TA-16

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Date: October 28, 2003
Refer To: SWRC:03-049

Carl Will
Permits Management Program
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Dear Mr. Will:

Subject: Recycling of High Explosives Contaminated Scrap Metal

We are writing this letter to respond to questions from the Hazardous Waste Bureau (HWB) regarding Los Alamos National Laboratory's (LANL's) comments on the Air Quality Bureau's open burning regulation. These questions relate to the regulatory status of certain scrap metals treated at the Technical Area 16 (TA-16) Burn Ground. We would like to take this opportunity to describe how metal contaminated with high explosives (HE) are decontaminated and give your staff an opportunity to review these practices with regard to Resource Conservation and Recovery Act (RCRA) regulations. Pertinent pages for each Federal Register (FR) or other documents referred to in the following discussion are attached.

At LANL, the Department of Energy (DOE) Explosives Safety Manual (DOE, 1996) controls the treatment of scrap metal contaminated with any amount of HE. Before releasing materials to the public (e.g., recyclers), Sections 19.5 and 18.4 of the manual require that HE-contaminated metal scrap be decontaminated as follows:

- If the item to be decontaminated has only smooth, flat surfaces that can be visually inspected, hot water, steam, or solvents may be employed to effect total decontamination.

- If the item to be decontaminated has tight places where explosives may remain following normal cleaning procedures, [or, by inference, is of a shape or length that a visual check cannot be made] the item must be further treated by thermal or chemical decontamination techniques.

LANL procedures also require that materials and equipment that have contacted HE be decontaminated before leaving the TA-16 HE access area.

HE experts determine whether the metal item should be steam cleaned or thermally treated. The steam-cleaning facility at TA-16-400 is used to clean items with smooth, flat surfaces (e.g., flat metal, short pieces of piping, etc.) that have trace amounts of contamination. Items of this sort do not meet the definition of a reactive waste (D003) under RCRA and can undergo visual and swipe test evaluations to ensure that the HE is removed.

The remainder of HE-contaminated metals is thermally treated at the TA-16-388 Flash Pad. LANL uses thermal treatment as the environmentally preferred option because chemical treatment results in HE-contaminated chemicals that require further treatment. Metals treated at the TA-16-388 Flash Pad are treated for the following reasons:

- All HE-contaminated metals that have significant HE contamination or configurations that would classify them as D003 are thermally treated to meet RCRA treatment standards.

- Other items that HE experts have determined are not D003 due to low levels of contamination or item use/history but have a configuration that cannot be visually inspected, (e.g., longer pieces of pipe, analytical equipment) or have forms of HE (e.g., on pipe scale) that cannot be effectively removed by steam cleaning are treated to meet DOE and LANL requirements.

Based on EPA regulations and guidance, LANL believes that one type of the non-D003 metals, scrap metal sorted by type, is exempt from the definition of solid waste (and, therefore, is not hazardous waste). The Environmental Protection Agency excludes certain types of scrap metal from the definition of solid waste under 40 CFR 261.4(a)(13), including "processed scrap metal." Processed scrap metal: *" includes, but is not limited to, scrap metal which has been baled, shredded, sheared, chopped, crushed, flattened, cut, melted, or separated by metal type (i.e., sorted), and, fines, drosses and related materials which have been agglomerated"* (40 CFR 261.1(10)). The generator, an intermediate scrap handler, or scrap metal recycler may perform the processing step. Once the scrap metal has undergone a processing step, it may qualify for the exempt scrap metal exclusion [*May 12, 1997, 62 Federal Register (FR) 26011*].

Generators at LANL often segregate HE-contaminated scrap by metal type to improve handling and treatment. For example, aluminum molds are segregated then treated separately from other types of metals. After treatment, TA-16 Burn Ground workers keep the aluminum separated from other metal types for transport to a metal processing facility. LANL believes these metals meet the definition of processed scrap. However, LANL would not apply the processed scrap metal exemption to items that contained reactive (D003) quantities of HE; these items require careful handling and storage and are treated to meet the RCRA standards

The HWB questioned whether the definition of processed scrap metal covered metal contaminated with non-metallic RCRA constituents. In the *January 25, 1996, FR [61 FR 2362]*, EPA states that scrap metal processing includes removing dispersible non-metallic components in the metal before being manufactured into a consumer article. Some of these processes are described by the Emission Inventory Improvement Program (EIIP, 2001), used by EPA to establish air pollutant emission factors for scrap metal recycling (EPA, 1995), such as:

- Separation of metal from contaminants such as dirt, oil, plastics, and paint;
- Solvent cleaning and centrifugations to remove grease and oils; and
- Pyrometallurgical techniques (e.g., heating/burning) used to separate metals from organic contaminants.

