miami in Claypool, AZ; and ASARCO in El Paso, TX) completely recycle the acid plant blowdown wastestream, and therefore do not generate K064. ASARCO (Hayden) entirely recycles and reuses both the solid and liquid portion of the blowdown stream. It recovers copper, gold, and silver from the blowdown solids. Blowdown liquids are processed in an electrowinning unit.[3] Cyprus Miami (Claypool) recovers copper, silver, gold, and lead. After putting the acid plant blowdown through a liquid/solid separation process, the resulting material is either recycled to the process or sent to an off-site recovery facility. Since 1974, 80 percent of the wastes produced by the smelter have been recycled on-site. The value of the recovered material exceeds $6 million. The remaining 20 percent of wastes generated are either beneficially recovered or processed off-site.[4] Cyprus Miami dries the acid plant blowdown in concrete bunkers and sells it to Encycle in Corpus Christi, TX for off-site lead and bismuth recovery.[5] ASARCO (El Paso) completely recycles and reuses both the solid and liquid portion of the blowdown stream. It recovers copper, gold, and silver from the blowdown solids. Blowdown liquids are used to produce an ammonium sulfate by-product.[6]

Of the remaining four facilities, three (Phelps Dodge in Hidalgo, NM; Magma Copper in San Manuel, AZ; and Kennecott in Garfield, UT) neutralize the acid plant blowdown stream and discharge it to an evaporation (tailings) pond. Phelps Dodge pipes acid plant blowdown from its smelter operation to a wastewater treatment facility. This facility neutralizes the wastewater with lime prior to discharging the effluent to surface impoundments. While some sludge may accumulate in the tank system at the wastewater treatment facility, most of the solids are discharged with the effluent. The sludge solids "settle out" in the surface impoundments. Because of the arid conditions, the supernatant liquid is lost to evaporation. The surface impoundments are double-lined, are supplemented by groundwater monitoring

[3] E. Rissmann, p. 16 and ICF personal communication, August, 1994.

[4] Letter from Robert F. Ressler, Cyprus Miami Mining Corporation, September 26, 1994.

[5] USEPA memorandum, *Trip Report -- Site Visit to Magma Copper and Cyprus Miami Copper Mines*, June 7, 1994.

[6] Rissmann, p. 16

wells, and are regulated by a state-imposed discharge plan.[7] Magma Copper transfers acid plant blowdown via pipeline to a tailings mixer tank where it combines the blowdown with alkaline tailings for neutralization. After neutralization, the resulting mixture is deposited in tailings ponds. In the future, Magma plans to add lime for neutralization.[8] Agency analysis of the waste (1989) indicated that it is not TC hazardous.[9]

Kennecott currently neutralizes the acid plant blowdown and sends it to a wastewater treatment plant, permitted under NPDES. The acid plant blowdown is neutralized in the wastewater treatment plant. The resulting sludge and treated waste are deposited in tailing ponds and tailings impoundments, respectively. In 1991, this wastewater treatment plant sludge was determined to be an exempt mineral processing waste under the Bevill Amendment. Kennecott is currently planning to modernize its smelter and refinery operations in a manner that will eliminate the need for the wastewater treatment facility. As a result, by the end of 1995, Kennecott will discontinue the use of the wastewater treatment plant that generates the sludge.[10] The facility plans instead to recover metals (copper, lead, etc.) from the waste. It will combine acid plant blowdown with other wastes such as flue dust and will send any waste remaining after the metal recovery to a tailings pond. This waste will resemble gypsum.[11] Kennecott plans to remove the sludge from four of its five tailings ponds. The wastes which will remain in the fifth pond pass the TCLP.[12]

The remaining facility that generates acid plant blowdown (Phelps Dodge in Hurley, NM) neutralizes the wastestream with magnesium hydroxide, recycles the solids back to the smelter, and uses the treated blowdown waste for ore flotation and other beneficiation operations. The recycling of the wastewater is, however, somewhat inefficient as some of the waste adheres to the gangue rejected in the ore beneficiation process.[13]

Exemption of Calcium Sulfate Plant Wastewater Treatment Plant Sludge. Under the terms of the revised Mining Waste Exclusion (promulgated on September 1, 1989 (54 FR 36592)), EPA exempted from regulation under Subtitle C of RCRA certain mineral processing

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[7] Letter from Benito J. Garcia, New Mexico Department of the Environment to EPA, September 8, 1993.

