UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

AUG 22 2013

Ms. Kerry Kelly
Director, Federal Public & Regulatory Affairs
Waste Management
701 Pennsylvania Ave., NW, Suite 590
Washington, DC 20004

Dear Ms. Kelly:

In your letter of March 16, 2012, you requested clarification from the U.S. Environmental Protection Agency (EPA) that your process engineered fuel, called SpecFUEL, is a non-waste fuel product under the Non-Hazardous Secondary Materials (NHSM) rule. In addition, you provided supplemental written information regarding your process and product specifications,[1] and representatives from Waste Management (WM) met with EPA officials on a number of occasions to discuss how SpecFUEL is characterized under the NHSM rule.[2] Both in your letters and in these discussions, you provided information regarding your position that SpecFUEL meets the legitimacy criteria (per 40 CFR 241.3(b)(4)) and, thus, should be considered a non-waste fuel.

To be designated as a non-waste fuel under 40 CFR 241.3(b)(4), the regulations require that processing of the NHSM meet the definition of processing in 40 CFR 241.2. After processing, the NHSM must also meet the legitimacy criteria for fuels in 40 CFR 241.3(d)(1). Units that combust NHSM as fuels that do not meet these requirements must meet applicable emissions standards issued under section 129 of the Clean Air Act (CAA).

Based on the information provided in your March 16, 2012, letter and supplemental materials, as well as information provided during several meetings with EPA officials, we believe that SpecFUEL would be considered a non-waste fuel under the 40 CFR part 241 regulations provided the specifications identified in your request are maintained, including, but not limited to, the moisture and ash content remain at 15% or less, the chlorine remains less than 0.3% and the sulfur content remains at or above a 1:1 stoichiometric ratio with chlorine, determined by daily composite sampling.[3] The remainder of this letter provides the basis for our position, including the reasons for these conditions. *If these conditions are not maintained, the Agency may reach a different conclusion.*

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[1] Supplemental material includes: May 4, 2012, "Introduction to SpecFuel" Powerpoint Briefing for Janet McCabe; May 4, 2012, Regulatory Analysis for SpecFuel; May 2012, Waste Management and SpecFuel—Product Stream Energy and Emissions Analysis, prepared for WalMart and Environmental Defense Fund; August 3, 2012, WM SpecFuel Process-Product Specifications; August 9, 2012, Assessment of Potential Dioxin/Furans Emissions; August 30, 2012, Powerpoint Briefing package for Robert Perciasepe, DA, "WM SpecFuel"; September 7, 2012, SpecFuel Metals and Halides Comparison to Traditional Fuels; October 17, 2012, SpecFuel Comparative Information for Antimony, Fluoride and DEHP; November 16, 2012, SpecFuel Additional Comparative Information for Spec Fuel, Pet Coke and Wood/Biomass; July 12, 2013 DF Assessment for SpecFuel; July 12, 2013, WM Product Process Information.

[2] Initial meetings with EPA staff occurred on February 15, 2012, and May 4, 2012. Waste Management then met with EPA Deputy Administrator Robert Perciasepe and other EPA representatives on August 30, 2012. EPA staff toured the San Antonio SpecFuel manufacturing plant on April 25, 2013.

[3] Note that a non-waste determination under 40 CFR Part 241 does not preempt a state's authority to regulate a non-hazardous secondary material as a solid waste. Non-hazardous secondary materials may be regulated simultaneously as a solid waste by the state, but as a non-waste fuel under 40 CFR Part 241 for the purposes of determining the applicable emissions standards under the Clean Air Act for the combustion unit in which it is used.