These pretreatment operations are exempt from RCRA permitting under 40 CFR 261.6 but are subject to 40 CFR 264, Subparts AA, BB, and CC and other environmental permitting requirements such as air quality permitting.

EPA also recognizes that scrap metal may be contaminated with non-metallic RCRA-regulated constituents. In response to a question regarding the scrap metal exemption under 40 CFR 261.6(a)(3)(ii), the December 2002 EPA Monthly Call Center Report (http://www.epa.gov/epaoswer/hotline/mrqs.htm) stated:

> *"Generators can take advantage of the exemption in Section 261.6(a)(3)(ii) for scrap metal that is contaminated with listed hazardous waste as long as the material meets the regulatory definition of scrap metal (Section 261.1(c)(6)). However, any residues resulting from the processing of contaminated scrap metal would remain a hazardous waste via the derived-from rule (57 FR 37194, 37237; August 18, 1992)."*

Because processed scrap metal is simply scrap metal that would be regulated under 40 CFR 261.6(a)(3)(ii) except that it has been sorted or otherwise processed, the same determination should apply. To summarize the above discussion:

- processed scrap metals are exempt from the definition of solid (and, therefore, hazardous) waste,
- the scrap metal exemptions apply to metal contaminated with non-metallic RCRA constituents, and
- recycling pretreatment and treatment processes are exempt from RCRA permitting.

LANL looks forward to discussing with the HWB the EPA regulations and guidance and how these apply to metals treated at the TA-16 Burn Ground. Please feel free to call me at 505-665-0451 or Ann Sherrard at 505-665-7226 with any questions and to set up a meeting at your convenience.

Sincerely,

Anthony R. Grieggs
Acting Group Leader

TG:AS:vc

References:

DOE, 1996, "Explosives Safety Manual", M440-1.1, Revision 8.0 and all errata sheets from biannual meetings, DOE Directive, DOE Headquarters, Washington, D.C.

EIIP, 2001, "Preferred and Alternative Methods for Estimating Air Emissions from Secondary Metal Processing, Volume II: Chapter 9," http://www.epa.gov/ttn/chief/eiip/techreport/volume02/ii09.pdf, prepared by Eastern Research Group, Inc., Morrisville, North Carolina.

EPA, 1995, "Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources," http://www.epa.gov/ttn/chief/ap42/index.html

