All Auto Shredding: Evaluation of Automotive Shredder Residue Generated by Shredding Only Vehicles

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Executive Summary

A well developed infrastructure exists for the reuse and recycling of automotive parts and materials. At the end of a vehicle's useful life many parts are removed and sold for reuse and fluids are recovered for recycling or proper disposal. What remains is shredded, along with other metal bearing scrap such as home appliances, demolition debris and process equipment, and the metals are separated out and recycled. The remainder of the vehicle materials is call shredder residue which ends up in the landfill.

As energy and natural resources becomes more treasured, increased effort has been afforded to find ways to reduce energy consumption and minimize the use of our limited resources. Many of the materials found in shredder residue could be recovered and help offset the use of energy and material consumption. For example, the energy content of the plastics and rubbers currently landfilled with the shredder residue is equivalent to 16 million barrels of oil per year. However, in the United States, the recovered materials, primarily polymers, cannot be recycled due to current regulatory barriers which preclude the re-introduction into commerce of certain materials because of residual contamination with substances of concern (SOCs) such as polychlorinated biphenyls (PCBs).

The source of the PCBs is not well understood. Old transformers, capacitors, white goods and ballasts from lighting fixtures are likely contributing factors. The project was designed to evaluate whether vehicles of varying age and manufacturing origin contribute to the PCB content in shredder residue. Additionally, the project was designed to determine if there are any trends in material composition of the shredder residue from varied age and manufacturing groups. This information would aid in future material recovery facility strategy and design.

The test utilized a newly installed shredder plant to shred four categories of automobiles. The categories were defined by vehicle age and the manufacturing company and location. Each category of vehicles was processed individually through the shredder plant and the resulting shredder residue was analyzed for its materials composition and presence of PCBs and leachable metals

The results show that shredder residue from all vehicle categories tested are not significant contributors of PCBs and leachable metals. It was evident that leachable cadmium levels have decreased in newer vehicles. The composition of the shredder residue from each of the four categories is similar to the others. In addition, these compositions are approximately equal to the composition of typical shredder residues, not limited to automotive materials.

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Table of Contents 2

List of Figures

List of Tables

1. Introduction

1.1. Objectives

The objectives of this project are:

1. Analyze and evaluate the composition of shredder residue generated during the shredding and recycling of four distinct categories of automobiles with no other source materials mixed with the vehicles. Specific vehicles included in each of the categories are listed in Appendix A.

2. Conduct TCLP and PCB analyses on the resulting shredder residues from the four vehicle categories; late model domestic, late model transplant, normal end-of-life and late model import vehicles.

1.2. Background

The current infrastructure for vehicle recycling includes de-polluting, dismantling to retrieve useable or remanufacturable parts for resale, followed by shredding for metals recovery. The typical de-polluting process for a vehicle involves removal of the battery, mercury switches, air conditioning refrigerant, gasoline and other fluids. Tires are often removed and air bags are sometimes deployed as well. Removal of parts for reuse or remanufacturing is driven by market demand. Typical parts that are removed include engines, transmissions, body panels, interior items and even entire vehicle sections including frames and structural body pillars. What remains of the vehicle after these phases is the hulk. The hulk is sent to a shredder where it is fed, along with other metal bearing scrap including home appliances, demolition debris and process equipment, to a large hammermill that reduces the vehicle into pieces the size of a person's fist. This scrap is then processed to separate out the ferrous and non-ferrous metals. What remains is the shredder residue which goes to landfill.

Considerable work has been performed to extract recyclable materials from this waste stream. However, in the United States, the recovered materials, primarily polymers, cannot be recycled due to current regulatory barriers which preclude the re-introduction into commerce of certain materials because of residual contamination with substances of concern (SOCs) such as polychlorinated biphenyls (PCBs).

Historically, shredder residue contains various SOCs, including PCBs. The source of the PCBs is not well understood. Old transformers, capacitors, white goods and ballasts from lighting fixtures are likely contributing factors. The project was designed to evaluate whether vehicles of varying age and manufacturing origin contribute to the PCB content in shredder residue.

Additionally, the project was designed to determine if there were any trends in material composition of the shredder residue from varied age and manufacturing groups. This information would aid in future material recovery facility strategy and design.

2. Facility Selection

A shredder facility, Garden Street Iron and Metal, in Fort Meyers, Florida was in its planning stages at the time the test was being planned. The owner of the shredder was interested in the test and offered to let his new facility be used for the test once it had been built. It was hoped that the vehicles for this test would be the first material that the facility would process, but it quickly became apparent that that would not be possible. The start-up and debug of the facility required various feed materials and a quantity of material needed to be processed just to get the equipment operating properly. Still, this would be the cleanest shredder the test would ever be able to take place.

The shredder facility had an automotive dismantler on the same property. This facility was used to purchase and process all of the vehicles for the test. The vehicles were grouped into their respective categories as the vehicles were obtained. The vehicles were not crushed so they could be inspected prior to the test. All vehicles were drained of their fluids, tires and rims were removed and mercury switches taken out. All items that did not belong to the vehicle were removed.

The four categories were:

- Late Model “Big 3”, (2000-2005 models)
- Late Model “Transplant”, (2000-2005 models)
- “Normal-aged” Domestic, (pre-2000 models)
- Late Model “Import”, (2000-2005 models)

The Late Model “Big 3” and “Normal-aged” Domestic categories included Ford, GM and Chrysler vehicles that were built in North America. “Transplant” vehicles included autos manufactured by foreign companies that were built in North America specifically for use in the United States. Late Model “Import” vehicles were built outside of North America.

3. Test Planning

Four categories of vehicles, with 40 vehicles in each category, were used for comparison. The test took place in a newly installed shredding facility with relatively clean equipment, grounds and surroundings. This is an exception to a normal shredding plant. The vehicles were manually inspected and all foreign, "non-auto" materials were removed. The vehicles used for this test were specifically chosen to make sure that damage did not prohibit inspection of the vehicles, see Figure 1 below. This would not be feasible for vehicles that have been damaged in a collision or flattened for transportation. There is also cost that will be attributed to the time it takes for a worker to thoroughly go through a vehicle. In addition, the vehicles chosen for this test were only a select few. The oldest vehicle was a 1983 model year; after the ban on PCBs had already taken place. There are still pre-ban vehicles being shredded today. Also, since the test was limited to the number of vehicles it could shred, many manufacturers were not included in the test.

Figure 1. Vehicle Storage Area before the Test. Note the minimal damage to the vehicles.

Each category was fed separately through the shredding plant and all output material streams were kept separate from one another. The shredder residue from each category was analyzed for TCLP (Metals), PCBs and material composition. Shredder residue consisted of two fractions: a coarse fraction (between 12 mm and 6 inches) and a fine fraction (smaller than 12 mm). Tree limbs were used as a separator material between each category to purge and clean the system of residual materials.

The TCLP and PCB analyses were performed by W. Z. Baumgartner and Associates, Inc. Argonne National Laboratory determined the material composition of the coarse shredder residues. Energy Anew, Inc. determined the material composition of the fine shredder residues (fines) fraction.

4. Test and Evaluation Procedures

Before the vehicle shredding began, swipe samples were taken by W. Z. Baumgartner and Associates, Inc. from various parts of the shredding equipment. Swipe samples were also taken from heavy mobile equipment and the floor of the dismantling area. These swipe tests were used to determine if anything was contaminated with PCBs before the test was started.

All of the actual vehicle shredding was completed in one day. First, the shredder equipment was started up and ran until no more residual debris was left in the system. The entire grounds were then cleaned of all materials from previous operation. A load of tree limbs was fed into the shredder and allowed to travel through the system. This was done to help remove debris remaining in the equipment and to provide a visual aid in identifying when all of debris had run out of the system. The wood shred was then removed and the Late Model "Transplant" vehicle category was fed to the shredder. Samples of the fine and coarse residues were obtained for PCB analysis during the discharge of the material from the system. At the conclusion of the category the fines and coarse residues were set aside. All of the bunkers were cleaned out and another round of tree limbs was fed to the shredder. The wood shred was removed from the bunkers and the next category of vehicles, Late Model "Big 3", were fed to the shredder. The same procedures were used for this category as well as for the "Normal-aged" Domestic and Late Model "Import" vehicle categories.

The day after the test, samples of the coarse shredder residues were put into gaylord boxes and prepared for shipment to Argonne. Samples of the fines were put into bins and prepared for shipment to Energy anew.

5. Results

5.1. Material Separation at the Shredder Plant

A general flowchart of the shredder's plant is shown in Figure 2. The basic operations of the plant include shredding, magnetic separation of the ferrous materials, trommeling to separate materials by size (for improved separation efficiencies downstream), non-ferrous metal recovery, and stainless steel recovery.

The steel shred and non-ferrous metal fractions generated by the system are usually sold as-is. The trommel ferrous material is produced by a magnetic head pulley on the conveyor feeding the trommel and contained just over 50% ferrous metal. This ferrous rich material can be re-fed to the front end of the system in order to recover the ferrous metals in this fraction. The >6 inch trommel material is that which is larger than the 6 inch holes in the trommel and therefore falls off the end of the trommel barrel. The stainless metal fraction is generated by a piece of equipment which detects metals on a moving belt and then ejects them from the other material using high pressure air jet pulses. The composition of the trommel ferrous, >6 inch trommel material and stainless metal fractions are presented in section 4.4. of this report.

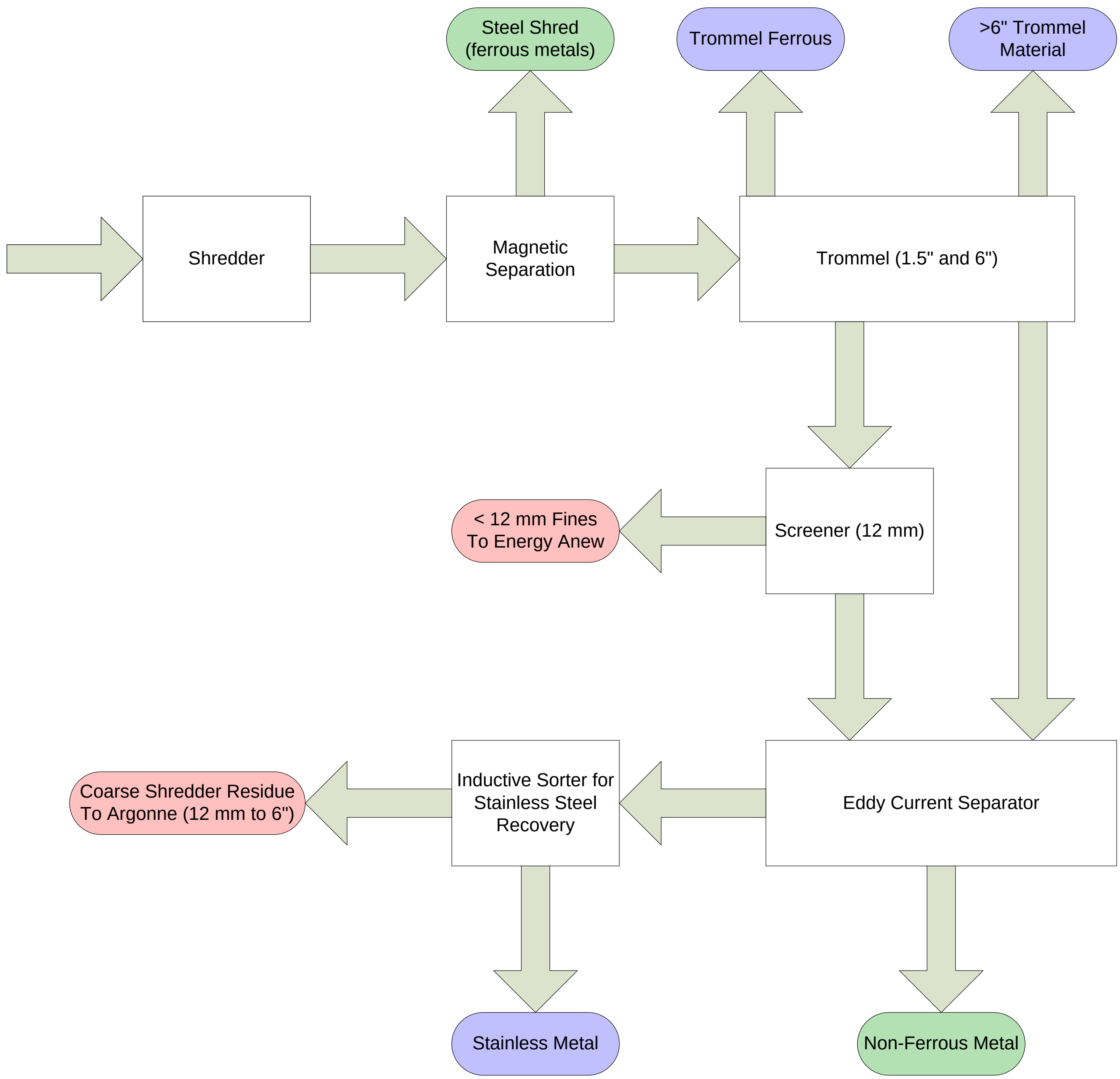


Figure 2. Simplified Flow Chart of the Shredder Facility.