Background Information on SpecFUEL

WM is currently operating one full-scale facility that produces SpecFUEL, an engineered fuel produced from the processing of various solid waste materials. The primary feedstock is derived from municipal solid waste (MSW) that may have undergone some source separation by households or businesses to extract recyclables, as well as commercial and industrial material streams such as hard to recycle plastics that would otherwise be landfilled. This facility is intended to be a prototype for future SpecFUEL plants throughout the country.[4]

According to the information provided, SpecFUEL can be engineered to meet precise end-user specifications for heating value, biogenic carbon content and low sulfur content. Specifically, the information provided describes the product specifications for SpecFUEL, which WM is currently producing, as follows:

- Fuel product consists of 99% or greater post-recycle paper/cardboard fiber and plastic
- Fuel/heat content (moisture free) between 7,500 Btu/lb and 11,000 Btu/lb, with each fuel product formulated to meet customer specifications within ± 10 percent, verified by SpecFUEL analyses and continuous process controls, including spectroscopic characterization
- Mechanical densification of the fuel into a cylindrical shape creates a thin plastic coating around the cylinder's outer surface, ensuring a stable fuel that will not break down or compost, has no odor, and is easy to transport
- Fuel moisture content will range between 5 and 20%[5]
- Fuel chlorine content will range from non-detect to 0.3%
- Fuel sulfur content will range from non-detect to 0.3%
- Fuel mercury content will range from non-detect to 0.3 ppm
- Additional contaminant specifications provided and discussed below
- The sulfur content remains at or above a 1:1 stoichiometric ratio with chlorine, determined by daily composite sampling

Processing

Processing is defined in 40 CFR 241.2 as operations that transform discarded NHSM into a non-waste fuel or non-waste ingredient, including operations necessary to: remove or destroy contaminants; significantly improve the fuel characteristics (e.g., sizing or drying of the material, in combination with other operations); chemically improve the as-fired energy content; or improve the ingredient characteristics. Minimal operations that result only in modifying the size of the material by shredding do not constitute processing for the purposes of the definition.

The determination of whether a particular operation or set of operations constitutes sufficient processing to meet the definition in 40 CFR 241.2 is necessarily a case-specific and fact-specific determination. This determination applies the regulatory definition of processing to the specific discarded material(s) being processed, as described in correspondence and supporting materials, taking into account the nature and content of the material, as well as the types and extent of the operations performed on it. Thus, the same operations may or may not constitute

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[4] The information provided by WM to support its position is based on the operations, and the SpecFUEL generated by those operations, at this one facility. To the extent that another facility built and operated by WM is the same as this facility—that is, the solid waste has been similarly processed, and to the extent that the SpecFUEL generated at this "other" facility meets the legitimacy criteria, including the specifications that you describe in your request, this letter would also address SpecFUEL generated at these other facilities.

[5] We note that in a discussion of differences between refuse derived fuel and SpecFUEL in the recently submitted WM document "Assessment of Potential Dioxin/Furans Emissions From Use of SpecFUEL in Selected Types of Combustion Sources" (July 12, 2013 ) WM indicated a moisture content range of 5 – 15% rather than 5 – 20 % referenced above. The discussion on pages 1 and 7 regarding maintenance of current moisture content specification of less than 15% is based on that July 12th submission.

sufficient processing under the regulation in a particular circumstance, depending on the material being processed and the specific facts of the processing. In some cases, certain operations will be sufficient to "transform discarded non-hazardous secondary material into a non-waste fuel[,]" and in other cases, the same operations may not be sufficient to do so.

As described in your letter, the SpecFUEL production process entails the use of sophisticated mechanical and spectroscopic equipment to remove contaminants from solid waste, recover the valuable fuel feedstock and improve the physical and combustion attributes of the material such that it meets unique customer specifications. The process begins when collection vehicles enter the WM facility and discharge their MSW loads onto the plant's enclosed "tipping floor." There, readily identifiable, high-quality, and safely accessible recyclable fibers (e.g., paper, cardboard) are removed, as are bulky materials deemed unsuitable for SpecFUEL (e.g., tires, mattresses, carpet). The remaining materials are then subjected to the following processing steps:

- The materials are mechanically conveyed from the tipping floor to the primary shredder, which is designed to reduce the material to a more manageable size and to homogenize and volumetrically expand the materials.