Att. a/s

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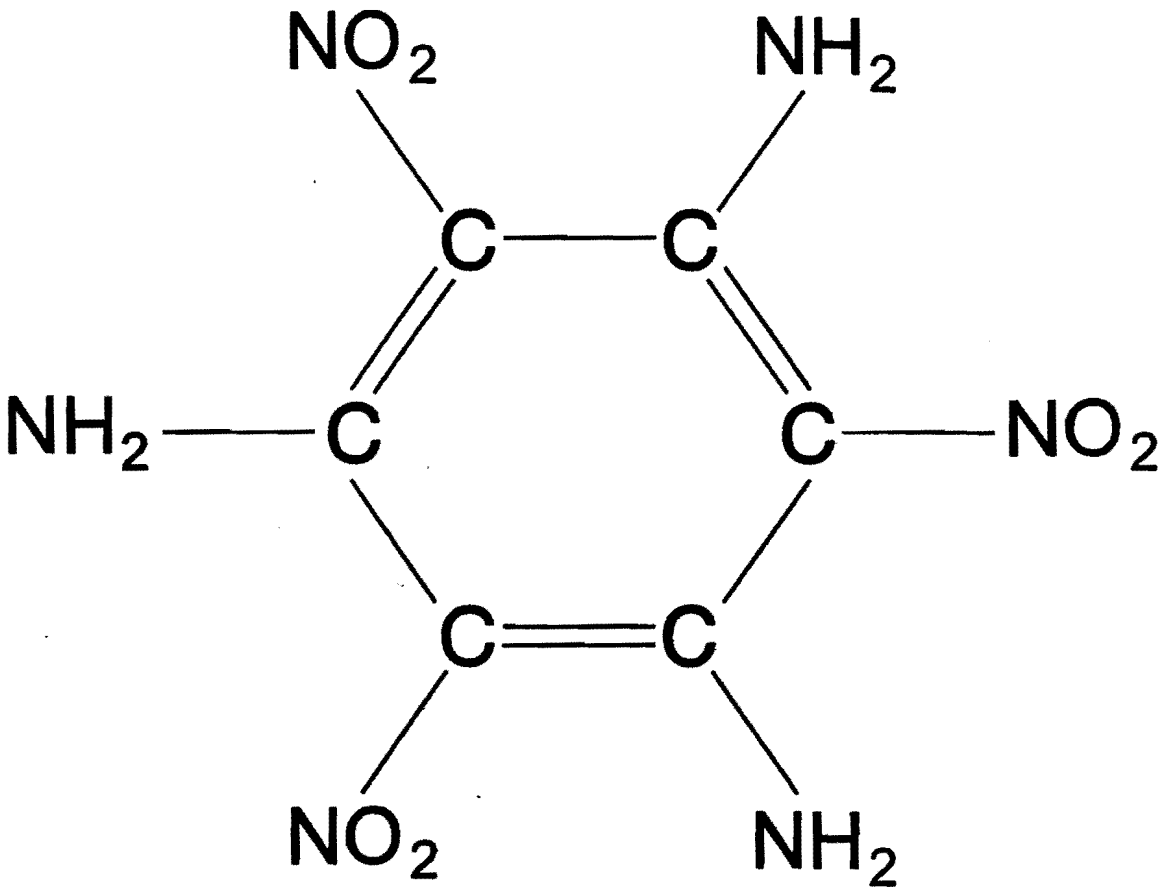
L. Vigil-Holterman, LANL, RRES-SWRC, K490
SWRC File
IM-5, A150

AB

DOE Explosives Safety Manual
Pantex Version

April 3, 2000



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Nuclear Explosives Safety Department
Explosives Safety Program

Official: A.G. Papp, Mason & Hanger
Authority Having Jurisdiction

Official: Scott A. Wood, DOE AAO
Authority Having Jurisdiction

18.4 Final Decontamination and Disposal of Equipment

a. If the item to be decontaminated has only smooth, flat surfaces (i.e., no cracks, seams, voids, or other places where explosive residue may be inaccessible), hot water, steam, or solvents may be employed to effect total decontamination. Any explosives contamination of concern will be visible to the unaided eye and will have dimensions (length, width, and depth).

b. If the item to be decontaminated has tight places where explosives may remain lodged following normal cleaning procedures, the item shall be subjected to final decontamination techniques. To facilitate cleanup, some items may have to be partially disassembled during the decontamination operation.

(1) Final decontamination by thermal techniques shall be done by subjecting the item to sustained heating at a temperature at least 60°C higher than required for decomposition of the most thermally stable explosive substance present. The item shall be kept at that temperature for a sufficient period of time to ensure that all parts have reached the temperature and all explosives material is decomposed. This is usually done by placing the item(s) to be decontaminated in a high-temperature sustained fire (see TB 700-4, "Decontamination of Facilities and Equipment"). This operation shall be conducted remotely or with operator protection.

(2) Final decontamination may also be accomplished by immersing the item in a chemical cleaning agent. The period of immersion shall be of sufficient duration to ensure that all explosive material is chemically decomposed. The chemical cleaning agent shall be one which is approved for use by the Department of Army TM 9-1300-214, "Military Explosives." Chemical cleaning agents for decontamination or destruction of explosives should not be used for more than about one oz. (or about 28 g) of explosives. Reference U.S. Department of the Army TM 9-1300-214 for decontaminating chemicals for explosives and for color tests for identification of energetic materials.

(3) Before subjecting the item to final decontamination by thermal or chemical techniques, as much explosive as possible shall be removed by the approved means (hot water, steam, and approved solvents in conjunction with cloth or paper wipes and non-metallic brushes or scrapers).