[8] Trip Report, June 7, 1994

[9] Rissmann, p.18.

[10] RUST Environment and Infrastructure. *Summary Report: Wastewater Treatment Plant Sludge Project.* Prepared for Kennecott Utah Copper Corporation. February, 1994.

[11] ICF personal communication with Kennecott, August, 1994. Rissmann notes that in 1990, the waste was TC hazardous for arsenic, lead, and cadmium.

[12] RUST. February, 1994.

[13] Rissmann, p. 16.

wastes. One of the exempted wastes is calcium sulfate wastewater treatment plant sludge generated from primary copper processing. This waste is generated when the operator of a copper smelting facility neutralizes wastewater treatment sludge with lime. Agency review of the practices described above indicates that some of the solid treatment residues generated through application of these practices is exempt from regulation under Subtitle C of RCRA because these solids consist of calcium sulfate sludge, a special waste.

Surface impoundment solids contained in and dredged from surface impoundments at primary lead smelting facilities (K065).

The process used in lead smelting is similar to the process used for copper. Ore is first sintered to convert metallic sulfides to oxides, remove volatile metals, and convert most sulfur to sulfur dioxide. The sinter is then charged to a blast furnace with coke, limestone, and other fluxing materials and smelted. During smelting, metallic oxides are reduced to metal. The mixture separates into as many as four distinct liquid layers, depending on sinter composition: lead bullion (94 to 98 percent lead by weight, and other metals); speiss (arsenides and antimonides of iron and other metals); matte (copper sulfides); and slag (flux and metal impurities). The matte and speiss layers are sold to operators of copper smelters for metal recovery and crude bullion is fed to drossing kettles. Depending on its zinc content, the slag may be either disposed of or sent to a zinc fuming furnace.

Process wastewater at lead smelters arises from two sources: slag quenching and gas cleaning (acid plant blowdown). Slag removed from smelter furnaces must be "quenched" (i.e., rapidly cooled with water) prior to land disposal. Water used in this cooling process contributes to the facility's wastewater stream. In addition, facilities generate acid plant blowdown in the cleaning process for sulfur dioxide gas (just as in copper production). About 20 years ago, smelters commonly would treat process wastewater in unlined surface impoundments. Solids contained in and dredged from these surface impoundments comprise the remanded wastestream, K065.

Because lead smelter operators would often treat the sludges in unlined surface impoundments, the Agency initially proposed to list the waste as hazardous. The Agency's new study of industry practices, however, has revealed that the lead smelters no longer use surface impoundments and completely recycle all wastewater treatment solids. The ASARCO facility in Glover, MO, no longer uses its existing unlined surface impoundments and is in the process of clean-closing them. Plant wastewaters (e.g., slag granulation water) are now clarified in two rubber-lined concrete settling tanks. Overflow from the second tank collects in a lined retention pond, and overflow from the retention pond is treated with lime in a wastewater treatment plant and discharged under a NPDES permit. When sufficient quantities of settled solids have accumulated in the concrete settling tanks, the plant operator removes these materials and recycles them to the process.[14]

The Doe Run plant (Herculaneum, MO) continuously treats wastewaters that were formerly routed to unlined surface impoundments. Plant washdown water, blast and dross furnace slag granulation water, and neutralized acid plant blowdown are treated with lime and charged to a clarifier (WWTP-1). The slag granulation waters receive some initial settling treatment in a concrete-lined impoundment before they are combined with washdown waters and neutralized blowdown. Clarifier underflow is treated in a thickener along with sinter plant scrubber blowdown. The clarifier overflow is sent to gravity filters; backwash from the gravity filters is routed to the clarifier and the filtrate is discharged through an outfall. The thickener underflow is dewatered by a filter press and returned to the sinter plant. The filter press liquids are recycled to the thickener and the thickener overflow is recycled to the sinter plant.[15]