- The materials exiting the primary shredder are then conveyed beneath an over-belt magnet to begin the process of extracting ferrous metals. Throughout the system, all extraction points have over-belt magnets to extract any remaining ferrous metals contained within the material stream.

- The material stream then enters an organics screening process that eliminates materials less than 2 inches. About 90-plus percent of this screened material is organic (e.g., food and yard waste) and it represents about 20-30 percent of the total in-bound raw material stream.

- Remaining material then enters a multiple-stage air classification system, designed to mechanically separate the material by weight density and categorically produce distinct streams of heavy weight materials, medium weight materials, and light weight materials. After passing under an over-belt magnet to extract any ferrous metals, the heavy weight material (primarily inert waste) is disposed of.

- Sequential air classifiers separate the remaining material into selected weight densities based on air flows, residence time and material recirculation. The equipment operators can select material for recirculation and can move material from one classifier to another to more closely monitor and control the materials that exit the classifier system.

- Medium and light weight materials exiting the air classification system are discharged onto two exclusive conveyor lines. This material is evenly distributed across the working width of the conveyor belts, and after once more being screened for metals using additional over-belt magnets and eddy currents (to remove non-ferrous metals), the materials are fed into the spectroscopic sorting system.

- A spectroscopic analyzer uses a near infrared (NIR) camera/hyper spectral imaging (HIS) system to detect and eject unwanted PVC plastics.

- Specific conveyor lines are selected to proportionally co-mingle specific materials to achieve fuel tuning based on customer specifications for heat content and biogenic composition. High speed shredders then further reduce the material size and homogenize the final proportionate blend of material components prior to manufacturing the final SpecFUEL product.

- Finally, materials are staged and dried as needed, after which conveyor systems, a tramp separator to extract inert fines, air cyclones and pelletizers blend and compact the materials into uniform pellets.[6]

Based on this description, we believe your operations meet the definition of processing in 40 CFR 241.2 and will transform waste materials into a processed, non-waste fuel. The near infrared camera/hyper spectral imaging system that detects and ejects unwanted PVC plastics is clearly more than the "minimal operations" described in the Part 241 processing definition.[7] In addition, as you noted in the supplemental information, the waste that is processed transforms the SpecFUEL into a product fuel that is largely homogenous, has moisture and ash contents within specified limits (2-15%), and can be customized per individual customer specifications In addition, SpecFUEL's composition of suitable fuel materials is at least 99 percent and has only trace levels of certain contaminants (e.g., less than 3,000 ppm chlorine, less than 3,000 ppm sulfur).

Legitimacy Criteria

Under 40 CFR 241.3(d)(1), the legitimacy criteria for fuels include: 1) management of the material as a valuable commodity based on the following factors—storage prior to use must not exceed reasonable time frames, and management of the material must be in a manner consistent with an analogous fuel, or where there is no analogous fuel, adequately contained to prevent releases to the environment; 2) the material must have a meaningful heating value and be used as a fuel in a combustion unit that recovers energy; and 3) the material must contain contaminants at levels comparable to or less than those in traditional fuels which the combustion unit is designed to burn.

**Manage as a Valuable Commodity**

The finished product SpecFUEL is stored indoors and generally shipped to the customer within one to three days via truck or rail. Purchasing customers store SpecFUEL in dedicated areas and generally use the fuel within 24 hours. The finished product is sold as a commodity fuel under contractual agreements between WM and its customers and SpecFUEL is manifested, shipped and delivered to customers in the same manner as any traditional fuel.

Based on this information, we agree that SpecFUEL will be managed as a valuable commodity by WM after it is produced, and we agree that storage—before and after delivery to customers—will not exceed reasonable time frames.[8]

**Meaningful Heating Value and Used as a Fuel to Recover Energy**

Regarding the second legitimacy criterion, you provided results from sampling and analysis of SpecFUEL over a five day production period. The data showed an average heat content of 9,260 Btu/lb (moisture free), with a standard deviation of 280 Btu/lb. You also state that the overall range of heating value can vary from 7,500 to 11,000 Btu/lb based on the proportional mix of paper and plastic, moisture limits, and the stability of the pellets.