18.5 Inspection

After decontamination procedures are complete and before transfer to a nonexplosive area, the item shall be inspected. The degree of decontamination shall be determined/documented and the item shall be labeled to indicate its decontaminated state. Inspection should be accomplished by representatives of at least two departments, such as the operating department and the safety department.

h. Dry-type portable vacuum collectors shall not be located in a bay or cubicle where explosives are present or in enclosed ramps, but may be positioned outside the building or in a separate cubicle. The building or cubicle walls shall provide adequate shielding for at least 2 kg of explosives and the explosives limits shall be defined by shielding and quantity-distance constraints.

i. Explosives dust shall be removed periodically from the collection chamber to eliminate unnecessary and hazardous explosives concentrations. The entire system should be cleaned periodically, dismantling the parts if necessary. A cleaning schedule for the collection chamber and the entire system shall be established using the operating hours as a basis.

j. The entire explosives-dust collecting system shall be electrically bonded and grounded with resistance-to-ground not exceeding 10 ohms. The grounds shall be tested periodically.

19.4 Explosives Slurries

a. Machine tools shall be fitted with wet boxes to catch and direct water and explosives fines to an explosives waste gutter system.

b. Wastewater that might contain explosives materials shall be kept from contaminating potable water or conventional wastewater systems.

c. Settling tanks shall be regularly inspected to monitor the accumulation of waste. Records shall be kept of waste removals.

d. If pumping is involved in removing the settled explosives from a slurry settling tank, the operation shall be arranged to preclude exposure of the explosive material to any pinching in the operation.

e. Explosives materials in the settling basins shall be kept wet until removed and the materials shall be maintained wet until spread out for disposal. Explosives materials containing powdered metals shall be kept sufficiently wet to prevent a dangerous temperature rise resulting from a reaction of the metal with water. The possibility of hydrogen generation in this situation must be anticipated.

19.5 Metal Scrap

a. Metal scrap shall be inspected to detect explosives-contaminated items and shall be certified by qualified responsible personnel to be free from explosives before disposition.

b. If the scrap is found to be contaminated with explosives, it shall be decontaminated in accordance with final decontamination procedures (see Section 18.4 of this chapter).

VIII. Changes to Definition of Solid Waste to Exclude Processed Scrap Metal and Shredded Circuit Boards From RCRA Jurisdiction

Summary: As proposed on January 25, 1995 (FR 61 2338), EPA is today amending the definition of solid waste to exclude from RCRA jurisdiction two types of materials: processed scrap metal and containerized shredded circuit boards.

A. Processed Scrap Metal

1. Summary of Proposal

The Agency proposed the exclusion of processed scrap metal and shredded circuit boards being recycled from the Definition of Solid Waste in the January 25, 1996 proposed Phase IV LDR supplemental rulemaking. Currently, scrap metal being reclaimed is a solid waste, but completely exempt from RCRA Subtitle C regulations. The proposal would have amended the definition of solid waste to exclude processed scrap metal and containerized shredded circuit boards that are being recycled from RCRA jurisdiction. In the proposal, the Agency did not propose to make changes to the current definition of scrap metal: "bits and pieces of metal parts (e.g., bars, turnings, rods, sheets, wire) or metal pieces that are combined together with bolts and soldering (e.g., radiators, scrap automobiles, railroad box cars), which when worn or superfluous can be recycled."

The proposal defined processed scrap metal as "scrap metal which has been manually or mechanically altered to either separate it into distinct materials to enhance economic value or to improve the handling of materials. Processed scrap metal includes but is not limited to scrap metal which has been bailed, shredded, sheared, melted, agglomerated (for fines, drosses and related materials which are not scrap metal prior to agglomeration) or separated by metal type." The Agency believes that processed scrap metal being recycled is distinct from other secondary materials defined as wastes when recycled due to established markets for the material's utilization, inherent positive economic value of the material, the physical form of the material, and absence of damage incidents attributable to the material, and is therefore sufficiently product-like that maintaining RCRA regulatory jurisdiction over this material is not necessary. A summary of the proposed exclusion from the definition of solid waste for shredded circuit boards being recycled follows the discussion of the exclusion from the definition of solid waste for processed scrap metal being recycled.

2. Modifications to the Proposal

The Agency received approximately twenty-five comments concerning the proposed scrap metal and shredded circuit board exclusions. The comments were generally supportive of the exclusions. A background document, the major comments received, and Agency responses on the proposed processed scrap metal exclusion can be found in the docket for this rulemaking. Comments on the shredded circuit board exclusion can also be found in this background document.