The weights of the output streams for this test are shown in Table 1. The weight of the feed material was obtained by driving the vehicles, loaded on a flatbed trailer, over a truck scale. The weight of the recovered ferrous fraction was obtained using a belt scale. The non-ferrous fraction was weighed using the truck scale. All other fractions were weighed using a scale on a front end loader. The measurements were approximate so caution should be taken regarding the accuracy of the values. The non-ferrous fraction from the Late Model Imports category was inadvertently dumped before a weight was obtained. Also, the percentage of ferrous metal from the Late Model Big 3 is abnormally high while that of the Late Model Transplant is abnormally low. The reason for this is unknown, but the two weights may have potentially been switched. This would generate more reasonable percentages. The weight of the coarse shredder residue is very dependent upon moisture content. Because the amount of water injected into the shredder is highly variable the moisture content of the shredder residues varies. The roll-off values in Table 1 show weights after they had been sitting for several months. This would have allowed the moisture content in the roll-offs to equalize to some degree. The weights of the >6 inch trommel material were obtained by taking the total weight of all of this material throughout the entire test and dividing proportionally among the categories.

Table 1. Weights of the Different Fractions Encountered in the Shredding and Separation Processes of the Different Vehicle Categories.

	Late Model Big 3		*Late Model Transplant*		*Pre-2000 Domestic ELV*		*Federalized Imports*		
	Weight	**Percentage**	**Weight**	**Percentage**	**Weight**	**Percentage**	**Weight**	**Percentage**	**Average**
Feed	126,400		105,320		123,920		112,440		
Steel Shred (ferrous metal)	76,000	60%	84,000	80%	86,000	69%	76,000	68%	69%
Trommel Ferrous	12,200	10%	12,000	11%	13,400	11%	10,200	9%	10%
>6"Trommel Output	1,250	1.0%	1,050	1.0%	1,230	1.0%	1,110	1.0%	1%
<12 mm Bivi-tec Fines (total)	2,798	2.2%	2,696	2.6%	3,099	2.5%	3,040	2.7%	2%
Bunker	*2,526*		*2,415*		*2,826*		*2,766*		
Energy Anew	*249*		*260*		*245*		*248*		
Argonne	*23*		*21*		*28*		*26*		
Eddy Current Non-Ferrous	5,540	4.4%	4,320	4.1%	4,400	3.6%		0.0%	3%
Long Throw Non-Ferrous	1,380	1.1%	980	0.9%	1,060	0.9%	1,090	1.0%	1%
Induction Sorter Stainless	1,200	0.9%	1,520	1.4%	3,000	2.4%	1,640	1.5%	2%
Coarse Shredder Residue (total)	20,400	16.1%	17,800	16.9%	19,600	15.8%	21,000	18.7%	17%
Roll-off	*11,360*		*11,100*		*13,020*		*12,760*		
Remainder	*4,400*		*5,320*		*2,360*		*6,640*		
Energy Anew	*991*		*249*		*404*		*294*		
Argonne	*3,640*		*1,179*		*3,777*		*1,259*		

5.2. Composition of the <12 mm Fine Shredder Residue

The fines fraction was generated using a Bivi-tec screener with a 12 mm perforated screen. A picture of the screener is shown in Figure 3. This fraction was sent to Energy Anew, Inc. for processing, and ultimately for determination of its material composition. A separate report was generated by Energy Anew, Inc. The information here was taken from that report.

The <12 mm fines represent an average of about 2.5% of the feed material entering the shredder. Table 2, from Energy Anew's report (Allen, 2009), shows the composition of this material from the various vehicle categories.

Figure 3. Picture of the Bivi-tec Screener Utilizing a 12 mm Perforated Screen

Table 2. Material Composition of the Fine Shredder Residue Fraction by Vehicle Grouping (Taken from the Energy Anew Report-Appendix B) (Allen, 2009)**.**

Material Composition by Vehicle Grouping and Size Range					
<12mm (Fines)	Big 3	Transplant	Pre-2000 Domestic	Import	Average
Fluff, Fines, Dust	22.0%	22.2%	19.8%	19.7%	21%
Weak Fe/SS/rusty fluff	11.6%	20.6%	16.1%	11.9%	15%
Polyolefin Concentrate	NA	NA	NA	NA	NA
Styrenic Polymer Conc.	NA	NA	NA	NA	NA
Mixed Polymer	43.1%	39.7%	47.9%	49.9%	45%
Glass/Rock/ Heavy Polymer	5.2%	3.5%	5.7%	6.0%	5%
Mixed Metal	6.3%	4.6%	5.3%	5.8%	5%
Other(proc. loss/moisture)	11.8%	9.5%	5.2%	6.8%	8%
	100.0%	100.0%	100.0%	100.0%	100%

[Note: The Polyolefin Concentrates and Styrenic Polymer Concentrate are designated as "NA" because "No polyolefin or styrenic polymer concentrate could be produced from the finest fraction because the fraction contained an insufficient quantity to create an acceptable concentrate" per Energy Anew's report.]

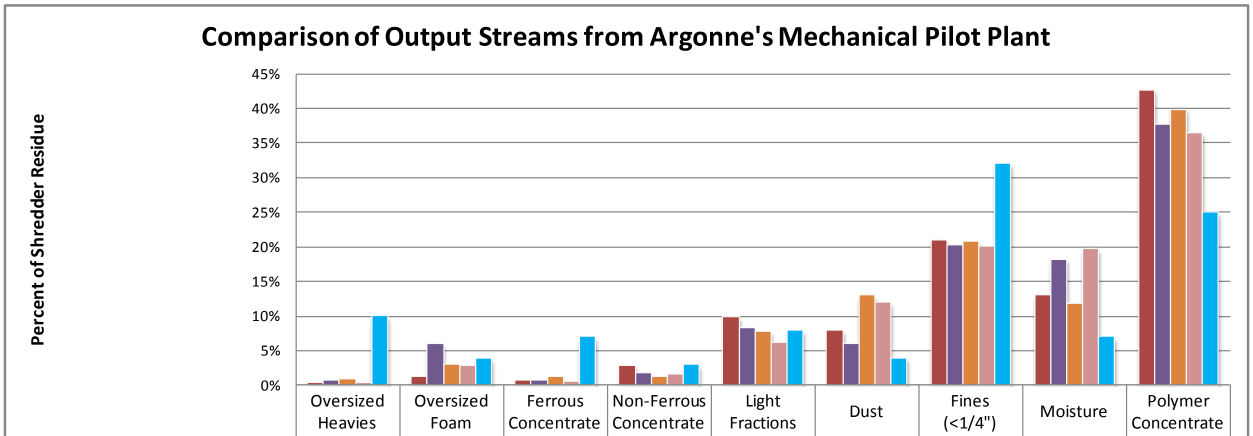
5.3. Composition of the Coarse Shredder Residue

The coarse shredder residue was the "non-metallic" residue, between 12 mm and 6 inches, remaining after the metal removal and screening operations were performed. This fraction represented about 17% of the feed material. This material was sent to Argonne National Laboratory for processing, and ultimately, for determination of its composition.

The material shipped to Argonne was processed in Argonne's pilot plant which consists of two stages. The first stage is a mechanical process that separates the shredder residue into several fractions. One of the fractions, the polymer concentrate, is then fed to the next stage of the process which separates the polymers into concentrated, compatible fractions.

All four categories of vehicles were processed through the mechanical system. The output fractions of each category are summarized in Figure 4. The "Oversized Heavies" fraction shown in Figure 4 was hand-picked and contained large pieces of metal and other hard objects which would potentially damage downstream equipment. The "Oversized Foam" was hand-picked as well. This material was seat foam and was removed due to its tendency to slow the throughput of the installed shredder. The "Ferrous Concentrate" was separated using a magnetic head pulley and contained about 90% ferrous metal. The "Non-Ferrous Concentrate" was recovered using an eddy current separator. This material, which is predominately aluminum, varied from 23% metal content in the Late Model Transplant category to 62% in the Normal Domestic ELV category. Typically, the ferrous fraction was 1% of the shredder residue by weight and the non-ferrous was about 2% on average. A little less than 10% of the shredder residue reported as a "Light Fraction". This fraction includes materials such as foam and fiber. Dust collectors were emptied at the end of processing each category and this material was about 10% of the shredder residue in each of the categories. The moisture content of the shredder residue was determined by moisture loss through heating 10 to 15 gallon samples of the as-received residues in a large oven set to 200 ºF.

A <1/4 inch fines fraction consistently accounted for about 20% of the shredder residue. The largest quantity of the shredder residue from each category reported to the "Polymer Concentrate" fraction. This fraction, amounting to roughly 40% of the coarse residue fed to the system, contains many different types of polymers, including different plastics and elastomers. It also contains small amounts of glass, rock, wood, foam, metal, and other materials. Though there is a slight difference in weight percent between the categories, the amount of polymer concentrate is roughly the same.



	Oversized Heavies	Oversized Foam	Ferrous Concentrate	Non-Ferrous Concentrate	Light Fractions	Dust	Fines (<1/4")	Moisture	Polymer Concentrate
Late Model Big 3 % of ASR	0.3%	1%	1%	3%	10%	8%	21%	13%	43%
Late Model Transplant % of ASR	1%	6%	1%	2%	8%	6%	20%	18%	38%
Normal Domestic ELV % of ASR	1%	3%	1%	1%	8%	13%	21%	12%	40%
Late Model Federalized % of ASR	0.4%	3%	1%	2%	6%	12%	20%	20%	36%
Typical Shredder Residue*	10%	4%	7%	3%	8%	4%	32%	7%	25%

* - Moisture and dust were recorded together as a loss for the typical shredder residue data. To better compare the five categories the loss of 11% was therefore separated into dust and moisture in a proportion equal to the average of the four vehicle categories.