[6] In the supplemental information provided on August 3, 2012, you noted that enhancing agents such as calcium hydroxide for acid gas scrubbing, or lignin to adjust fuel oxidation rate and improve handling, could be added to SpecFUEL upon customers' request.

[7] Prior to completion of the processing of the waste, these materials are considered solid waste and are subject to appropriate federal, state, and local regulations.

[8] While not directly relevant to this criterion, the information provided indicated that once the waste arrives at the facility, all of the processes occur in an enclosed facility. Specifically, the facility's receiving area is enclosed with an impervious material tipping floor to keep materials dry and well contained, and to ensure that the waste materials and liquids are controlled to prevent runoff. You also note that keeping the moisture content of the incoming waste materials as low as possible is important to improve material handling.

As the Agency stated in the preamble to the NHSM final rule, NHSMs with an energy value greater than 5,000 Btu/lb, as fired—different than moisture free—are considered to have a meaningful heating value.[9] According to your specifications, SpecFUEL can have moisture levels less than 15 percent. Assuming a 15 percent moisture level, SpecFUEL would still have an as-fired heating value between 6,375 and 9,350 Btu/lb. Thus, we believe that SpecFUEL meets the meaningful heating value criterion.

**Comparability of Contaminant Levels**

Regarding the third legitimacy criterion, you indicated that SpecFUEL is a precisely engineered material and, thus, you would expect SpecFUEL to have significantly lower variability than is naturally found in traditional fuels. Overall, you have indicated both in the materials you have provided to the Agency and in meetings with EPA representatives that the operations employed to manufacture SpecFUEL ensure a homogenous product. Thus, you would expect this contaminant comparison to be representative of all SpecFUEL, regardless of when it is manufactured.

A direct contaminant-to-contaminant comparison is attached in Tables 1A and 1B. Based on this contaminant-to-contaminant comparison, all contaminants in SpecFUEL are comparable to or lower than those contaminants in both coal and wood/biomass with the exceptions of antimony, fluorine, and bis(2-ethylhexl)phthalate. The latter is a synthetic chemical commonly referred to as DEHP and is used as a plasticizer in plastics, resins, consumer products, and building materials.

To address these three contaminants, you analyzed each as part of a group of contaminants—antimony as a low-volatile metal (along with arsenic, beryllium, chromium, cobalt, manganese, and nickel); fluorine as a halogen (along with chlorine); and DEHP as a semi-volatile organic compound (along with naphthalene and other polycyclic aromatic hydrocarbons (PAHs)). For each contaminant group, you indicated that the total concentrations in SpecFUEL are comparable to or lower than those in coal and, thus could replace coal in those facilities designed to burn coal.

EPA previously stated that for the purposes of contaminant comparisons, it could be appropriate to group contaminants sharing physical and chemical properties that influence behavior in the combustion unit prior to the point where emissions occur. Semi-volatile organic compounds (SVOC) are one such group. Although the Agency did not include low-volatile metal or halogen groups in its sample approach, persons were advised that they may consider other groupings they can show are technically reasonable.[10]

Based on the information provided, we agree that, *in your specific situation*, grouping low-volatile metals and grouping total halogens are both reasonable.[11, 12] Contaminants within each group share key physical and chemical properties and would be expected to behave similarly in a combustion unit. With regard to low-volatile metals, the Agency notes that, relative to other contaminants, a significant portion can be expected to remain in the bottom ash after combustion. With regard to the halogens, chlorine and fluorine predominantly form acid

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[9] See 76 FR 15541, March 21, 2011. Also see 76 FR 15482: "Except as otherwise noted, to satisfy the meaningful heating value criterion, the non-hazardous secondary material must have at least 5,000 Btu/lb, as fired (accounting for moisture), since the as-fired energy content is the relevant parameter that must be assessed to determine if it is being discarded rather than used as a fuel for energy recovery."