In response to comment on the proposed exclusion to the definition of solid waste for processed scrap metal being recycled, the Agency has made several modifications to the exclusion in the final rule. First, the Agency has expanded the exclusion to cover unprocessed home and unprocessed prompt scrap metal being recycled. Home scrap is scrap metal generated by steel mills, foundries, and refineries such as turnings, cuttings, punchings, and borings. Prompt scrap, also known as industrial or new scrap metal, is generated by the metal working/fabrication industries and includes such scrap metal as turnings, cuttings, punchings, and borings. These categories of scrap metal do not fit the definition of processed scrap metal found in the proposal because they often do not require a processing step before being sent for recycling. The Agency evaluated unprocessed home scrap and prompt scrap metal and found that these categories of scrap metal are substantially similar to processed scrap metal due to established markets for the material's utilization, inherent positive economic value of the material, the physical form of the material, and absence of damage incidents attributable to the material. Based on this analysis, the Agency has expanded scope of the exclusion to include both unprocessed home and unprocessed prompt scrap metal. In the final rule, the term "excluded scrap metal" will be used to reflect this decision. Commenters also suggested the Agency evaluate obsolete scrap metal (scrap which is composed of worn out metal or a metal product that has outlived it original use, such as automobile hulks, railroad cars, aluminum beverage cans, steel beams from torn down buildings, and household appliances) using the same factors. The Agency has not found sufficient data to fully evaluate unprocessed obsolete scrap metal. Therefore, in today's final rule the Agency is not expanding the scope of the exclusion from the definition of solid waste to include obsolete scrap metal. Providing an exclusion from the definition of solid waste for obsolete scrap metal at this time would be premature and is better addressed in the Definition of Solid Waste rulemaking, due to be proposed in the near future.

Second, the Agency clarifies that the exclusion for processed scrap metal being recycled applies to scrap metal that has undergone a processing step (as defined in the preamble to the proposed rule) regardless of who does the processing. In other words, a processing step may be performed by the generator, an intermediate scrap handler (e.g. broker, scrap processor), or a scrap recycler. Once the scrap metal has undergone a processing step, it may qualify for today's exclusion.

Third, the Agency has added chopping, crushing, flattening, cutting and sorting, processes typically used in the processing of scrap metal for recycling, to the definition of processed scrap metal in today's final rule. In today's final rule, the definition of processing reads: "manually or physically altered to either separate it into distinct materials to enhance economic value or to improve the handling of materials. Additionally, to avoid confusion, the definition of processed scrap metal has been reworded to clarify the status of agglomerated fines, drosses and other related materials. Therefore, in today's final rule, the category of processed scrap metal now includes but is not limited to scrap metal which has been baled, shredded, sheared, chopped, crushed, flattened, cut, melted, or separated by metal type (i.e., sorted), and, fines, drosses and related materials which have been agglomerated." Note that circuit boards that are shredded and being sent for recycling are covered under the exclusion from the definition of solid waste for shredded circuit boards being recycled (261.4(a)(13)) see discussion following) and are not covered under the definition of excluded scrap metal.

B. Shredded Circuit Boards

1. The Proposal

In the proposed rule, EPA proposed to exclude shredded circuit boards being reclaimed from the definition of solid waste in order to facilitate their recovery. 61 F.R. 2339, 2361. The proposed exclusion was conditioned on the storage of the shredded circuit boards in containers prior to recovery that would be adequate to prevent a release of the boards to the environment. This condition was

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MONTHLY CALL CENTER REPORT
December 2002

RCRA, Superfund & EPCRA Call Center
National Toll-Free No.: (800) 424-9346 Local: (703) 412-9810
TDD National Toll-Free No.: (800) 553-7672 Local: (703) 412-3323
This report is prepared and submitted in support of Contract No. 68-W-01-020.

Scott Maid, Project Officer
U.S. Environmental Protection Agency
Washington, DC 20460

Availability

The complete text of the 1991 (November and December only), 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, and 2002 Monthly Call Center Reports may be accessed from the Internet. Go to the Call Center Home Page at www.epa.gov/epaoswer/hotline and select "Monthly Reports."

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FREQUENTLY ASKED QUESTIONS

Can generators of scrap metal that is contaminated with a listed hazardous waste take advantage of the exemption in 40 CFR Section 261.6(a)(3)(ii) when recycling the metal?