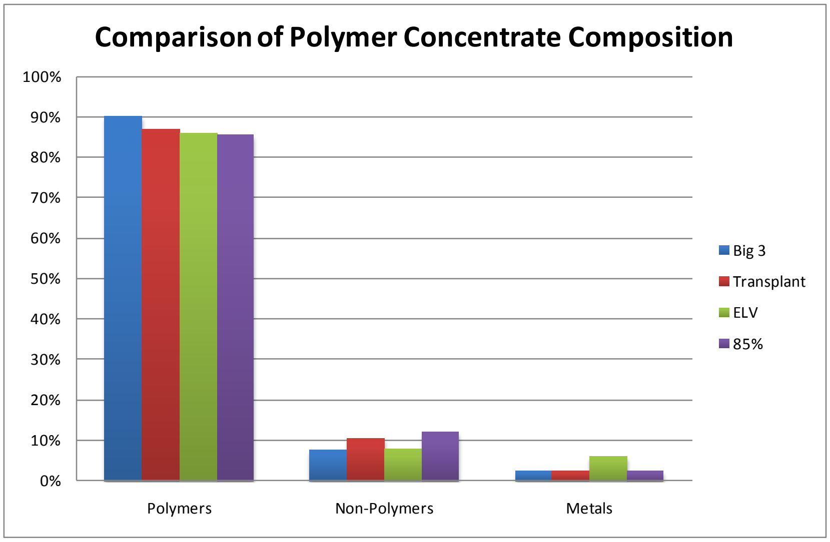
Figure 4. Output Streams from Argonne's Mechanical Pilot Plant

The shredder residue compositions of the four categories generated in Argonne's pilot plant are only slightly different from that of "typical" shredder residues processed through the same pilot plant. The fractions showing the most difference were the Polymer Concentrates, Oversized Heavies, Ferrous Concentrates and Fines. The Polymer Concentrate generated from strictly automotive residues was on the higher end of percentages seen from "typical" shredder residues. This is due to the fact that automobiles contain a high percentage of polymers compared to most other metal bearing scrap that is fed to a shredder. The decrease seen in the Oversized Heavies and Ferrous Concentrates are likely due to the larger sized metal chunks generated by industrial metal scrap. It is typical to see large knuckles and gears in "typical" shredder residue because it is difficult for magnets to suspend the large pieces due to their large mass and spherical type shapes. The average percentages of the Oversized Heavies and Ferrous Concentrates in "typical" shredder residues processed through Argonne's pilot plant are 9% and 8%, respectively. The larger percentage of Fines in the "typical" shredder residue, averaging 32%, is because of two factors. One being that the <12 mm fraction is present in the typical shredder residue while it is absent for the vehicle categories. The other is that the feed material typically seen by shredders usually contains dirt, rock, and gravel while the vehicles used for this test were relatively clean and free of this type of material

5.3.a. Composition of the Polymer Concentrate

Analysis of the polymer concentrate was performed on all four categories. Figure 5 shows that the relative amount of polymer, non-polymer, and metal is about the same among the categories. Polymer concentrates generated in Argonne's pilot plant using "typical" shredder residue contained the same ranges of materials. One hundred pieces of polymer were randomly chosen from each category and scanned using FTIR analysis. The results are shown in the second chart of Figure 4.

The polymer concentrates generated in Argonne's pilot plant while processing "typical" shredder residues contained the same polymers as the auto-only polymer concentrate. The most notable differences in quantities were in the amount of rubber and polypropylene. The "typical" shredder residues generally contain between 20% and 40% rubber while the polymer concentrates from this test contained from 7% to 17%. The tires for this test, which generally account for 3-5% of a car's mass, were removed. The large increase in polypropylene with the auto-only polymer concentrates is because these are very commonly used plastics in vehicles. In fact, polypropylene, primarily filled polypropylene, is replacing other polymers in newer vehicle applications. Typical shredder residue polymer concentrates produced in Argonne's pilot plant contain an average of 11% polypropylene.



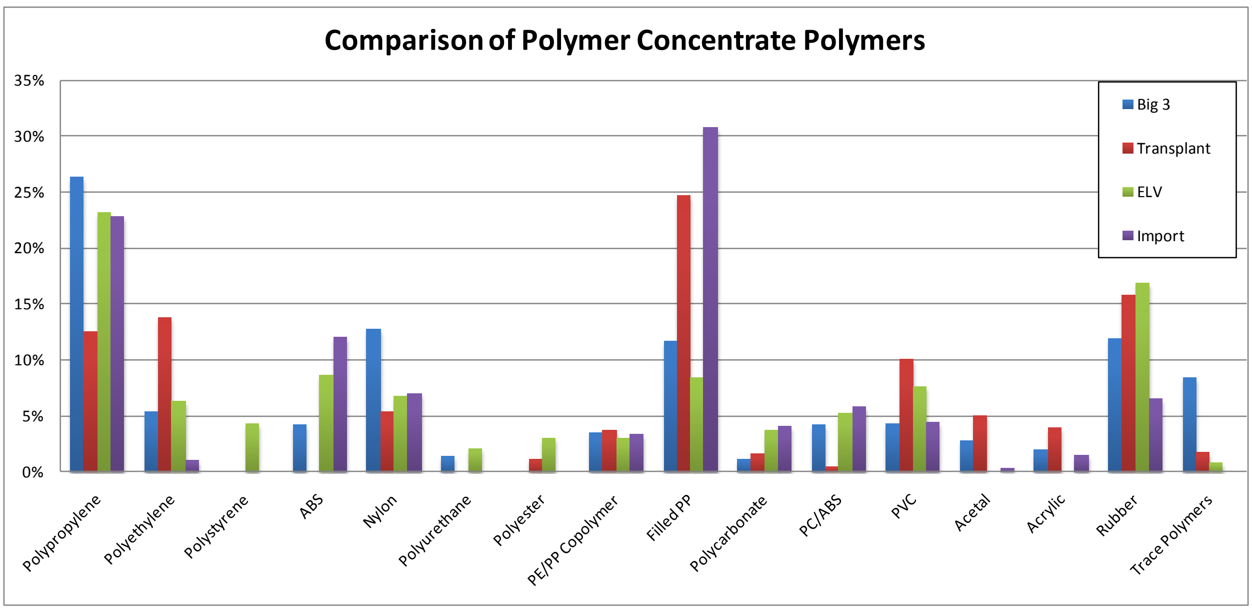


Figure 5. Composition of the Polymer Concentrate and Polymers in the Polymer Concentrate Generated from each of the Four Categories

5.3.b. Polymer Concentrate Separation

The polymer concentrate from the Late Model Big 3 and Normal ELV categories were processed in Argonne's wet based sink-float/froth flotation pilot plant. The process uses a series of sink/float style tanks to achieve polymer separations. The first tank separates out a polyolefin concentrate fraction. This fraction, which is usually between 60% and 75% olefin, was then purified in another Argonne process. This process produced a 92% and 95% pure olefin product for the Late Model Big 3 and Normal ELV categories, respectively. The amount of olefin product produced was 10% of the coarse shredder residue for the Late Model Big 3 category, but only 7% for the Normal ELV category. Though this was a relatively small quantity of material to process, it is apparent that the recoverable olefins are of greater quantity in the newer vehicles.

The material which sank in the first tank was then processed in another tank which targets a styrenics concentrate. The material separated out contained 32% styrenics plastics from the Late Model Big 3 category and 36% from the Normal ELV. The plastics considered to be styrenics include polystyrene, acrylonitrile-butadiene-styrene (ABS) and polycarbonate/ABS alloys. Further purification was not pursued by Argonne for this work.

The material which sank in the first two tanks was then processed in a third tank. This produced a rubber rich fraction. The Late Model Big 3 category's material contained 34% rubber while the Normal ELV contained 40%. Further separation of the rubber was not pursued by Argonne for this work.

5.4. Various Shredder Output Fractions Hand Separated at Argonne

Several fractions produced at the shredder plant were not analyzed in detail for this study. These streams, however, were characterized for their material composition.

5.4.a. Trommel Ferrous Fraction from the Shredding Plant

The belt conveyor feeding the trommel at the shredder site had a magnetic head pulley. This operation takes place after the vast majority of the ferrous material has been removed by the primary magnetic separation operation. This material represents about 10% of the outputted material from the shredder's plant. The composition of this fraction is shown in Figure 6. It was assumed that this fraction's ferrous content would not vary between vehicle categories, but the material analyzed was specifically from a 282 lb sample of the Late Model Big 3 category. It is assumed that the shredder re-feeds this material and recovers much of the ferrous metals.

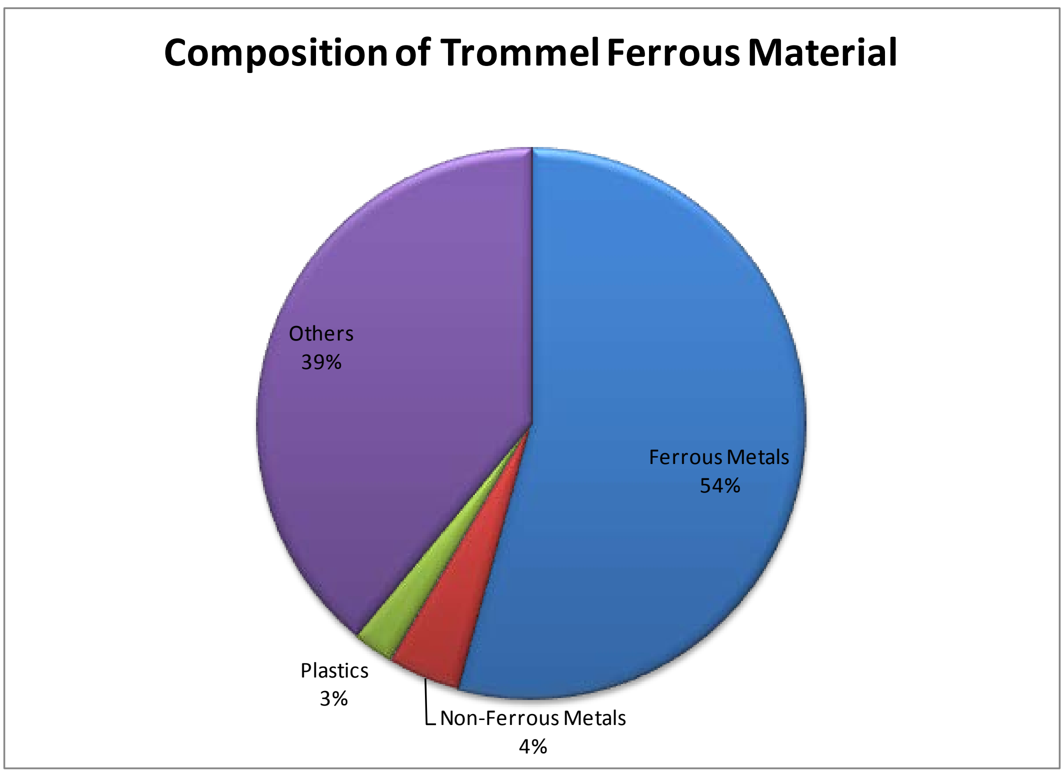


Figure 6. Composition of the Typical Trommel Ferrous Fraction Content Generated at the Shredding Site

5.4.b. >6 inch Trommel Fraction from the Shredding Plant

The shredder plant used a 2-stage trommel to aid in non-ferrous metal recovery by separating the material into size groupings. The first stage had 1.5" openings and the second had 6 inch openings. The material that is larger than 6 inches is an output stream providing about 1% of the feed material (Table 1). Figure 7 shows the composition of this fraction. The sample that was analyzed was a 173 lb and was a mixture of all four vehicle categories. There is a large percentage of plastic in this fraction. It is not known if the shredder re-feeds this material to the shredder.