The remaining operating primary lead smelting facility (ASARCO in East Helena, MT) recycles wastewater treatment solids from the treatment of acid plant blowdown and other process wastewaters. Wastewater treatment solids are blended with lead ore concentrate and recycled to the process.[16] The facility no longer uses any surface impoundments; however, an inactive surface impoundment still exists on the site. This remaining surface impoundment is currently being cleaned up under Superfund.[17]

The ASARCO primary lead refinery in Omaha, NE does not utilize any surface impoundments, and therefore does not generate waste K065.[18]

<u>Sludge from treatment of process wastewater and/or acid plant blowdown from primary zinc production (K066).</u>

Zinc may be produced using either of two processes: a pyrometallurgical or a hydrometallurgical process. In both processes, the ore concentrates are first roasted. In the pyrometallurgical process, the roasted ore concentrate is mixed with coke and fed to smelting furnaces. Zinc becomes volatile upon heating and is collected by condensation. The zinc then

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[14] SAIC. *Characterization Report for Surface Impoundment Solids Contained in and Dredged from Surface Impoundments at Primary Lead Smelting Facilities (K065) for ASARCO, Glover, Missouri, and Doe Run Company, Herculaneum, Missouri.* Prepared for EPA, Office of Research and Development, Risk Reduction Engineering Laboratory. April 25, 1991.

[15] <u>Ibid.</u>

[16] ICF personal communication August, 1994.

[17] G. Light Trip Report, August 10, 1993.

[18] ASARCO 1989. *National Survey of Solid Wastes from Mineral Processing, ASARCO,* Omaha, NE.

is cast into ingots and sent to refining. The sources of process wastewater from primary zinc smelting are the same as those from primary lead smelting (i.e., slag quenching and acid plant gas cleaning). In the hydrometallurgical process, the roasted concentrate is digested with sulfuric acid to generate a zinc sulfate solution, which is then electrolyzed to recover zinc. While most of the spent electrolyte is recycled, a small amount is purged to the wastewater treatment system to prevent buildup of impurities. Residues from the digestion operation frequently contain high lead concentrations and generally are sold to lead smelters.

In the past, plant operators treated the wastewater in unlined surface impoundments and did not recycle the majority of the waste. The sludge resulting from the treatment was the K066 wastestream. Of the three zinc plants currently operating, one facility (Zinc Corporation of America (ZCA) in Monaca, PA) currently filters the sludge and recycles the entire liquid portion of the acid plant blowdown stream. The filter cakes are returned to the process for roasting. A small amount of solids from the filter cakes is disposed off-site at a hazardous waste landfill.[19] One of the other two facilities (Jersey Miniere in Clarkesville, TN) neutralizes the waste with lime, creating a synthetic gypsum. The facility then sells the product to a gypsum manufacturer or construction firms. This company uses a continuous process to recycle the wastewater.[20] The remaining facility (Big River Zinc in Sauget, IL) neutralizes the acid plant blowdown with magnesium oxide in a concentrator. This process produces a magnesium-sulfate solution. This solution is mixed with the remaining acid plant blowdown and neutralized with lime and sodium hydro-sulfide. The solids are sent to a special waste landfill. The solids pass the TC test (though the waste contains mercury at the TC hazardous waste threshold).[21]

In addition to its unease over the use of unlined surface impoundments, the Agency was initially concerned that some smelter operators processed lead-zinc ores for primary zinc production. The Agency has found, however, that the use of lead-zinc ores for primary zinc production has dramatically declined since the original listing.[22] The primary user of these ores closed during the early 1980s, thereby eliminating this issue as a primary consideration.