Generators can take advantage of the exemption in Section 261.6(a)(3)(ii) for scrap metal that is contaminated with listed hazardous waste as long as the material meets the regulatory definition of scrap metal (Section 261.1(c)(6)). However, any residues resulting from the processing of contaminated scrap metal would remain a hazardous waste via the derived-from rule (57 FR 37194, 37237; August 18, 1992).

Is the Resource Conservation and Recovery Information System (RCRIS) available to track hazardous waste data?

Users can no longer access RCRIS because it was replaced in September 2000 by a new system, RCRAInfo. RCRAInfo is EPA's

different metals (e.g., ferrous and non-ferrous, copper and steel) or metal and non-metal components (such as shredded steel and fluff), and 2) unit operations such as sintering and melting operations which melt or agglomerate materials such as drosses and fines into scrap metal. In the first category, processing includes but is not limited to bailing, shredding and shearing operations. This category of processing also includes manual or other separation of unprocessed or partially processed scrap metal into separate categories to enhance the economic value of the material. The second category of processing includes unit operations (such as sintering or melting operations) which change the physical form of secondary materials into scrap metal for secondary materials that would not otherwise be scrap metal prior to processing such as drosses and fines.

Processed scrap metal does not include any distinct components separated from unprocessed or partially processed scrap metal that would not otherwise meet the current definition of scrap metal. For example, processed scrap metal does not include batteries, capacitors or other liquid-bearing metal articles; fluff or other non-metal residuals; liquid metals such as mercury or metal-bearing liquids such as spent caustics and acids, and process secondary materials such as slags, drosses, ashes and sludges which have a physical form dissimilar to scrap metal.

The Agency is proposing to exclude processed scrap metal being recycled from the definition of solid waste because EPA believes that this type of secondary material is a commodity-like and has not historically contributed to the waste management problem. Unlike many other metal-bearing secondary materials, processed scrap metal has qualities which make it unlikely to contribute to the waste management problem.

In making this finding, EPA has considered the following factors relevant in determining whether or not processed scrap metal is commodity-like. These factors are the same criteria listed in 40 CFR § 260.31(c) providing a variance from the definition of solid waste for materials that have been reclaimed but must be reclaimed further): 1) the degree of processing the material has undergone and the degree of further processing that is required, 2) the value of the material after it has been reclaimed, 3) the degree to which the reclaimed material is like an analogous raw material, 4) the extent to which an end market for the reclaimed material is guaranteed, 5) the extent to which a material is managed to minimize loss.

Regarding the first factor or the degree of processing, processed scrap metal as defined in this proposal has been separated, melted or otherwise processed to add value or improve handling qualities. This processing is necessary for the purpose of adding value, meeting product specifications (and subsequent use) and helping to put the metal into a form to help minimize loss either by removing dispersible non-metallic components (e.g., removing fluff) or by converting a dispersible metal (e.g., fines) into a non-dispersible scrap metal form. Virtually all processed scrap metal undergoes further processing prior to being manufactured into a consumer article. However, the economic value added to the processed scrap itself is significant.

With respect to the second factor regarding the value of the material, processed scrap metal is typically traded nationally and internationally in established markets for positive economic value (i.e., the processor is paid by the purchaser for the metal). In general, processed scrap metal is sold under market specifications for purity and physical form to ensure efficient recycling of the material.[24]

Regarding the third factor, processed scrap metal is very similar to analogous raw metal concentrates and intermediates. For example, in the iron and steel industry, electric arc furnaces (which typically use processed scrap iron and steel as an input) compete in steel production with integrated steel facilities (which use basic oxygen furnaces that typically use iron derived from iron ore as an input). Non-ferrous processed scrap such as aluminum cans is a significant portion of the current aluminum market.

Fourth, guaranteed end-markets at smelters, mills and foundries for processed scrap metal are likely given the economic value added to the material through processing. Because processed scrap has been sorted, sized, separated and agglomerated for insertion into a manufacturing process to produce a metal intermediate or end product, it is likely that processed scrap metal will continue to be a substitute for raw material feedstocks. Because analogous raw materials (e.g., ores) are finite and non-renewable, their decreasing supply will also ensure that end markets for processed scrap metal remain.