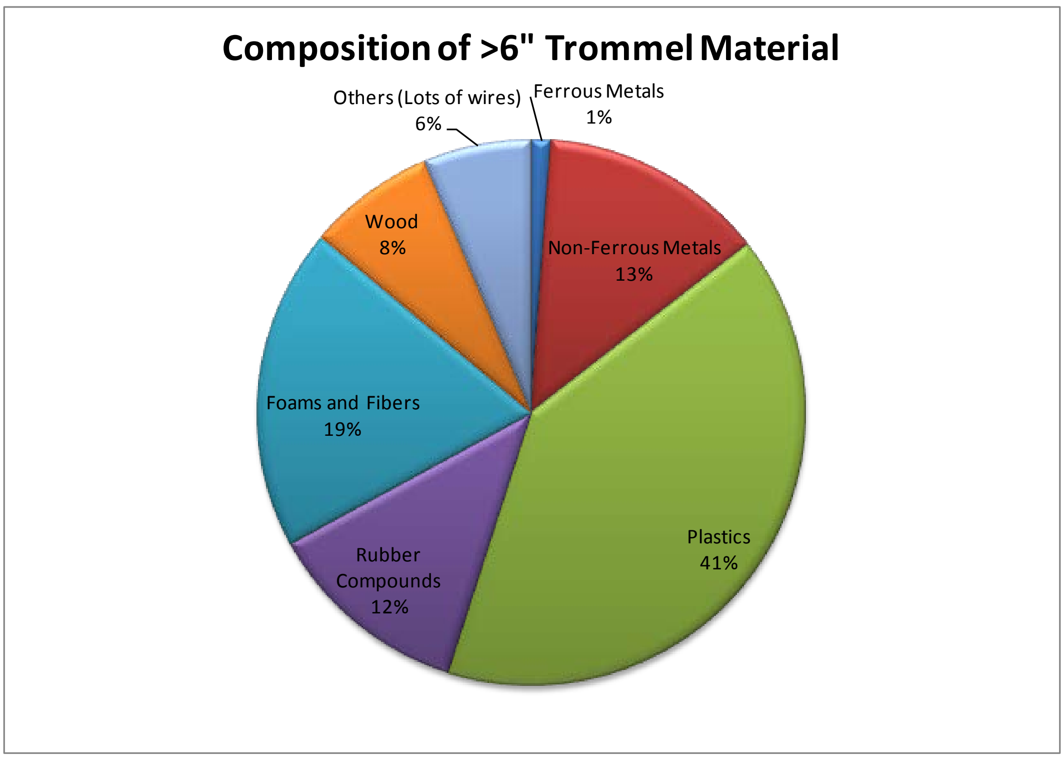


Figure 7. Composition of the >6 inch Trommel Fraction Content Generated at the Shredding Site

5.4.c. Stainless Steel Fraction Generated at the Shredding Plant

The shredder plant used an inductive type sorter to separate out non-ferrous metals that the eddy current separators missed. This operation is predominately used to produce a stainless steel rich fraction because the eddy current separators and magnets do not separate these types of metals very effectively. During normal plant operation this material is typically re-fed through downstream separation equipment to produce cleaner metal fractions, but for this test it was not. Much of the metal in this fraction, largely stainless steel, is recovered and not landfilled with the shredder residue. Figure 8 summarizes the results of the hand separation of a 123 lb sample from the Late Model Big 3 vehicle category. The other three vehicle categories are expected to have contained the same basic composition.

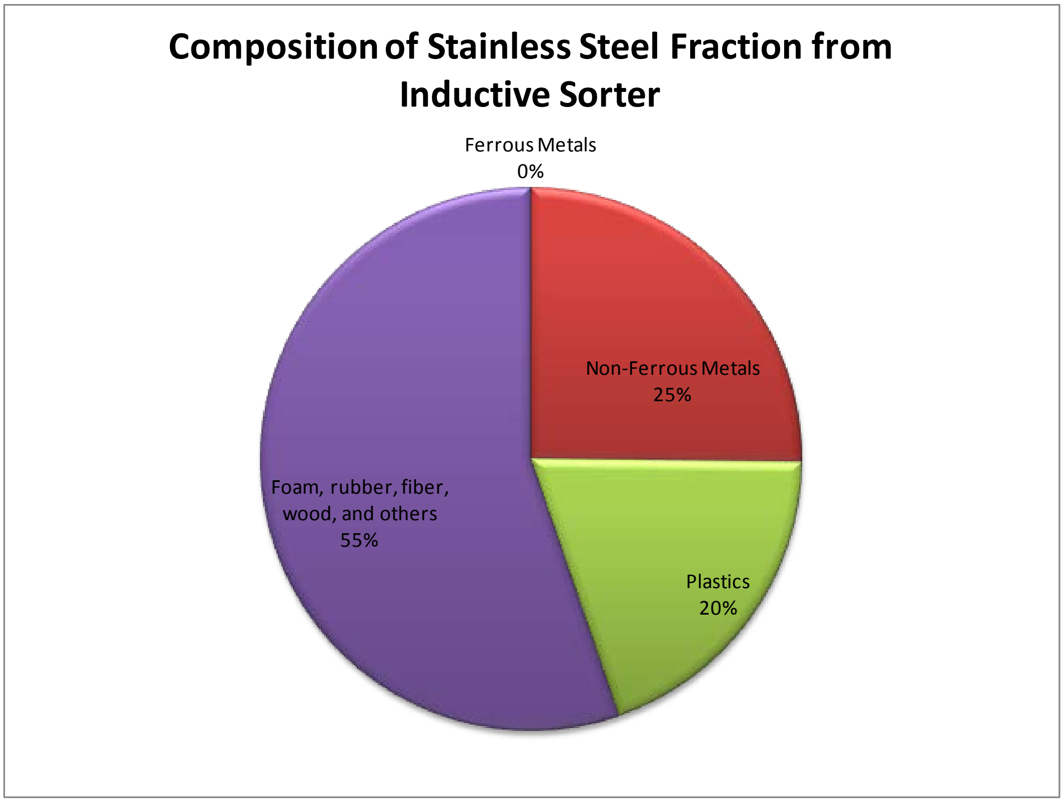


Figure 8. Composition of the Stainless Steel Fraction Separated by an Inductive Sorter at the Shredder Site

5.5. PCBs and TCLP

5.5.a. Swipe Tests Analysis

Before any of the testing began W.Z. Baumgartner & Associates (WZB) performed swipe tests from various locations at the shredder site. This was done to verify that the shredder plant did not contain significant PCB contamination. A picture of the swipe sample template and an example of a swipe test location are shown in Figure 9. A list of all the swipe test locations is shown in Appendix C. In addition to equipment being tested for surface contamination, the dismantling area and several bumpers from vehicles to be shredded during the test were swipe tested as well.

The results are presented in Appendix D. The samples were analyzed per EPA method 8082. For reference, e-CFR §761.79 indicates that decontamination of non-porous surfaces for unrestricted use was successful if measured below 10 µg/wipe. All swipe tests of the vehicles to be shredded and the dismantling area reported as non-detects with a detection limit of 5.00 µg/wipe. Of all the 42 swipes that were taken on shredder plant belts and feeders, eight of them contained detectable levels of PCBs. Of these eight, two of them were above 10 µg/wipe, 10.8 µg/wipe and 16.6 µg/wipe.

Figure 9. A Picture of the Sample Size Template for a Swipe Test and an Example Location of this Type of Sample

5.5.b. Fine and Coarse Material Sample Analysis

Ten samples of the <12 mm fines and 10 samples of the coarse shredder residue were obtained from each of the four categories of vehicles. Of these, three from each group were randomly selected for analysis and then an average concentration was determined. Figures 10 and 11 show the sample location fine and coarse shredder residues, respectively. The results are presented in Appendix E. Many of the samples contained non-detectable amounts of PCBs (detection limit of 0.3 ppm). Only one <12 mm fines sample contained a detectable level of PCBs (1.77 ppm). This sample was from the Late Model Big 3 category. Only one coarse shredder residue sample contained a detectable level of PCBs (2.17 ppm). This sample was from the Late Model Transplant category. The EPA limit for PCBs is 50 ppm before the waste is considered hazardous. For comparison, a study found that shredder residues from seven different facilities in California contained 16-82 ppm (Boughton, 2006).

Figure 10. Sampling location for the <12 mm fines residue.

Figure 11. Sampling location for the coarse shredder residue.

5.5.c. Polymer Concentrate Sample Analysis

Samples of a polymer concentrate generated using Argonne's material separation pilot plant were sent out for PCB analysis by a different company. The results are presented in Appendix F. All analyses performed returned non-detectable levels of PCBs. Note the elevated detection limit for the 1254 and 1260 Aroclors. The analytical company struggled to segregate two overlapping peaks in this range and therefore could not provide a lower detection limit.

5.5.d. TCLP Analysis

A randomly selected sample, one from each category's <12 mm fines and coarse shredder residue, was selected for TCLP metals analysis. Three samples were taken for lead and cadmium. The results along with the EPA limit, per Baumgartner and Associates, are presented in Appendix G and are summarized in Table 3. One cadmium sample came back abnormally high as 3.91 mg/L. The sample was retested and the result was 0.33 mg/L. It is believed that the first analysis may not have been a representative sample. It can be seen that the average cadmium concentrations for the three late model categories ranged from 0.02 to 0.07 mg/L while the Normal ELV category produced 0.22 mg/L for the fine shredder residue and 0.32 mg/L for the coarse shredder residue. Zinc was analyzed twice from the coarse shredder residue of the Late Model Big 3 category. Both came back with a result of 178 mg/L. One of the Late Model Import Category lead samples contained an elevated concentration. It was 10 times that of any other sample taken. This sample was not tested further.

Table 3. Results of the TCLP Analysis

Units = mg/L	EPA Limit	Late Model Big 3 Coarse	Late Model Big 3 Fine	Late Model Transplant Coarse	Late Model Transplant Fine	Normal ELV Coarse	Normal ELV Fine	Late Model Import Coarse	Late Model Import Fine
Arsenic	5	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Barium	100	0.6	0.6	1.0	1.2	0.8	0.7	1.0	1.2
Cadmium	1	0.03	0.08	0.04	0.06	0.34	0.33*	0.04	0.01
		0.03	0.05	0.04	0.03	0.36	0.14	<0.01	0.02
		0.02	0.07	0.05	0.03	0.27	0.20	0.02	0.02
Average		0.03	0.07	0.04	0.04	0.32	0.22	0.02	0.02
Chromium (T)	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Copper		0.12	<0.10	0.38	<0.10	0.31	<0.10	0.16	<0.10
Lead	5	0.23	0.66	0.10	0.15	0.84	0.61	6.01	0.19
		0.39	0.56	0.37	0.08	0.29	0.06	0.21	0.58
		0.82	0.42	0.16	0.22	0.59	0.12	0.70	0.97
Average		0.48	0.55	0.21	0.15	0.58	0.26	2.3	0.58
Nickel		0.89	1.28	0.45	0.54	0.71	0.65	1.26	1.10
Mercury	0.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium	1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Silver	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc		173	178**	145	99	201	71	53	133

* - Initial result 3.91 mg/L - uncharacteristic and unconfirmed
** - Two samples tested. Both coming back at 178 mg/L.

5.5.e. Summary of PCB and TCLP analyses

The PCB concentrations which were detectable were 2.17 ppm for one sample and 1.77 ppm for another. The other samples were below the detection limit. It is evident that automotive feed material is not a major source of PCBs in the shredder residue, bearing in mind that the oldest vehicle in this test was manufactured in 1983, after the ban on PCBs in the United States. Most of the TCLP metals were non-detectable. As mentioned earlier, one sample tested abnormally high in cadmium. Though this appears to be an anomaly, there is a noticeable difference in cadmium concentrations between the pre-2000 vehicle category and post-2000 vehicle categories. The average cadmium concentrations for the three post-2000 categories ranged from 0.02 to 0.07 mg/L while the pre-2000 category produced 0.22 mg/L for the fine shredder residue and 0.32 mg/L for the coarse shredder residue. Also, a sample tested abnormally high on lead. This sample was not retested. The high concentration could be due to an analytical error or the sample could have contained a piece of lead, perhaps from a seat belt actuator or other lead device.