[10] See, for example, 76 FR 80477.

[11] While the agency does not consider the grouping of *total metals* to be appropriate, it may consider a group of low-volatile metals to be appropriate for combustion units and operating conditions that lead those metals to concentrate in the bottom ash during combustion. See 78 FR 9147.

[12] This interpretation is restricted to this specific situation (and other similar situations) to prevent a general low-volatile metals group from allowing NHSM to have significantly higher levels of known human carcinogens than traditional fuels. Nickel and manganese generally act as low-volatile metals, and their much higher concentration in solid traditional fuels relative to arsenic and chromium would otherwise make such a result possible.

gases HCl and HF, respectively, during the combustion process, and these pollutants would be captured by the same air pollution control devices. Furthermore, the Agency notes that for the two known human carcinogens in the low-volatile metals group—arsenic and hexavalent chromium—SpecFUEL contains, on average, significantly less arsenic than coal, and chromium levels are comparable to and well within the range of coal.

Attached, Table 2 provides grouping data for a comparison of low-volatile metals (including antimony); Table 3 provides grouping data for a comparison of total halogens (including fluorine); and Table 4 provides grouping data for a comparison of semi-volatile organic compounds (including DEHP).

The data show that, for of each of the three groups of contaminants, the range of the totals present in SpecFUEL is within the range found in coal. SpecFUEL also compares favorably when compared to wood/biomass for both low-volatile metals and total halogens, with the range of contaminant concentrations in SpecFUEL within the range found in clean wood and biomass materials. Semi-volatile organic compounds found in SpecFUEL do not, however, appear to be comparable to or lower than those compounds found in clean wood and biomass. As indicated in Table 4, EPA does not have data for DEHP or PAHs (the SVOCs in question) in clean wood and biomass, but this is predominantly because neither is expected to be present. Thus, SpecFUEL would likely not meet the contaminant legitimacy criterion for a combustion unit designed to burn only biomass. We note, however, that a combustion unit that burns biomass, but could also burn coal, would meet this criterion. Such a unit is "designed to burn" coal and, thus, may use coal as the traditional fuel with which to make contaminant comparisons.

The conclusion that SpecFUEL meets the contaminant legitimacy criterion for units designed to burn coal assumes that SpecFUEL was tested for any contaminant expected to be present. Additional contaminants for which SpecFUEL was not tested must be present at levels comparable to or lower than those in the appropriate traditional fuel, based on your knowledge of the material.

Conclusion

Overall, based on the information provided, we believe that SpecFUEL, as described in your letter and supplemental information, meets both the processing definition and the legitimacy criteria outlined above provided the specifications in your request are maintained, including, but not limited to, the moisture and ash content are maintained at 15% or less, the chlorine remains less than 0.3% and the sulfur content remains at or above a 1:1 stoichiometric ratio with chlorine, determined by daily composite sampling. Since our assessment is based on information you provided showing that SpecFUEL meets certain specifications/conditions, our decision is based on the maintenance of the specifications/conditions in the SpecFUEL product. These specifications/conditions will ensure the consistency and homogeneity of the fuel product and that it will not contain waste materials for combustion, including contaminant levels that exceed those comparable to those typically found in traditional fuels. Accordingly, we would consider this NHSM a non-waste fuel (as described in this letter) under the 40 Part 241 regulations.

If you have any other questions regarding the applicability of Clean Air Act emissions to SpecFUEL, please contact David Cozzie at (919)541-5356. For questions regarding processing and legitimacy criteria, please contact George Faison of my staff at (703) 305-7652.