Finally, regarding the extent to which processed scrap metal is managed to minimize loss and release to the environment, available information indicates that processed scrap metal has little potential for release because it is usually in a solid non-dispersible form and is managed to minimize loss because of its economic value. The Agency's review of damage incidents on both the Superfund (RODS) database and Damage Incident Data Base (DIDB) related to hazardous waste recycling, consultation with Bureau of Mines commodity trade specialists and relevant literature and on-line searches failed to reveal any incidents where releases to the environment of hazardous constituents were attributable to the management of processed scrap metal itself. In this review, the Agency assessed the potential of any hazardous constituents in processed scrap to be released to the environment during its management prior to final recovery.

However, EPA's review did indicate that materials generated from the recycling of unprocessed scrap were mismanaged and have historically contributed to the waste management problem. These materials include batteries, ash, and other residuals from processing scrap metal. Many of these residuals are subject to full or partial regulations under RCRA Subtitle C.[25] The Agency is continuing to evaluate whether or not the regulation of unprocessed scrap is necessary. For the time being, we are proposing to continue to assert RCRA jurisdiction for unprocessed scrap metal being recycled while maintaining the regulatory exemption. The Agency solicits comment on the availability of data for evaluating risks to human health and the environment potentially posed by unprocessed scrap metal destined for reclamation.

B. Shredded Circuit Boards

EPA is also proposing today to exclude shredded circuit boards destined for metal recovery that are managed in containers during storage and shipment prior to recovery from the definition of solid waste in order to facilitate recovery of this material.

Circuit boards destined for recovery are often processed through shredders, hammer mills and similar devices to decrease the size of the boards for a

[24] See Institute of Scrap Recycling Industries (ISRI) Scrap Specifications Circular 1994, Guideline for Ferrous Scrap, Nonferrous Scrap, Paper Stock, Plastic Scrap. Note: some materials listed in this circular which are considered scrap metal by ISRI are not scrap metal under the Resource Conservation and Recovery Act such as battery plates, drosses and other materials.

[25] For example, spent lead-acid batteries are subject to specific standards when destined for metal recovery. See 40 CFR Part 266 Subpart G.

VOLUME II: CHAPTER 9

PREFERRED AND ALTERNATIVE METHODS FOR ESTIMATING AIR EMISSIONS FROM SECONDARY METAL PROCESSING

January 2001

Prepared by:
Eastern Research Group, Inc.

Prepared for:
Point Sources Committee
Emission Inventory Improvement Program

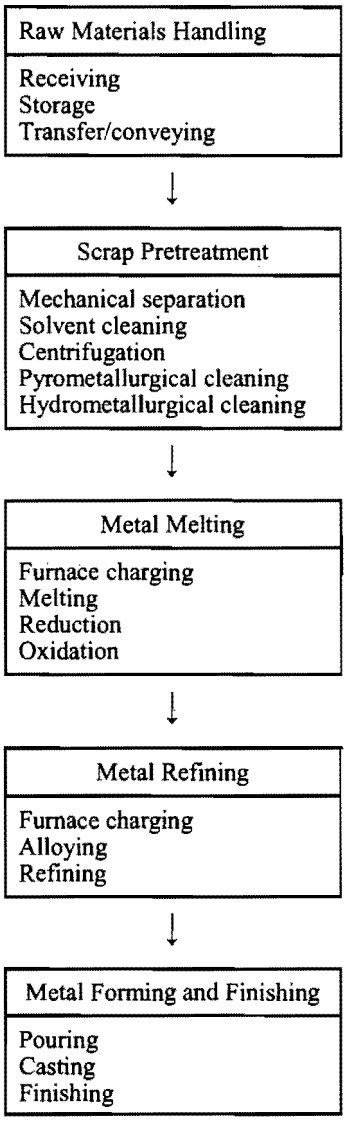

FIGURE 9.2-1 FLOW DIAGRAM OF SECONDARY METAL PROCESSING OPERATIONS*

* It should be noted that not all industries, or facilities, use all of the processes and operations.

pig iron, iron and steel scrap, foundry returns, and metal turnings. Fluxes used at iron foundries might include carbonates (limestones, dolomite), fluoride (fluorospar), and carbide compounds (calcium carbide). Examples of alloys used in secondary aluminum processing include zinc, copper, manganese, magnesium, and silicon. The fuels used in secondary metal processing might include coal, oil, natural gas, or coke. Coal, oil, or natural gas are used to fire reverberatory furnaces; coke is used as fuel for cupolas and blast furnaces at iron foundries. Raw materials used in mold and core making for casts include sand and additives.