6. Conclusions

The results and conclusions drawn based on these results are based on processing a small number of vehicles and models that were very carefully de-polluted, inspected, and from which all non-auto materials were removed prior to shredding in a newly installed shredder. These issues will have to be considered when interpreting the results. This study leads to several observations and conclusions. These are discussed below:

1. The composition of shredder residue from each of the four categories is similar to the others. In addition, these compositions are approximately equal to the composition of typical shredder residue.

2. When the materials were processed in Argonne's pilot plant, the separated streams were essentially the same as what is produced from processing typical shredder residue. This is important because a process that is designed to handle today's shredder residue will be able to handle shredder residue from recently built vehicles that will become obsolete in 10-15 years.

3. Shredder residue generated by shredding only autos contained very low levels of PCBs. This demonstrates that autos, at least newer than 1983 model year, are not a significant source of PCBs seen in shredder residue.

4. Shedder residue generated by shredding only autos contained low levels of TCLP metals. The cadmium concentration in the Normal ELV category was considerably higher than all of the late model categories, yet below the EPA limits per Baumgartner and Associates, Inc.

References

Allen, T. (2009). *Final Report: Plastic Recovery for Marketability Assessment.*

Boughton, B. (2006). *Evaluation of Shredder Residue as Cement Manufacturing Feedstock.*

Acknowledgement

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The following persons were active participants in conducting this work. Their active participation and professional contributions to the success of this project are appreciated.

Claudia Duranceau worked with Ford Motor Company and was the project manager at the beginning of this work as a VRP member. At the time in which this report was written, Claudia is an Argonne National Laboratory employee.

Trip Allen (Energy Anew, Inc.)
James Kolb (American Chemistry Council - Plastics Division)
Claiborne Thornton (W.Z. Baumgartner & Associates, Inc.)
Joseph A. Pomykala, Jr. (Argonne National Laboratory)

Appendices:

Appendix A. Lists of vehicles included in each of the four categories

List of vehicles included in "Late Model Big 3" category

LATE MODEL BIG 3

	YEAR	MAKE	MODEL	VIN
1	2000	GENERAL MOTORS	CADILLAC	W06VR54R0YR041092
2	2000	GENERAL MOTORS	SATURN	1G8JS52F344641535
3	2000	FORD	ESCORT SE	3FAFP13P9YR188250
4	2000	GENERAL MOTORS	CADILLAC-DEVILLE	1G6KD54Y9YU206175
5	2004	FORD	CROWN VICTORIA	2FAHP71W64X124765
6	2003	CHEVROLET	CAVALIER	1G1JC12F737190614
7	2000	CHEVROLET	LUMINA	2G1WL52J3Y1224845
8	2003	DODGE	NEON	1B3ES66SX3D206114
9	2000	GMC	SIERRA	2GTEC19T0Y1116816
10	2002	FORD	CROWN VICTORIA	2FAFP71W22X149117
11	2000	FORD	FOCUS	1FAFP33P2YW350065
12	2001	FORD	TAURUS	1FAFP52U31A124932
13	2001	FORD	EXPLORER	1FMZU62E51ZA42034
14	2001	OLDSMOBILE	ALERO	1G3NL12E81C189024
15	2000	FORD	MERCURY	1MEFM66L1YK601449
16	2005	PONTIAC	SUNFIRE	3G2JB12F55S145769
17	2004	FORD	CROWN VICTORIA	2FAHP71W34X154659
18	2001	DODGE	INTREPID	2B3AD46R01H626376
19	2003	FORD	CROWN VICTORIA	2FAFP71W13X167559
20	2000	OLDSMOBILE	SILLOUTTE	1GHDX03E6YD213912
21	2000	CHRYSLER	TOWN & COUNTRY	1C4GP44G2YB793603
22	2000	DODGE	GRAND CARAVAN SE	2B4GP44GXYR734863
23	2000	CHRYSLER	TOWN & COUNTRY	1C4GP64L2YB631057
24	2001	PONTIAC	GRAND PRIX	1G2WP12K51F261539
25	2001	CHEVROLET	MALIBU	1G1ND52J116269385
26	2001	PONTIAC	GRAND PRIX	1G2WP52K61F262805
27	2000	PONTIAC	SUNFIRE	1G2JB1243Y7176990
28	2001	GENERAL MOTORS	SATURN	1G8ZP128X1Z338623
29	2000	GENERAL MOTORS	SATURN	1G8JW52R8YY635292
30	2000	DODGE	NEON	1B3ES46CSYD795836
31	2001	DODGE	INTREPID	2B3HD46R01H690058
32	2004	SATURN	ION	1G8AG54F84Z106302
33	2002	PONTIAC	SUNFIRE	1G2JB124427298233
34	2000	SATURN	S SERIES	1G8ZK5276YZ155744
35	2000	FORD	TAURUS	1FAFP55U6YG255937
36	2000	CHEVROLET	TAHOE	1GNEC13T6YJ164178
37	2003	FORD	CROWN VICTORIA	2FAFP71W43X119280
38	2000	CHRYSLER	NEON	1B3ES46C2YD581919
39	2001	CHEVROLET	TAHOE	1GNEC13T21R209236
40	2005	DODGE	RAM	1D7HA18DX5S156822

List of vehicles included in "Late Model Transplant" category

LATE MODEL TRANSPLANT

	YEAR	MAKE	MODEL	VIN
1	2001	MITSUBISHI	ECLIPSE	4A3AC34G71E045216
2	2001	MITSUBISHI	GALANT	4A3AA46G41E215198
3	2001	MITSUBISHI	ECLIPSE	4A3AC44G91E203528
4	2000	MITSUBISHI	GALANT	4A3AA46G0YE128490
5	2000	MITSUBISHI	ECLIPSE	4A3AC34G2YE063973
6	2005	TOYOTA	TUNDRA	5TBJU32185S455773
7	2000	MAZDA	626	1YVGF22CXY5173601
8	2003	MITSUBISHI	ECLIPSE	4A3AC34G53E001461
9	2000	HONDA	CIVIC	2HGEJ6612YH513605
10	2001	HONDA	ACCORD	1HGCG56441A083722
11	2000	MITSUBISHI	GALANT	4A3AA46L1YE162662
12	2001	MAZDA	626	1YVGF22C315236785
13	2001	NISSAN	ALTIMA	1N4DL01D61C154373
14	2000	NISSAN	ALTIMA	1N4DL01D3YC120398
15	2004	HONDA	CIVIC	1HGEM21934L026181
16	2001	HONDA	ACCORD	1HGCG56471A018864
17	2000	TOYOTA	CAMRY SOLARA	2T1CG22P2YC353758
18	2000	NISSAN	ALTIMA	1N4DL01DXYC239856
19	2001	NISSAN	ALTIMA	1N4DL01D01C177986
20	2003	NISSAN	ALTIMA	1N4AL11DX3C105236
21	2001	NISSAN	ALTIMA	1N4DL01D21C100892
22	2002	ISUZU	AXIOM	4S2CE58X524609999
23	2000	TOYOTA	COROLLA	1NXBR12E3YZ396132
24	2003	HONDA	CIVIC	2HGES25753H506684
25	2000	NISSAN	ALTIMA	1N4DL01A8YC217571
26	2000	HONDA	CIVIC	1HGEM1150YL059958
27	2003	MITSUBISHI	GALANT	4A3AA4CGX3F057887
28	2000	MITSUBISHI	ECLIPSE	4A3AC34G6YE066908
29	2002	MAZDA	626	1YVGF22C725303082
30	2001	MITSUBISHI	ECLIPSE	4A3AC34G71E202789
31	2001	ACURA	3.2 CL	19UYA424X1A021541
32	2003	ACURA	3.2 CL-S	19UYA416X3A015633
33	2000	TOYOTA	COROLLA	1NXBR12E2YZ407301
34	2001	HONDA	CIVIC EX	2HGES26771H513051
35	2002	MITSUBISHI	ECLIPSE SPYDER GT	4A3AE85H22E101689
36	2001	MITSUBISHI	GALANT ES	4A3AA46GX1E040438
37	2000	MAZDA	626 LX	1YVGF22C0Y5108210
38	2002	HONDA	ACCORD V6	1HGCG225X2A008392
39	2002	ACURA	MDX	2HNYD18602H548739
40	2004	TOYOTA	TUNDRA	5TBRT341X4S442699

List of vehicles included in "Normal-aged Domestic" category

PRE-2000 DOMESTIC

	YEAR	MAKE	MODEL	VIN
1	1987	BUICK	CENTRY	1G4AH51WXHD463972
2	1991	JEEP	CHEROKEE	1J4FT27S2ML638785
3	1998	JEEP	LAREDO	1J4GZ58S5WC158942
4	1992	PONTIAC	TRANS SPORT SE	1GMDU06L4NT241133
5	1996	CHEVROLET	LUMINA	2G1WL52M8T1127868
6	1990	CHEVROLET	BLAZER	1GNCS18Z9L0114557
7	1996	OLDSMOBILE	CIERRA SL	1G3AJ55M4T6336228
8	1991	CHEVROLET	S-10	1GCCS19Z3M2220855
9	1991	BUICK	PARK AVENUE	1G4CU53L8M1627674
10	1999	GMC	SONOMA	1GTCS1443X8512812
11	1984	CHEVROLET	BEAUVILLE	1G8EG25L8E7215280
12	1996	FORD	RANGER	1FTCR10X9TTA73585
13	1988	DODGE	DAKOTA SPORT	1B7GR64X8JS736074
14	1993	PLYMOUTH	VOYAGER	2P4GH2533PR223344
15	1994	CHEVROLET	LUMINA	1GNDU06D3RT134987
16	1994	FORD	PROBE GT	1ZVLT22B8R5104831
17	1986	FORD	F-150 XL	1FTEF15NXGNA71699
18	1990	FORD	F-150	1FTEF15Y6LNB45978
19	1992	OLDSMOBILE	CUTLASS SUPREME	1G3WT34TXND354891
20	1998	CADILLAC	DEVILLE	1G6KD54Y5WU720571
21	1991	CHEVROLET	LUMINA	2G1WL54T5M9101395
22	1983	PONTIAC	BONNEVILLE	1G2AR69A5DB216501
23	1989	FORD	BRONCO	1FMCU12T1KUA66921
24	1996	BUICK	REGAL	2G4WB52K2T1425353
25	1996	DODGE	NEON	1B3ES47C7TD502476
26	1992	BUICK	REGAL GRAN SPORT	2G4WF54L6N1475265
27	1992	BUICK	PARK AVENUE	1G4CW53L3P1604270
28	1997	CHRYSLER	LHS	2C3HC56F4VH641601
29	1991	FORD	F-150 XLT	1FTEF14N2MNA96402
30	1998	LINCOLN	CONTINENTAL	1LNFM97V2WY729031
31	1994	OLDSMOBILE	CUTLASS SUPREME SL	1G3WH55M9RD344525
32	1985	CADILLAC	FLEETWOOD	1G6DW4783F9733542
33	1993	LINCOLN	TOWNCAR	1LNLM81W2PY719227
34	1995	FORD	F-150	1FTEF14N3SNB38220
35	1997	FORD	ESCORT	1FALP13P7VW283109
36	1993	PLYMOUTH	GRAND VOYAGER SE	1P4GH44R8PX528499
37	1994	OLDSMOBILE	ROYALE	1G3HN52L4R4804638
38	1997	DODGE	CARAVAN	2B4FP2537VR448248
39	1984	JEEP	CHEROKEE	1JCWB7714ET140360
40	1998	FORD	TAURUS	1FAFP52U9WA218286