Sincerely,

Barnes Johnson

Barnes Johnson, Acting Director
Office of Resource Conservation and Recovery

Enclosure

cc: Mr. Peter Tsirigotis
EPA Office of Air Quality Planning and Standards

## Enclosure

## Table 1A: Contaminant-by-Contaminant Comparison, Elemental Contaminants

| Contaminant | Units | SpecFuel: Range[1] | Wood / Biomass: Range[2] | Coal: Range[2] | Results of Comparison |
|---|---|---|---|---|---|
| Metal Elements - dry basis | | | | | |
| Antimony (Sb) | ppm | 16.9 - 51.4 | ND - 26 | ND - 10 | Not comparable to wood or coal |
| Arsenic (As) | ppm | ND - 0.61 | ND - 298 | ND - 174 | Lower than wood & coal |
| Beryllium (Be) | ppm | ND | ND - 10 | ND - 206 | Lower than wood & coal |
| Cadmium (Cd) | ppm | 0.34 - 1.37 | ND - 17 | ND - 19 | Lower than wood & coal |
| Chromium (Cr) | ppm | 10.3 - 20.6 | ND - 340 | ND - 168 | Lower than wood & coal |
| Cobalt (Co) | ppm | 0.78 - 1.38 | ND - 213 | ND - 25.2 | Lower than wood & coal |
| Lead (Pb) | ppm | 12.3 - 45 | ND - 229 | ND - 148 | Lower than wood & coal |
| Manganese (Mn) | ppm | 34 - 47.2 | ND - 15800 | ND - 512 | Lower than wood & coal |
| Mercury (Hg) | ppm | 0.05 - 0.28 | ND - 1.1 | ND - 3.1 | Lower than wood & coal |
| Nickel (Ni) | ppm | 1.72 - 7.24 | ND - 540 | ND - 730 | Lower than wood & coal |
| Selenium (Se) | ppm | 1.03 - 1.28 | ND - 9.0 | ND - 74.3 | Lower than wood & coal |
| Non-metal elements - dry basis | | | | | |
| Chlorine (Cl) | ppm | 1840 - 2250 | ND - 5400 | ND - 9080 | Lower than wood & coal |
| Fluorine (F) | ppm | 585 - 1070 | ND - 300 | ND - 178 | Not comparable to wood or coal |
| Nitrogen (N) | ppm | 4300 - 6800 | 200 - 39500 | 13600 - 54000 | Lower than wood & coal |
| Sulfur (S) | ppm | 1470 - 2100 | ND - 8700 | 740 - 61300 | Lower than wood & coal |

**Notes:**

1. SpecFUEL range represents five samples taken on different days in January 2012, provided by Waste Management on March 16, 2012.
2. Ranges for Wood & Biomass Materials and Coal from a combination of EPA data and literature sources, as presented in EPA document *Contaminant Concentrations in Traditional Fuels: Tables for Comparison, November 29, 2011*, available at www.epa.gov/epawaste/nonhaz/define/index.htm.

## Table 1B: Contaminant-by-Contaminant Comparison, HAP Compounds

| Contaminant | Units | SpecFuel: Range[1] | Wood / Biomass: Range[2] | Coal: Range[2] | Results of Comparison |
|---|---|---|---|---|---|
| Volatile Organic Compounds (VOC) | | | | | |
| Ethyl benzene | ppm | 0.038 - 0.055 | No Data | 0.7 - 5.4 | Lower than coal |
| Formaldehyde | ppm | 3.30 - 6.30 | 1.6 - 27 | No Data | Lower than wood |
| Isopropylbenzene (Cumene) | ppm | 0.012 - 0.025 | No Data | No Data | Comparable to wood & coal [3] |
| Methylene chloride | ppm | 0.027 - 0.143 | No Data | No Data | Comparable to wood & coal [3] |
| Styrene | ppm | 0.240 - 0.422 | No Data | 1.0 - 26 | Lower than coal |
| Tetrachloroethylene | ppm | ND - 0.008 | No Data | No Data | Comparable to wood & coal [3] |
| Toluene | ppm | 0.018 - 0.089 | No Data | 8.6 - 56 | Lower than coal |
| Xylenes | ppm | 0.020 - 0.135 | No Data | 4.0 - 28 | Lower than coal |
| 21 Additional VOC [4] | ppm | ND for all 21 | No Data | ND - 38 | Lower than coal |
| Semi-Volatile Organic Compounds (SVOC) | | | | | |
| Bis(2-ethylhexyl) phthalate (DEHP) [5] | ppm | 240 - 1410 | No Data | No Data | Not comparable to wood or coal |
| PAHs [6] | ppm | 0.101 - 0.566 | No Data | 14 - 2090 | Lower than coal |
| 13 Additional SVOC [7] | ppm | ND for all 13 | No Data | No Data | Comparable to wood & coal |