2.1.2 SCRAP PRETREATMENT

Scrap refers to discarded materials, such as old appliances and automobile parts that contain a metal of interest, as well as to metal-bearing by-products or wastes generated by other operations in secondary metal processing. The scrap pretreatment process prepares the scrap for melting and involves sorting and processing metal-containing scrap to separate the metal of interest from unwanted materials and contaminants such as dirt, oil, plastics, and paint. Scrap pretreatment also involves the preliminary separation of the metal of interest from other metals contained in the scrap. The most commonly used operations, one or more of which are used by all secondary metal processing facilities, are described below.

Mechanical Separation

Mechanical separation usually begins with sorting, crushing, pulverizing, shredding, and other mechanical means to break scrap into small pieces. Breaking the scrap into smaller pieces improves the efficiency of removing unwanted materials and concentrating the metal for further processing. Methods used to concentrate the metal include magnetic removal, eddy currents, screening, and pneumatic classification. Secondary copper processing and secondary aluminum processing are two of the secondary metal processing industries that make use of mechanical separation operations.

Solvent Cleaning

Solvent cleaning of scrap is performed to remove grease and oils. This method is used at some facilities that utilize electric furnaces to melt metal.

Centrifugation

Centrifugation, although rarely used, is another cleaning process for removing grease and oils from the scrap. Like solvent cleaning, this operation is found at some facilities that use electric furnaces.

Pyrometallurgical Cleaning

Pyrometallurgical cleaning techniques, including roasting and sweating, use heat to separate the metal of interest from contaminates and other metals. The roasting process involves heating metal scrap that contains organic contaminates to temperatures high enough to vaporize or carbonize the organic contaminates, but not high enough to melt the metal of interest. Burning

insulation from copper wire is an example of a roasting process. In the aluminum industry, roasting is used to vaporize water.

The sweating process involves heating scrap containing the metal of interest and other metals to temperatures above the melting temperature of the metal of interest but below that of the other metals. For example, sweating recovers aluminum from high-iron-content scrap by heating the scrap to temperatures above the melting temperature of aluminum, but below the melting temperature of iron. This condition causes aluminum and other constituents with low melting points to melt and trickle down the sloped hearth, through a grate and into air-cooled molds or collecting pots. The materials with higher melting points, including iron, brass, and the oxidation products formed during the sweating process, are periodically removed from the furnace.

It should be noted that while pyrometallurgical cleaning is not used at iron and steel foundries, the metal may be preheated to facilitate melting and conserve energy.

Hydrometallurgical Cleaning

Hydrometallurgical cleaning techniques include leaching and heavy media separation. First, the scrap is crushed and then washed with water to remove water-soluble contaminants. The remaining material may be screened or magnetically separated before it goes to the melting process. Leaching is used in secondary copper and secondary zinc processing.

Heavy Media Separation

The heavy media separation process separates high density metal from low density metal using a viscous medium. Metal-containing materials are added to water. Compressed air is applied and chemicals are added that cause the low density metal to float to the surface of the liquid medium and form a foam of air bubbles. The foam is subsequently removed. Secondary aluminum processing and secondary copper processing use heavy media separation to separate metals.

2.1.3 METAL MELTING/SMELTING

Melting is performed primarily to separate the metals of interest from their metallic compounds, although impurities and contaminants remaining after the pretreatment operation may also be removed. In addition, melting allows the creation of an alloy and allows castings to be made from the metal in a liquid state. Smelting in nonferrous metal processing, takes place in furnaces or heated crucibles. The furnaces may be heated with fuels or through the use of electricity.

Pretreated scrap, fuels, and flux materials are added ("charged") to the furnace where melting takes place. The mixture of the flux materials depends on the type of metal being processed. In secondary lead processing, for example, flux materials may consist of rerun slag, scrap iron, coke, recycled dross, flue dust, and limestone. The flux may chemically react with the scrap in the presence of heat, breaking metallic-oxide bonds to produce pure metal. The process is called chemical reduction. Also, the flux may oxidize impurities in the scrap and further purify the metal.