List of vehicles included in "Late Model Import" category

LATE MODEL IMPORT

	YEAR	MAKE	MODEL	VIN
1	2000	HYUNDAI	SONATA	KMHWF35V8YA291654
2	2000	VOLVO	V70	YV1LW61J9Y2708084
3	2005	KIA	OPTIMA	KNAGD128655401846
4	2000	VOLKSWAGON	JETTA VR6	3VWTE29M2YM077202
5	2005	SUZUKI	FORENZA	KL5JJ86Z45K092169
6	2003	KIA	SPECTRA	KNAFB161835094322
7	2002	HYUNDAI	SONATA	KMHWF35HX24619903
8	2005	HYUNDAI	ACCENT	KMHCG45C25U604230
9	2001	HYUNDAI	ACCENT	KMHCF35G91U107301
10	2002	DAEWOO	LANOS	KLATA22632B702769
11	2002	KIA	SPECTRA	KNAFB121X25147090
12	2000	MITSUBISHI	MIRAGE	JA3AY26C9YU042325
13	2000	HYUNDAI	ELANTRA	KMHJF35F6YU993800
14	2001	DAEWOO	LANOS	KLATA22641B634058
15	2001	MAZDA	PROTÉGÉ	JM1BJ225110462904
16	2002	KIA	SEDONA	KNDUP131126320225
17	2001	HYUNDAI	SONATA	KMHWF25S91A395320
18	2001	HYUNDAI	SONATA	KMHWF25S91A413041
19	2002	ACURA	3.5 RL	JH4KA96652C000713
20	2000	VOLKSWAGON	PASSAT	WVWMA23B0YP228221
21	2000	SAAB	95	YS3ED55E5Y3049743
22	2000	VOLKSWAGON	JETTA GLS	3VWSA29M1YM119558
23	2002	KIA	OPTIMA	KNAGD128025172382
24	2001	HYUNDAI	ELANTRA	KMHDN55D81U023155
25	2000	KIA	SEPHIA	KNAFB1215Y5887767
26	2000	KIA	SEPHIA	KNAFB1213Y5883393
27	2000	KIA	SEPHIA	KNAFB1214Y5887677
28	2003	MITSUBISHI	DIAMANTE LS	6MMAP67P33T002954
29	2003	KIA	SPECTRA	KNAFB121X35211792
30	2002	NISSAN	SENTRA GXE	3N1CB51D22L662046
31	2000	ISUZU	TROOPER 3.5L	JACDJ58XXY7306986
32	2005	NISSAN	SENTRA 1.8 S	3N1CB51D35L543359
33	2003	VOLKSWAGON	JETTA	3VWSP69M63M177132
34	2002	MAZDA	MILLENIA	JM1TA221X21731348
35	2002	KIA	OPTIMA	KNAGD126625112699
36	2000	KIA	SEPHIA	KNAFB121XY5898019
37	2002	MITSUBISHI	MONTERO SPORT	JA4LS21H82J028000
38	2005	KIA	OPTIMA	KNAGD126155378863
39	2000	VOLVO	S40	YV1VS2556YF575061
40	2003	JAGUAR	S-TYPE V8	SAJEA01U83HM61152

Appendix B. Lists of the swipe test locations

VRP
PCB Wipe Sample Locations
Garden Street Iron & Metal
Ft. Myers, FL

1. Dismantling Area Beneath Shed – Oily Area
2. Dismantling Area Beneath Shed – Dry Area
3. Dismantling Area Storage Stacking Area
4. Field Blank While Running
5. Bumper before Shredding Cat 1
6. Bumper before Shredding Cat 3
7. Bumper before Shredding Cat 4
8. Bumper after Shredding Cat 1
9. Bumper after Shredding Cat 3
10. Bumper after Shredding Cat 4
11. Infeed Conveyor
12. Rotor Inside Mill Before First batch of Trees
13. Spacer inside Mill Before First batch of Trees
14. Shaker Table Left
15. Shaker Table Right
16. Shaker Table Center
17. Belt #1 A
18. NF Pan #1 Left
19. NF Pan #1 Right
20. Belt #1 B
21. Belt #1 C

VRP
PCB Wipe Sample Locations
Garden Street Iron & Metal
Ft. Myers, FL

22. Belt #1 D
23. Front End Loader Bucket OPEN
24. NF Residue Belt A
25. NF Residue Belt B
26. Switch Conveyor A
27. Switch Conveyor B
28. NF Pan A
29. NF Pan B
30. Trommel @ 1.5"
31. Trommel @ 6"
32. 1.5 Belt A
33. 1.5 Belt B
34. 6" Belt A
35. 6" Belt B
36. Bivitec A Top
37. Bivitec B Bottom
38. Rotor after 1st Trees
39. Spacer after 1st Trees
40. 6" Belt A After all Testing
41. 6" Belt B after all Testing
42. 1.5" Belt A After all Testing

WZB

VRP
PCB Wipe Sample Locations
Garden Street Iron & Metal
Ft. Myers, FL

43. 1.5" Belt B After all Testing
44. Bivitec A After all Testing
45. Bibitec B After all Testing
46. Loader Bucket A
47. Loader Bucket B
48. Red Plastic 6"
49. Gray Plastic
50. Interior
51. Black
52. Red/Yellow

WZB

Appendix C. Swipe Test PCBs Analytical Results

EXHIBIT NO. 1

VEHICLE RECYCLING PARTNERSHIP, LLC
FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS
PCB WIPE TEST (ug/Wipe)

OCTOBER 4, 2008

SAMPLE ID		PCB
WIPE TEST 1 (84559)		<5.00
WIPE TEST 2 (84564)		<5.00
WIPE TEST 3 (84565)		<5.00
WIPE TEST 12 (84560)		<5.00
WIPE TEST 13 (84561)		<5.00
WIPE TEST 14 (84573)		<5.00
WIPE TEST 15 (84574)		<5.00
WIPE TEST 15 (84568)	SHAKER TABLE RIGHT	10.8
WIPE TEST 16 (84570)		<5.00
WIPE TEST 20 (84572)	BELT # 1B	7.28
WIPE TEST 21 (84569)	BELT # 1C	16.6

WZB

Page 1 of 4

EXHIBIT NO. 1 (continued)

VEHICLE RECYCLING PARTNERSHIP, LLC
FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS
PCB WIPE TEST (ug/Wipe)

OCTOBER 4, 2008

SAMPLE ID			PCB
WIPE TEST 22	(84566)	BELT #1D	8.12
WIPE TEST 24	(84550)		<5.00
WIPE TEST 25	(84562)		<5.00
WIPE TEST 26	(84549)		<5.00
WIPE TEST 27	(84548)	SWITCH CONVEYOR B	8.95
WIPE TEST 28	(84551)		<5.00
WIPE TEST 29	(84555)		<5.00
WIPE TEST 30	(84563)		<5.00
WIPE TEST 31	(84547)		<5.00
WIPE TEST 32	(84553)		<5.00

EXHIBIT NO. 1 (continued)

VEHICLE RECYCLING PARTNERSHIP, LLC
FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS
PCB WIPE TEST (ug/Wipe)

OCTOBER 4, 2008

SAMPLE ID		PCB
WIPE TEST 33 (84557)	1.5" BELT B	6.51
WIPE TEST 34 (84552)	6" BELT A	7.54
WIPE TEST 35 (84556)		<5.00
WIPE TEST 36 (84554)		<5.00
WIPE TEST 37 (84558)	BIVITEC B BOTTOM	6.22
WIPE TEST 38 (84567)		<5.00
WIPE TEST 39 (84571)		<5.00
WIPE TEST 40 (84541)		<5.00
WIPE TEST 41 (84542)		<5.00
WIPE TEST 42 (84543)		<5.00
WIPE TEST 43 (84544)		<5.00
WIPE TEST 44 (84545)		<5.00

WZB

EXHIBIT NO. 1 (continued)

VEHICLE RECYCLING PARTNERSHIP, LLC
FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS
PCB WIPE TEST (ug/Wipe)

OCTOBER 4, 2008

SAMPLE ID	PCB
WIPE TEST 45 (84546)	<5.00
WIPE TEST 46 (84575)	<5.00
WIPE TEST 47 (84576)	<5.00
WIPE TEST 48 (84577)	<5.00
WIPE TEST 49 (84578)	<5.00
WIPE TEST 50 (84579)	<5.00
WIPE TEST 51 (84580)	<5.00
WIPE TEST 52 (84581)	<5.00
WIPE TEST 53 (84582)	<5.00

W. Z. BAUMGARTNER & ASSOCIATES, INC.
Environmental Engineers & Consultants
P. O. Box 680369
Franklin, TN 37068-0369

Appendix D. Shredder Residue PCB Analytical Results

Late Model Big 3
Fines
PCB Results

EXHIBIT NO. 2

VEHICLE RECYCLING PARTNERSHIP, LLC
FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS FINES

OCTOBER 4, 2008

PARAMETER	|-----Three Random Samples----- CAT 1-3 (84274)	CAT 1-4 (84275)	CAT 1-5 (84162) -----|	Average CONCEN TRATION	EPA LIMIT
PCB[1]	<0.328	<0.348	1.77	0.703	50.0
% Moisture	19.4	32.2	24.4	25.33	N.S.

[1]Concentration corrected for moisture content - EPA Method 8082
N.S. - No Standard

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Late Model Big 3
ASR
PCB Results

EXHIBIT NO. 2

VEHICLE RECYCLING PARTNERSHIP, LLC
FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS COURSE

OCTOBER 4, 2008

	|-----Three Random Samples-----|			Average	
PARAMETER	CAT 1-5 (84266)	CAT 1-7 (84163)	CAT 1-10 (84268)	CONCEN TRATION	EPA LIMIT
PCB[1]	<0.331	<0.339	<0.336	<0.168	50.0
% Moisture	41.4	48.2	55.2	48.26	N.S.

[1]Concentration corrected for moisture content - EPA Method 8082
N.S. - No Standard

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Late Model Transplant
Fines
PCB Results

EXHIBIT NO. 2

VEHICLE RECYCLING PARTNERSHIP, LLC
FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS FINES

OCTOBER 4, 2008

	|-----Three Random Samples-----|			Average	
PARAMETER	CAT 2-6 (84278)	CAT 2-7 (84165)	CAT 2-8 (84280)	CONCEN TRATION	EPA LIMIT
PCB[1]	<0.337	<0.339	<0.339	<0.169	50.0
% Moisture	13.8	19.3	16.7	16.6	N.S.

[1]Concentration corrected for moisture content - EPA Method 8082
N.S. - No Standard

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SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS COURSE

OCTOBER 4, 2008

	|-----Three Random Samples-----|			Average	
PARAMETER	CAT 2-5 (84164)	CAT 2-6 (84243)	CAT 2-7 (84245)	CONCEN TRATION	EPA LIMIT
PCB[1]	<0.334	2.17	<0.333	0.835	50.0
% Moisture	14.2	12.0	28.4	18.2	N.S.

[1]Concentration corrected for moisture content - EPA Method 8082
N.S. - No Standard

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Normal ELV
Fines
PCB Results

EXHIBIT NO. 2

VEHICLE RECYCLING PARTNERSHIP, LLC
FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS FINES

OCTOBER 4, 2008

PARAMETER	|-----Three Random Samples----- CAT 3-3 (84166)	CAT 3-5 (84286)	-----| CAT 3-6 (84288)	Average CONCEN TRATION	EPA LIMIT
PCB[1]	<0.339	<0.335	<0.336	<0.168	50.0
% Moisture	16.1	14.8	12.3	14.4	N.S.

