DRAFT REPORT
California's Automobile Shredder Waste Initiative

Department of Toxic Substances Control

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(Photograph intentionally omitted)

Hazardous Waste Management Program
Statewide Compliance Division

Acknowledgments

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DTSC would also like to use this opportunity to acknowledge California's automobile shredder industry for the valuable information and assistance that they provided.

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Definition of Acronyms and Abbreviations

ATS	Alternative Technology Section
DHS	Department of Health Services
DTSC	Department of Toxic Substances Control
HWMP	Hazardous Waste Management Program
mg/kg	Milligrams per kilogram
mg/l	Milligrams per liter
ND	Not Detected
PCBs	Polychlorinated biphenyls
PPE	Personal protective equipment
PPM	Parts per million
RCRA	Resource Conservation and Recovery Act
RT	Regulatory Threshold
SB	Senate Bill
SCD	Statewide Compliance Division
STLC	Soluble Threshold Limit Concentration
SVOC	Semi-Volatile Organic Compounds
TCLP	Toxicity Characteristic Leaching Procedure
TTLC	Total Threshold Limit Concentration
UCI	Upper Confidence Interval
WET	Waste Extraction Test

Executive Summary

California's Automobile Shredder Waste Initiative (Initiative) was financed with grant funds provided by the United States Environmental Protection Agency through the Resource Conservation and Recovery Act. The goals of the Initiative were three fold: evaluate the adequacy of the Department of Toxic Substances Control's (DTSC) automobile shredder waste policy; affirm the regulatory status of the automobile shredders operating in California; and ensure compliance by the automobile shredders with the existing statutes and regulations.

In early 2000, DTSC initiated a comprehensive review of its past policies to ensure that the policies conform to current laws and regulations, and are still valid considering current scientific knowledge. One of the policies that came under review was Policy and Procedure 88-6 entitled "Auto Shredder Waste Policy and Procedures" and addressing DTSC's regulation of both untreated and treated shredder waste. As part of reviewing the subject policy and meeting the other goals of the Initiative, it was determined that on-site surveys would provide the most up-to-date information regarding the current status of California's shredder industry.

On-site surveys were conducted at each of the seven shredder facilities operating within the State. Based on the results of the surveys, three facilities were selected for sampling of both untreated and treated shredder waste. The analytical data characterizing a total of 70 samples collected at those facilities indicated that all samples of untreated shredder waste exceeded the State regulatory thresholds for total lead (1,000 mg/kg), copper (2,500 mg/kg) and zinc (5,000 mg/kg). The data also revealed that all samples of untreated shredder waste exceeded the State regulatory thresholds for soluble lead (5.0 mg/l), cadmium (1.0 mg/l) and zinc (250 mg/l). Selected samples of untreated shredder waste were also subjected to the federal Toxicity Characteristic Leaching Procedure where less than one-third of those tested failed the federal regulatory thresholds for soluble lead (5.0 mg/l) and cadmium (1.0 mg/l). The data also indicate that the treated shredder waste from each facility exceeded the State regulatory thresholds for total lead and zinc. Furthermore, treated shredder waste from two facilities exceeded the State's soluble regulatory threshold for zinc, and treated shredder waste from one of the facilities exceeded California's soluble regulatory threshold for cadmium, thereby disqualifying the treated wastes from classification as nonhazardous. Treated shredder waste which fails to meet the conditions of its nonhazardous waste classification is subject to all applicable hazardous waste management requirements including the payment of hazardous waste generation fees. Although polychlorinated biphenyls were found in all samples collected, only two samples exceeded the federal and State regulatory threshold of 50 mg/kg.

Based on the results of the sampling investigation, it is recommended that DTSC:

- Rescind DTSC Policy and Procedure 88-6 entitled “Auto Shredder Waste Policy and Procedures”;
- Require facilities that wish to continue treating their shredder waste on-site to obtain the appropriate authorization within a specified period of time; and
- Rescind all previously issued nonhazardous waste classifications for treated shredder waste.