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[19] ICF personal communication, August, 1994.

[20] Rissmann, p. 28. Confirmed by ICF, August, 1994.

[21] Rissmann, p. 28. Confirmed by ICF, August, 1994.

[22] Rissmann p. 25.

Emission control dust or sludge from ferrochromium-silicon production (K090).

Ferrochromium-silicon is a smelted product of chromite ore; silicon is added during the smelting process. During ferrochromium-silicon production, the producer first blends chromite ore, silica, and coke and then feeds the mixture to an electric arc furnace. Both the metal alloy and slag are liquid when withdrawn from the furnace. The smelter then casts the alloy in molds. Unlike the lead and zinc processes that use water to cool the slag, this process uses air. The smelter then disposes of the slag on land as waste.

The gases are directed from the furnace into baghouses that remove entrained particulate matter before venting the gases into the atmosphere. This emission control dust is wastestream K090.

No ferrochromium-silicon has been produced in the United States since 1982, and experts believe that is unlikely to be produced in this country again.[23]

TCLP data collected in 1990 show that waste number K090 passes the TC test for all metals.[24]

Emission control dust or sludge from ferrochromium production (K091).

In the production of ferrochromium alloy, the producer blends chromite ore, fluxes, and coke, and feeds the mixture to electric arc furnaces. Metal and slag are withdrawn from the furnaces as liquids. The operator casts the metal alloy into molds and sells the product as ingots. The slag is allowed to air cool and is disposed of as waste.

As in ferrochromium-silicon alloy production, the baghouses are used to remove entrained particles before venting the gases into the atmosphere. This emission control dust is wastestream K091.

Data collected by the Agency indicate that only one facility in the country generates wastestream K091.[25] This facility, Macalloy, is located in North Charleston, South Carolina, a state that adopted and kept the listing of wastestream K091. In the past, this facility stabilized the waste and shipped it to Stollar Chemical, which blended the waste into a soil-nutrient mixture. Stollar Chemical is no longer in operation and is now under a CERCLA removal action. Today, Macalloy collects the wastestream in an electrostatic precipitator.

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[23] ICF personal communication with John Papp, U.S. Bureau of Mines (March 1994) and last known producer of ferrochromium-silicon (SKW Alloys in Calvert City, KY), August, 1994.

[24] Rissmann, p. 26.

[25] Rissmann, p. 27.

After treating the waste with water and ferrosulfate, the facility operator tests a sample of the wastewater. If the wastewater contains less than 5 ppm metals, the operator will release the wastewater through a NPDES outfall. Otherwise, the operator will continue to treat the wastewater until it contains less than 5 ppm metals.[26]

3.0 Basis for Considering a No-List Decision

The Agency recently restated the principles it relies on in making listing decisions, emphasizing eleven factors in particular. "Of these 11 factors, seven deal with risk (constituent toxicity, concentration, waste quantity, migration potential, persistence, and bioaccumulation potential) and are integrated into the risk values generated. The other four factors (plausible management, damage cases, coverage of other regulatory programs, and other factors as may be appropriate) are individual factors that also are considered in a listing determination. Waste quantity (specifically, "de minimis" amounts of waste) also can be a special consideration in making a listing determination for a lower volume wastestream."[27]

The basis for considering a no-list decision for each wastestream is presented below.

<u>Acid plant blowdown slurry/sludge resulting from the thickening of blowdown slurry from primary copper production (K064).</u>

As described above, three of the seven generators of waste K064 currently recycle the predecessor wastestream. A fourth plans to change its process by the end of 1995 to allow metals to be removed from wastes. This recycling either prevents the waste from being generated at all or greatly reduces any risk that may be associated with generating it. Accordingly, under the most plausible management scenario, EPA does not believe that listing is warranted. Furthermore, by enforcing the regulations for management of TC wastes the Agency should be able to address any problems with current (and future) disposal practices at facilities that do not recycle the blowdown.