**Notes:**

1. SpecFUEL range represents five samples taken on different days in January 2012, provided by Waste Management on March 16, 2012.
2. Ranges for Wood & Biomass Materials and Coal from a combination of EPA data and literature sources, as presented in EPA document *Contaminant Concentrations in Traditional Fuels: Tables for Comparison, November 29, 2011,* available at www.epa.gov/epawaste/nonhaz/define/index.htm.
3. EPA has previously stated that, where a traditional fuel contains no detectable amount of a contaminant, the NHSM may contain a minimal amount (e.g., 1 ppm) and be considered comparable. See 76 FR 15524.
4. All SpecFUEL samples tested non-detect for the following 21 VOC HAPs: Acetophenone; acetonitrile (methyl cyanide); acrolein; acrylonitrile; aniline; allyl chloride; benzene; bromoform; chlorobenzene; chloroform; chloroprene; 1,4-dichlorobenzene(p); hexachlorobutadiene; hexachloroethane; methyl methacrylate; methyl tert butyl ether (MTBE); hexane; phenol; 1,1,2,2-tetrachloroethane; 1,2,4-trichlorobenzene; and 1,1,2-trichloroethane.
5. DEHP is a synthetic plasticizer. Although EPA has no data for DEHP in wood or coal, the agency would not expect the chemical to be present in either traditional fuel.
6. Waste Management tested for 17 PAHs, with naphthalene being the only PAH detected in any sample. Non-detects included acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(a)fluoranthene, benzo(g,h,i)perylene, benzO(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, 1-methylnaphthalene, and 2-methylnaphthalene.
7. All SpecFUEL samples tested non-detect for the following 13 SVOC HAPs: biphenyl; dibenzofurans; 3,3-dichlorobenzidene; dimethyl phthalate; 2,4-dinitrophenol; 2,4-dinitrotoluene; hexachlorobenzene; hexachlorocyclopentadiene; nitrobenzene; 4-nitrophenol; pentachlorophenol; 2,4,5-trichlorophenol; and 2,4,6-trichlorophenol.

## Table 2: Contaminant Comparison, Low-Volatile Metals (LVM) Group

| Metal[1] | Units | Average | | | Range | | |
|---|---|---|---|---|---|---|---|
| | | SpecFUEL[2] | Coal[3] | Wood[3] | SpecFUEL[2] | Coal[3] | Wood[3] |
| Antimony (Sb) | ppm | 29.1 | 1.7 | 0.9 | 16.9 - 51.4 | ND - 10 | ND - 26 |
| Arsenic (As) | ppm | 0.61 | 8.2 | 6.3 | ND - 0.61 | ND - 174 | ND - 298 |
| Beryllium (Be) | ppm | ND | 1.9 | 0.3 | ND | ND - 206 | ND - 10 |
| Chromium (Cr) | ppm | 15.2 | 13.4 | 5.9 | 10.3 - 20.6 | ND - 168 | ND - 340 |
| Cobalt (Co) | ppm | 1.09 | 6.9 | 6.5 | 0.78 - 1.38 | ND - 30 | ND - 213 |
| Manganese (Mn) | ppm | 38.5 | 26.2 | 302 | 34 - 47.2 | ND - 512 | ND - 15800 |
| Nickel (Ni) | ppm | 2.86 | 21.5 | 2.8 | 1.72 - 7.24 | ND - 730 | ND - 540 |
| Total LVMs[4] | ppm | 87.3 | 79.8 | 324.7 | 70.5 - 117.9 | ND - 767 | ND - 15871 |