[1]Concentration corrected for moisture content - EPA Method 8082
N.S. - No Standard

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Normal ELV
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PCB Results

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SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS COURSE

OCTOBER 4, 2008

PARAMETER	|-----Three Random Samples-----| CAT 3-3 (84260)	CAT 3-9 (84167)	CAT 3-10 (84262)	Average CONCEN TRATION	EPA LIMIT
PCB[1]	<0.334	<0.334	<0.331	<0.166	50.0
% Moisture	12.7	11.7	19.0	14.47	N.S.

[1]Concentration corrected for moisture content - EPA Method 8082
N.S. - No Standard

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Late Model Import
Fines
PCB Results

EXHIBIT NO. 2

VEHICLE RECYCLING PARTNERSHIP, LLC
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SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS FINES

OCTOBER 4, 2008

	|-----Three Random Samples-----|			Average	
PARAMETER	CAT 4-2 (84282)	CAT 4-8 (84284)	CAT 4-10 (84169)	CONCEN TRATION	EPA LIMIT
PCB[1]	<0.341	<0.340	<0.338	<0.170	50.0
% Moisture	13.5	16.2	21.9	17.20	N.S.

[1]Concentration corrected for moisture content - EPA Method 8082
N.S. - No Standard

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Late Model Import
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EXHIBIT NO. 2

VEHICLE RECYCLING PARTNERSHIP, LLC
FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS COURSE

OCTOBER 4, 2008

	|-----Three Random Samples-----|			Average	
PARAMETER	CAT 4-1 (84270)	CAT 4-2 (84168)	CAT 4-8 (84272)	CONCEN TRATION	EPA LIMIT
PCB[1]	<0.336	<0.337	<0.333	<0.168	50.0
% Moisture	30.8	30.3	11.1	24.07	N.S.

[1]Concentration corrected for moisture content - EPA Method 8082
N.S. - No Standard

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Appendix E. Polymer Concentrate (Produced by Argonne's Mechanical Separation Pilot Plant) PCB Analytical Results

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Report of Laboratory Analysis

CLIENT:	Argonne National Laboratory	**Client Sample ID:**	NB370A-121-1
Lab Order:	09020124	**Report Date:**	2/9/2009
Project:	Argonne PCB Analysis	**Collection Date:**	2/3/2009
Lab ID:	09020124-01	**Matrix:**	Solid

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Polychlorinated biphenyls (PCBs)		**Method:**	**SW8082 / SW3540C**				
Aroclor 1016	< 0.391	0.391		mg/Kg	2/6/09	48805	IP
Aroclor 1221	< 0.391	0.391		mg/Kg	2/6/09	48805	IP
Aroclor 1232	< 0.391	0.391		mg/Kg	2/6/09	48805	IP
Aroclor 1242	< 0.391	0.391		mg/Kg	2/6/09	48805	IP
Aroclor 1248	< 0.391	0.391		mg/Kg	2/6/09	48805	IP
Aroclor 1254	< 3.91	3.91		mg/Kg	2/6/09	48805	IP
Aroclor 1260	< 3.91	3.91		mg/Kg	2/6/09	48805	IP
Surrogates:							
2,4,5,6-Tetrachloro-m-xylene	91.1	9.34-155		%REC	2/6/09	48805	IP
Decachlorobiphenyl	294	13-177	S	%REC	2/6/09	48805	IP

Auto-Only Late Model Big 3. PCB from polymer concentrate mixed sample buckets (Sample 1)

Qualifiers:
B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

4

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Report of Laboratory Analysis

CLIENT:	Argonne National Laboratory	**Client Sample ID:**	NB370A-121-2
Lab Order:	09020124	**Report Date:**	2/9/2009
Project:	Argonne PCB Analysis	**Collection Date:**	2/3/2009
Lab ID:	09020124-02	**Matrix:**	Solid

Analyses	Result	EMT Reporting Limit	Qual	Units	Date Analyzed	Batch	Analyst
Polychlorinated biphenyls (PCBs)		**Method:**	**SW8082 / SW3540C**				
Aroclor 1016	< 0.397	0.397		mg/Kg	2/6/09	48805	IP
Aroclor 1221	< 0.397	0.397		mg/Kg	2/6/09	48805	IP
Aroclor 1232	< 0.397	0.397		mg/Kg	2/6/09	48805	IP
Aroclor 1242	< 0.397	0.397		mg/Kg	2/6/09	48805	IP
Aroclor 1248	< 0.397	0.397		mg/Kg	2/6/09	48805	IP
Aroclor 1254	< 3.97	3.97		mg/Kg	2/6/09	48805	IP
Aroclor 1260	< 3.97	3.97		mg/Kg	2/6/09	48805	IP
Surrogates:							
2,4,5,6-Tetrachloro-m-xylene	113	9.34-155		%REC	2/6/09	48805	IP
Decachlorobiphenyl	350	13-177	S	%REC	2/6/09	48805	IP

Auto-Only Late Model Big 3. PCB from polymer concentrate mixed sample buckets (Sample 2)

Qualifiers:
B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

5

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Report of Laboratory Analysis

CLIENT:	Argonne National Laboratory	**Client Sample ID:**	NB370A-121-3
Lab Order:	09020124	**Report Date:**	2/9/2009
Project:	Argonne PCB Analysis	**Collection Date:**	2/3/2009
Lab ID:	09020124-03	**Matrix:**	Solid

Analyses	Result	EMT Reporting Limit	Qual	Units	Date Analyzed	Batch	Analyst
Polychlorinated biphenyls (PCBs)		**Method:**	**SW8082 / SW3540C**				
Aroclor 1016	< 0.398	0.398		mg/Kg	2/6/09	48805	IP
Aroclor 1221	< 0.398	0.398		mg/Kg	2/6/09	48805	IP
Aroclor 1232	< 0.398	0.398		mg/Kg	2/6/09	48805	IP
Aroclor 1242	< 0.398	0.398		mg/Kg	2/6/09	48805	IP
Aroclor 1248	< 0.398	0.398		mg/Kg	2/6/09	48805	IP
Aroclor 1254	< 0.398	0.398		mg/Kg	2/6/09	48805	IP
Aroclor 1260	< 0.398	0.398		mg/Kg	2/6/09	48805	IP
Surrogates:							
2,4,5,6-Tetrachloro-m-xylene	103	9.34-155		%REC	2/6/09	48805	IP
Decachlorobiphenyl	241	13-177	S	%REC	2/6/09	48805	IP

Auto-Only Late Model Transplant. PCB from polymer concentrate mixed sample buckets (Sample 1)

Qualifiers:
- B - Analyte detected in the associated Method Blank
- E - Estimated
- H - Holding Time Exceeded
- S - Spike Recovery outside accepted recovery limits
- R - RPD outside accepted recovery limits
- J - Analyte detected below quanititation limits

6

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Report of Laboratory Analysis

CLIENT:	Argonne National Laboratory	**Client Sample ID:**	NB370A-121-4
Lab Order:	09020124	**Report Date:**	2/9/2009
Project:	Argonne PCB Analysis	**Collection Date:**	2/3/2009
Lab ID:	09020124-04	**Matrix:**	Solid

Analyses	Result	EMT Reporting Limit	Qual	Units	Date Analyzed	Batch	Analyst
Polychlorinated biphenyls (PCBs)		Method:		SW8082 / SW3540C			
Aroclor 1016	< 0.392	0.392		mg/Kg	2/6/09	48805	IP
Aroclor 1221	< 0.392	0.392		mg/Kg	2/6/09	48805	IP
Aroclor 1232	< 0.392	0.392		mg/Kg	2/6/09	48805	IP
Aroclor 1242	< 0.392	0.392		mg/Kg	2/6/09	48805	IP
Aroclor 1248	< 0.392	0.392		mg/Kg	2/6/09	48805	IP
Aroclor 1254	< 0.392	0.392		mg/Kg	2/6/09	48805	IP
Aroclor 1260	< 0.392	0.392		mg/Kg	2/6/09	48805	IP
Surrogates:							
2,4,5,6-Tetrachloro-m-xylene	121	9.34-155		%REC	2/6/09	48805	IP
Decachlorobiphenyl	571	13-177	S	%REC	2/6/09	48805	IP

Auto-Only Late Model Transplant. PCB from polymer concentrate mixed sample buckets (Sample 2)

Qualifiers:

- B - Analyte detected in the associated Method Blank
- E - Estimated
- H - Holding Time Exceeded
- S - Spike Recovery outside accepted recovery limits
- R - RPD outside accepted recovery limits
- J - Analyte detected below quanititation limits

7

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Report of Laboratory Analysis

CLIENT:	Argonne National Laboratory	**Client Sample ID:**	NB370A-121-5
Lab Order:	09020124	**Report Date:**	2/9/2009
Project:	Argonne PCB Analysis	**Collection Date:**	2/3/2009
Lab ID:	09020124-05	**Matrix:**	Solid

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Polychlorinated biphenyls (PCBs)		**Method:**	**SW8082 / SW3540C**			
Aroclor 1016	< 0.37	0.37	mg/Kg	2/6/09	48805	IP
Aroclor 1221	< 0.37	0.37	mg/Kg	2/6/09	48805	IP
Aroclor 1232	< 0.37	0.37	mg/Kg	2/6/09	48805	IP
Aroclor 1242	< 0.37	0.37	mg/Kg	2/6/09	48805	IP
Aroclor 1248	< 0.37	0.37	mg/Kg	2/6/09	48805	IP
Aroclor 1254	< 3.7	3.7	mg/Kg	2/9/09	48805	IP
Aroclor 1260	< 3.7	3.7	mg/Kg	2/9/09	48805	IP
Surrogates:						
2,4,5,6-Tetrachloro-m-xylene	106	9.34-155	%REC	2/6/09	48805	IP
Decachlorobiphenyl	171	13-177	%REC	2/6/09	48805	IP

Auto-Only Normal ELV. PCB from polymer concentrate mixed sample buckets (Sample 1)

Qualifiers:

- B - Analyte detected in the associated Method Blank
- E - Estimated
- H - Holding Time Exceeded
- S - Spike Recovery outside accepted recovery limits
- R - RPD outside accepted recovery limits
- J - Analyte detected below quanititation limits

8

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Report of Laboratory Analysis

CLIENT:	Argonne National Laboratory	**Client Sample ID:**	NB370A-121-6
Lab Order:	09020124	**Report Date:**	2/9/2009
Project:	Argonne PCB Analysis	**Collection Date:**	2/3/2009
Lab ID:	09020124-06	**Matrix:**	Solid

Analyses	Result	EMT Reporting Limit	Qual	Units	Date Analyzed	Batch	Analyst
Polychlorinated biphenyls (PCBs)		**Method:**	**SW8082 / SW3540C**				
Aroclor 1016	< 0.344	0.344		mg/Kg	2/6/09	48805	IP
Aroclor 1221	< 0.344	0.344		mg/Kg	2/6/09	48805	IP
Aroclor 1232	< 0.344	0.344		mg/Kg	2/6/09	48805	IP
Aroclor 1242	< 0.344	0.344		mg/Kg	2/6/09	48805	IP
Aroclor 1248	< 0.344	0.344		mg/Kg	2/6/09	48805	IP
Aroclor 1254	< 3.44	3.44		mg/Kg	2/9/09	48805	IP
Aroclor 1260	< 3.44	3.44		mg/Kg	2/9/09	48805	IP
Surrogates:							
2,4,5,6-Tetrachloro-m-xylene	127	9.34-155		%REC	2/6/09	48805	IP
Decachlorobiphenyl	387	13-177	S	%REC	2/6/09	48805	IP

Auto-Only Normal ELV. PCB from polymer concentrate mixed sample buckets (Sample 2)

Qualifiers:
B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

9

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Report of Laboratory Analysis