<u>Surface impoundment solids contained in and dredged from surface impoundments at primary lead smelting facilities (K065).</u>

Because lead smelter operators have replaced surface impoundments with tanks and filtration equipment in wastewater management systems, no facilities currently generate waste number K065 as originally listed. Furthermore, all primary lead smelters currently recycle all wastewater treatment solids. The Agency has determined that any residual materials could be managed as characteristic wastes. Therefore, EPA is considering not to retain the listing

[26] EPA personal communication with Macalloy, October, 1995. See Docket for telephone log.

[27] 59 FR 66074. December 22, 1994.

based on the considerations of waste quantity, plausible management, and availability of other regulatory controls.

Sludge from treatment of process wastewater and/or acid plant blowdown from primary zinc production (K066).

The Agency is consdiering not to re-list waste number K066 because most of the wastes are either recycled in process, neutralized and resold, or are non-hazardous. None of the zinc producers treat the waste in unlined surface impoundments, which threaten groundwater and surface water, as they did in the past. The Agency has determined that management by toxic characteristic would be appropriate as virtually all zinc smelters recycle the waste. Therefore, EPA is considering not to retain the listing based on the considerations of waste quantity, plausible management, and availability of other regulatory controls.

Emission control dust or sludge from ferrochromium-silicon production (K090).

The Agency is considering that re-listing waste number K090 would be unnecessary, as ferrochromium-silicon alloy and its associated wastestream are no longer generated in the United States. Furthermore, recent studies indicate that the wastestream passes the TCLP toxicity test.[28]

Emission control dust or sludge from ferrochromium production (K091).

EPA is considering not to list waste K091 because only small quantities are generated and because the most plausible management is discharge to a treatment facility for treatment in accordance with Clean Water Act requirements. Any waste not managed in this way could still be regulated as a characteristic waste. Furthermore, the State of South Carolina adopted the original listing of waste K091, meaning that it will continue to be regulated as a listed hazardous waste in South Carolina, irrespective of EPA's decision.

4.0 Summary of Findings

As a result of the research and analysis described above, the Agency is considering to revoke the current hazardous waste listings for five court-remanded smelting wastes. The Agency is also considering not to re-list them as hazardous. Because of changes in the nature of the wastes generated and the way in which they are managed, the Agency has determined that they no longer meet the criteria for listing. The Agency will instead regulate these wastes according to their hazardous characteristics.

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[28] Rissmann, p. 26.

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APPENDIX A

Rissmann Trip Report

The Rissmann Report contains information obtained by the Agency through site visits on waste management practices related to the five remanded wastestreams. The information attached to the letter can not be disclosed because some data may be classified as confidential business information.

APPENDIX B

Magma and Cyprus Trip Report

APPENDIX C

Letter from Benito Garcia, New Mexico Department of the Environment

US EPA ARCHIVE DOCUMENT

APPENDIX D

SAIC Characterization Report

APPENDIX E

ICF Telephone Contact Log

Management of Primary Metal Smelting Waste - Copper

Mineral	Company Name, Location	Contact Name	Process Change?	Description of New Management Process/Other Comments
Copper	Magma Copper San Manuel, AZ	Jerry May (602)385-3100	No	Did add an additional treatment step, but process essentially the same.
Copper	Asarco Hayden, AZ	Neil Gambell (602) 356-7811	No	Noted that most of the liquid portion of the waste steam is processed in an electrowinning unit, not in an electrolytic unit as noted in our EPA report.
Copper	Asarco El Paso, TX	Michael Jackson (915) 541-1800	Yes	Asarco (El Paso) established a new process in 1993. This process, Continuous Smelting Top Blowing (ConTop), is used in the flash smelting process. It generates between 70 and 80 gallons of wastewater per minute. The company built a new plant to pretreat and treat the new wastestream. Water flows through recondenser distillation unit with spray driver. The unit can process between 80 and 100 gallons per minute. The distilled quality water is sent back to the boiler. The remainder of the waste is a dry dust that contains about 0.05 percent water, 1,400 to 2,000 ppm arsenic and some cadmium. This hazardous waste is shipped off-site.