**Notes:**

1. Low-volatile metals identified by Waste Management, citing 40 CFR 63.1219(e)(4)—National Emission Standards for Hazardous Air Pollutants from Hazardous Waste Combustors.
2. SpecFUEL data represents five samples taken on different days in January 2012, provided by Waste Management on March 16, 2012.
3. Data for coal and wood (i.e., clean wood and biomass materials) from a combination of EPA data and literature sources, as presented in EPA document *Contaminant Concentrations in Traditional Fuels: Tables for Comparison, November 29, 2011,* available at www.epa.gov/epawaste/nonhaz/define/index.htm.
4. The high and low ends of each individual metal's range do not necessarily add up to the total LVM range. This is because maximum and minimum concentrations for individual metals do not always come from the same sample.

## Table 3: Contaminant Comparison, Total Halogens Group

| Halogen | Units | Average | | | Range | | |
|---|---|---|---|---|---|---|---|
| | | SpecFUEL[1] | Coal[2] | Wood[2] | SpecFUEL[1] | Coal[2] | Wood[2] |
| Chlorine | ppm | 2033 | 992 | 259 | 1840 - 2250 | ND - 9080 | ND - 5400 |
| Fluorine | ppm | 892 | 64 | 32.4 | 585 - 1070 | ND - 178 | ND - 300 |
| Total Halogens[3] | ppm | 2925 | 1056 | 291 | 2425 - 3320 | ND - 9080 | ND - 5497 |

**Notes:**

1. SpecFUEL data represents five samples taken on different days in January 2012, provided by Waste Management on March 16, 2012.
2. Data for coal and wood (i.e., clean wood and biomass materials) from a combination of EPA data and literature sources, as presented in EPA document *Contaminant Concentrations in Traditional Fuels: Tables for Comparison, November 29, 2011,* available at www.epa.gov/epawaste/nonhaz/define/index.htm.
3. The high and low ends of each individual halogen's range do not necessarily add up to total halogens range. This is because maximum and minimum concentrations for individual halogens do not always come from the same sample.

**Table 4: Contaminant Comparison, Semi-Volatile Organic Compounds (SVOC) Group**

| Contaminant | Units | Average | | | Range | | |
|---|---|---|---|---|---|---|---|
| | | SpecFUEL[1] | Coal | Wood[2] | SpecFUEL[1] | Coal[3] | Wood[2] |
| Bis(2-ethylhexyl) phthalate (DEHP) | ppm | 732 | No Data | No Data | 240 - 1410 | No Data | No Data |
| PAHs [4] | ppm | 0.23 | Not Available | No Data | 0.10 - 0.57 | 14 - 2090 | No Data |
| Total SVOC [5] | ppm | 732.2 | Not Available | No Data | 240 - 1411 | 14 - 2090 | No Data |

**Notes:**

1. SpecFUEL data represents five samples taken on different days in January 2012, provided by Waste Management on March 16, 2012.
2. EPA does not have data for DEHP or PAHs in wood, but concentrations for each are presumed to be zero or close to zero.
3. Data for coal comes from literature sources, as presented in EPA document *Contaminant Concentrations in Traditional Fuels: Tables for Comparison, November 29, 2011,* available at www.epa.gov/epawaste/nonhaz/define/index.htm.
4. This comparison is based on the assumption that the absence of 16 PAHs (aside from naphthalene, which was detected) for which Waste Management analyzed its SpecFUEL is indicative of the absence of additional PAHs.