CLIENT:	Argonne National Laboratory	**Client Sample ID:**	NB370A-121-7
Lab Order:	09020124	**Report Date:**	2/9/2009
Project:	Argonne PCB Analysis	**Collection Date:**	2/3/2009
Lab ID:	09020124-07	**Matrix:**	Solid

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Polychlorinated biphenyls (PCBs)		**Method:**	**SW8082 / SW3540C**			
Aroclor 1016	< 0.391	0.391	mg/Kg	2/6/09	48805	IP
Aroclor 1221	< 0.391	0.391	mg/Kg	2/6/09	48805	IP
Aroclor 1232	< 0.391	0.391	mg/Kg	2/6/09	48805	IP
Aroclor 1242	< 0.391	0.391	mg/Kg	2/6/09	48805	IP
Aroclor 1248	< 0.391	0.391	mg/Kg	2/6/09	48805	IP
Aroclor 1254	< 3.91	3.91	mg/Kg	2/9/09	48805	IP
Aroclor 1260	< 3.91	3.91	mg/Kg	2/9/09	48805	IP
Surrogates:						
2,4,5,6-Tetrachloro-m-xylene	93.2	9.34-155	%REC	2/6/09	48805	IP
Decachlorobiphenyl	106	13-177	%REC	2/6/09	48805	IP

Auto-Only Late Model Import. PCB from polymer concentrate mixed sample buckets (Sample 1)

Qualifiers:
- B - Analyte detected in the associated Method Blank
- E - Estimated
- H - Holding Time Exceeded
- S - Spike Recovery outside accepted recovery limits
- R - RPD outside accepted recovery limits
- J - Analyte detected below quanititation limits

10

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Report of Laboratory Analysis

CLIENT:	Argonne National Laboratory	**Client Sample ID:**	NB370A-121-8
Lab Order:	09020124	**Report Date:**	2/9/2009
Project:	Argonne PCB Analysis	**Collection Date:**	2/3/2009
Lab ID:	09020124-08	**Matrix:**	Solid

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Polychlorinated biphenyls (PCBs)		Method:	SW8082 / SW3540C			
Aroclor 1016	< 0.393	0.393	mg/Kg	2/6/09	48805	IP
Aroclor 1221	< 0.393	0.393	mg/Kg	2/6/09	48805	IP
Aroclor 1232	< 0.393	0.393	mg/Kg	2/6/09	48805	IP
Aroclor 1242	< 0.393	0.393	mg/Kg	2/6/09	48805	IP
Aroclor 1248	< 0.393	0.393	mg/Kg	2/6/09	48805	IP
Aroclor 1254	< 3.93	3.93	mg/Kg	2/6/09	48805	IP
Aroclor 1260	< 3.93	3.93	mg/Kg	2/6/09	48805	IP
Surrogates:						
2,4,5,6-Tetrachloro-m-xylene	117	9.34-155	%REC	2/6/09	48805	IP
Decachlorobiphenyl	131	13-177	%REC	2/6/09	48805	IP

Auto-Only Late Model Import. PCB from polymer concentrate mixed sample buckets (Sample 2)

Qualifiers:
- B - Analyte detected in the associated Method Blank
- E - Estimated
- H - Holding Time Exceeded
- S - Spike Recovery outside accepted recovery limits
- R - RPD outside accepted recovery limits
- J - Analyte detected below quanititation limits

11

Appendix F. TCLP Analytical Results

Late model Big 3
Fines
TCLP Results

EXHIBIT NO. 1

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SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS FINES

OCTOBER 4, 2008

PARAMETER	|-----Three Random Samples-----| CAT 1-3 (84273)	CAT 1-4 (84154)	CAT 1-5 (84275)	Average CONCEN-TRATION	EPA LIMIT
TCLP METALS (mg/L)[1]					
Arsenic	<0.10	---	---	<0.10	5.0
Barium	0.614	---	---	0.614	100.0
Cadmium	0.081	0.053	0.070	0.068	1.0
Chromium (T)	<0.050	---	---	<0.050	5.0
Copper	<0.10	---	---	<0.10	
Lead	0.656	0.559	0.42	0.545	5.0
Nickel	1.28	---	---	1.28	
Mercury	<0.010	---	---	<0.010	0.2
Selenium	<0.10	---	---	<0.10	1.0
Silver	<0.050	---	---	<0.050	5.0
Zinc	178	---	178	178	

[1]EPA Method 1311; Analysis according to *SW 846*

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Late Model Big 3
ASR
TCLP Results

EXHIBIT NO. 1

VEHICLE RECYCLING PARTNERSHIP, LLC
FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS COURSE

OCTOBER 4, 2008

	|-----Three Random Samples-----|			Average	
PARAMETER	CAT 1-5 (84264)	CAT 1-7 (84155)	CAT 1-10 (84267)	CONCEN-TRATION	EPA LIMIT
TCLP METALS (mg/L)[1]					
Arsenic	<0.10	---	---	<0.10	5.0
Barium	0.593	---	---	0.593	100.0
Cadmium	0.033	0.031	0.018	0.027	1.0
Chromium (T)	<0.050	---	---	<0.050	5.0
Copper	0.117	---	---	0.117	
Lead	0.233	0.391	0.822	0.482	5.0
Nickel	0.888	---	---	0.888	
Mercury	<0.010	---	---	<0.010	0.2
Selenium	<0.10	---	---	<0.10	1.0
Silver	<0.050	---	---	<0.050	5.0
Zinc	173	---	---	173	

[1]EPA Method 1311; Analysis according to *SW 846*

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Laet Model Transplants
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TCLP Results

EXHIBIT NO. 1

VEHICLE RECYCLING PARTNERSHIP, LLC
FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS FINES

OCTOBER 4, 2008

	|-----Three Random Samples-----|			Average	
PARAMETER	CAT 2-6 (84277)	CAT 2-7 (84157)	CAT 2-8 (84279)	CONCEN-TRATION	EPA LIMIT
TCLP METALS (mg/L)[1]					
Arsenic	<0.10	---	---	<0.10	5.0
Barium	1.20	---	---	1.20	100.0
Cadmium	0.058	0.030	0.030	0.039	1.0
Chromium (T)	<0.050	---	---	<0.050	5.0
Copper	<0.10	---	---	<0.10	
Lead	0.148	0.076	0.222	0.149	5.0
Nickel	0.535	---	---	0.535	
Mercury	<0.010	---	---	<0.010	0.2
Selenium	<0.10	---	---	<0.10	1.0
Silver	<0.050	---	---	<0.050	5.0
Zinc	99.1	---	---	99.1	

[1]EPA Method 1311; Analysis according to *SW 846*

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Late Model Transplant
ASR
TCLP Results

EXHIBIT NO. 1

VEHICLE RECYCLING PARTNERSHIP, LLC
FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS COURSE

OCTOBER 4, 2008

PARAMETER	|-----Three Random Samples-----| CAT 2-5 (84156)	CAT 2-6 (84242)	CAT 2-7 (84244)	Average CONCEN-TRATION	EPA LIMIT
TCLP METALS (mg/L)[1]					
Arsenic	<0.10	---	---	<0.10	5.0
Barium	1.01	---	---	1.01	100.0
Cadmium	0.040	0.038	0.049	0.042	1.0
Chromium (T)	<0.050	---	---	<0.050	5.0
Copper	0.382	---	---	0.382	
Lead	0.10	0.370	0.156	0.209	5.0
Nickel	0.454	---	---	0.454	
Mercury	<0.010	---	---	<0.010	0.2
Selenium	<0.10	---	---	<0.10	1.0
Silver	<0.050	---	---	<0.050	5.0
Zinc	145	---	---	145	

[1]EPA Method 1311; Analysis according to *SW 846*

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Normal ELV
Fines
TCLP Results

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FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS FINES

OCTOBER 4, 2008

PARAMETER	|-----Three Random Samples----- CAT 3-3 (84263)	CAT 3-5 (84285)	-----| CAT 3-6 (84287)	Average CONCEN-TRATION	EPA LIMIT
TCLP METALS (mg/L)[1]					
Arsenic	---	<0.10	---	<0.10	5.0
Barium	---	0.691	---	0.691	100.0
Cadmium	0.327*	0.141	0.198	0.222	1.0
Chromium (T)	---	<0.050	---	<0.050	5.0
Copper	---	<0.10	---	<0.10	
Lead	0.613	0.057	0.120	0.263	5.0
Nickel	---	0.649	---	0.649	
Mercury	---	<0.010	---	<0.010	0.2
Selenium	---	<0.10	---	<0.10	1.0
Silver	---	<0.050	---	<0.050	5.0
Zinc	---	71.4	---	71.4	

[1]EPA Method 1311; Analysis according to *SW 846*
* Initial result 3.91 mg/L - uncharacteristic and unconfirmed

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p\28098

Normal ELV
ASR
TCLP Results

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FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS COURSE

OCTOBER 4, 2008

	|-----Three Random Samples-----|			Average	
PARAMETER	CAT 3-3 (84259)	CAT 3-9 (84159)	CAT 3-10 (84261)	CONCEN-TRATION	EPA LIMIT
TCLP METALS (mg/L)[1]					
Arsenic	<0.10	---	---	<0.10	5.0
Barium	0.816	---	---	0.816	100.0
Cadmium	0.342	0.360	0.270	0.324	1.0
Chromium (T	<0.050	---	---	<0.050	5.0
Copper	0.312	---	---	0.312	
Lead	0.837	0.293	0.586	0.575	5.0
Nickel	0.710	---	---	0.710	
Mercury	<0.010	---	---	<0.010	0.2
Selenium	<0.10	---	---	<0.10	1.0
Silver	<0.050	---	---	<0.050	5.0
Zinc	201	---	---	201	

[1]EPA Method 1311; Analysis according to *SW 846*

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Late Model Import
Fines
TCLP Results

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FORT MYERS, FLORIDA

SUMMARY OF ANALYTICAL DATA
SPECIAL ANALYSIS FINES

OCTOBER 4, 2008

	|-----Three Random Samples-----|			Average	
PARAMETER	CAT 4-2 (84281)	CAT 4-8 (84283)	CAT 4-10 (84161)	CONCEN-TRATION	EPA LIMIT
TCLP METALS (mg/L)[1]					
Arsenic	<0.10	---	---	<0.10	5.0
Barium	1.22	---	---	1.22	100.0
Cadmium	0.014	0.016	0.018	0.016	1.0
Chromium (T)	<0.050	---	---	<0.050	5.0
Copper	<0.10	---	---	<0.10	
Lead	0.194	0.582	0.973	0.583	5.0
Nickel	1.10	---	---	1.10	
Mercury	<0.010	---	---	<0.010	0.2
Selenium	<0.10	---	---	<0.10	1.0
Silver	<0.050	---	---	<0.050	5.0
Zinc	133	---	---	133	

[1]EPA Method 1311; Analysis according to *SW 846*

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ASR
TCLPResults

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OCTOBER 4, 2008

PARAMETER	|-----Three Random Samples-----| CAT 4-1 (84269)	CAT 4-2 (84160)	CAT 4-8 (84271)	Average CONCEN-TRATION	EPA LIMIT
TCLP METALS (mg/L)[1]					
Arsenic	<0.10	---	---	<0.10	5.0
Barium	1.02	---	---	1.02	100.0
Cadmium	0.041	<0.010	0.017	0.021	1.0
Chromium (T)	<0.050	---	---	<0.050	5.0
Copper	0.164	---	---	0.164	
Lead	6.01	0.208	0.693	2.30	5.0
Nickel	1.26	---	---	1.26	
Mercury	<0.010	---	---	<0.010	0.2
Selenium	<0.10	---	---	<0.10	1.0
Silver	<0.050	---	---	<0.050	5.0
Zinc	53.1	---	---	53.1	

[1]EPA Method 1311; Analysis according to *SW 846*

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