Management of Primary Metal Smelting Waste - Copper (continued)

Mineral	Company Name, Location	Contact Name	Process Change?	Description of New Management Process/Other Comments
Copper	Kennecott Garfield, UT	Fred Fox (801) 569-6000	Yes	Kennecott is in a modernization process. Currently, acid plant blowdown is neutralized and sent to a wastewater treatment plant, permitted under NPDES. In October, the smelter plans to begin recovering precious metals (e.g., copper, lead, etc.). In this process, the smelter will combine acid plant blowdown with other wastes such as flu dust. Most of the wastestream will recovered. The remainder will be neutralized and sent to a tailings pond. The resulting product will be a gypsum-like product.

Management of Primary Metal Smelting Wastes - Lead

Mineral	Company Name, Location	Contact Name	Process Change?	Description of New Management Process/Other Comments
Lead	Asarco E. Helena, MT	George Nichol	Yes	Now the company completely recycles the wastestream, as planned.

Management of Primary Metal Smelting Wastes - Ferroalloys

Mineral	Company Name, Location	Contact Name	Process Change?	Description of New Management Process/Other Comments
Ferroalloys	Macalloy N. Charleston, SC	Tim Nelson (803) 722-8355	Yes	Macalloy no longer sends waste to Stollar Chemical (now a Superfund site). It treats the wastestream in an electrostatic precipitator. The smelter generates about 7 tons/day of low-density waste similar to fly ash. They use a screw conveyor to bring the waste to a 2,500 gallon plastic tank. They mix the waste with water and ferrosulphate. After treatment, they perform an EP test on wastewater samples. If the wastewater contains fewer than 5 ppm of metals, it is released to an unlined surface impoundment. The State of South Carolina has listed wastestream K091.
Ferroalloys	SKW Alloys Calvert City, KY	Bobby Smith (502) 395-7631	No	As noted in the 1992 data, the company does not produce ferrochromium-silicon.

Management of Primary Metal Smelting Wastes - Zinc

<table>
<tr><th>Mineral</th><th>Company Name, Location</th><th>Contact Name</th><th>Process Change?</th><th>Description of New Management Process/Other Comments</th></tr>
<tr><td>Zinc</td><td>Jersey Miniere
Clarkseville, TN</td><td>Environmental Mgr.
(615) 552-4200</td><td>No</td><td>Jersey Miniere still recycles the wastewater treatment solids and sells the gypsum product to construction firms. The company has expanded its recycling program by replacing the batch recycling process with a continuous process. The firm now recycles wastewater in-situ.</td></tr>
<tr><td>Zinc</td><td>Zinc Corporation of America
Monaca, PA</td><td rowspan="2">Jim Reese
(412) 774-1020</td><td rowspan="2">No</td><td rowspan="2">The entire portion of the liquid acid is recycled. A small amount of the filter cake solid impurities are disposed of off-site as a hazardous waste.</td></tr>
<tr><td>Zinc</td><td>ZCA
Bartlesville, OK</td></tr>
</table>

APPENDIX F

RUST Report

APPENDIX G

Letter from Robert Ressler, Cyprus Mining

The information which is referenced in the letter may contain information which is classified as confidential business information and, therefore, can not be included.

APPENDIX H

ASARCO Survey of Mineral Processing Wastes

The *National Survey of Solid Wastes from Mineral Processing* submitted by ASARCO contains information on the generation and management of the wastes at the ASARCO primary lead facility in Omaha, NE that were being considered for special waste status. Facility specific information including process units for generating wastes, process units for handling wastes, on-site wastewater processes, and solid waste management techniques are described in the document. The actual data from this document can not be disclosed because the information is classified as confidential business information.

APPENDIX I

Light Trip Report