Section 1: The Regulation of Automobile Shredder Waste in California: A Summary

I. Introduction

The shredding of automobiles and major household appliances produces a waste consisting of primarily non-metallic materials that remain after the recyclable metals have been removed. In California, the waste produced at metal shredding facilities large enough to shred an automobile has been referred to as “automobile shredder waste” or, more appropriately, “shredder waste” as these facilities shred a variety of recyclable metals. Since 1984, shredder waste has been regulated as a non-Resource Conservation and Recovery Act (RCRA) hazardous waste in California due to the presence of lead, cadmium, copper, and zinc at levels above the State’s regulatory thresholds for those metals. Shredder waste has been found to contain polychlorinated biphenyls (PCBs) at concentrations which occasionally exceed the federal and State regulatory threshold of 50 ppm. Shredder waste is both a hazardous waste and a recyclable material subject to California’s Hazardous Waste Control Law and the regulations that apply to hazardous wastes.

Between 1986 and 1992, California’s Department of Health Services (DHS) -Toxic Substances Control Division[1] - issued conditional nonhazardous waste classifications to seven shredder facilities in California who successfully treated their shredder waste to nonhazardous levels using similar metals fixation treatment technologies. DHS also determined that if the treatment of shredder waste was “in-line” with the shredding operation, authorization for hazardous waste treatment was not required. However, none of the treatment technologies were capable of treating organic constituents such as PCBs, or reducing total concentrations of the inorganic constituents present in shredder waste. Once the facility operator received a nonhazardous waste classification from DHS, the treated shredder waste was no longer regulated as a hazardous waste. California’s regulation of shredder waste and shredder facilities was formalized in the DHS Policy and Procedure 88-6 in 1988.

In early 2001, DTSC began implementation of the Initiative to: evaluate the adequacy of the Department of Toxic Substances Control’s (DTSC) automobile shredder waste policy; affirm the regulatory status of the automobile shredders operating in California; and ensure compliance by the automobile shredders with the existing statutes and regulations. On-site surveys were conducted at each of the seven shredder facilities operating in the State. Based on the results of the surveys, three facilities were selected for sampling of both untreated and treated shredder waste. The analytical data from those facilities indicated that all samples of untreated shredder waste exceeded the State regulatory thresholds for

[1] DHS’ Toxic Substances Control Division was the forerunner to the Department of Toxic Substances Control.

total lead, copper and zinc. The data also showed that all samples of untreated shredder waste exceeded the State regulatory thresholds for soluble lead, cadmium and zinc. Selected samples of untreated shredder waste were subjected to the federal Toxicity Characteristic Leaching Procedure (TCLP) where a relatively small number failed the regulatory threshold for soluble lead and cadmium. The data indicate that the treated shredder waste from each facility also exceeded the State regulatory thresholds for total lead and zinc. Furthermore, treated shredder waste from two facilities exceeded the State's soluble regulatory threshold for zinc, and treated shredder waste from one of the facilities exceeded California's soluble regulatory threshold for cadmium, thereby disqualifying the wastes from classification as nonhazardous. Although PCBs were found in all samples collected, only two samples exceeded the regulatory threshold.

The results of the Initiative provide DTSC with valuable information regarding new metal separation methods now employed by California's shredder industry to significantly increase their ability to remove non-ferrous metals from shredder waste. Moreover, the Initiative has also yielded information regarding the nature and amounts of shredder waste currently being generated in California. However, it's important to recognize that the analytical data collected during the Initiative may not be representative of the remaining four shredders currently operating within the State.

II. Background

In the United States, approximately 10 to 12 million automobiles and about 40 million appliances[2] are recycled every year. DTSC estimates that approximately 700,000 automobiles and an unknown number of appliances are recycled by shredders in California each year producing approximately 1.1 million tons of recyclable scrap metal and 300,000 tons of waste. At the heart of the shredder is the hammermill which acts much as a giant tree chipper by grinding the materials fed into it to fist-sized pieces (see Figure 1.). The shredding of automobiles and household appliances results in a mixture of ferrous metal (e.g. iron-containing scrap), nonferrous metal (e.g. non-iron-containing metal alloys such as aluminum and copper), and shredder waste. These constituents are separated by a variety of methods, generally on-site. Both the ferrous and non-ferrous metals are sold to secondary smelters where they are recycled and used to manufacture various metal products.

Shredder waste consists of glass, fiber, rubber, automobile fluids, dirt and plastics found in automobiles and household appliances that remain after the recyclable metals have been removed. Prior to 1984, shredder waste was not considered hazardous and was either disposed or used as daily cover in municipal solid waste landfills.

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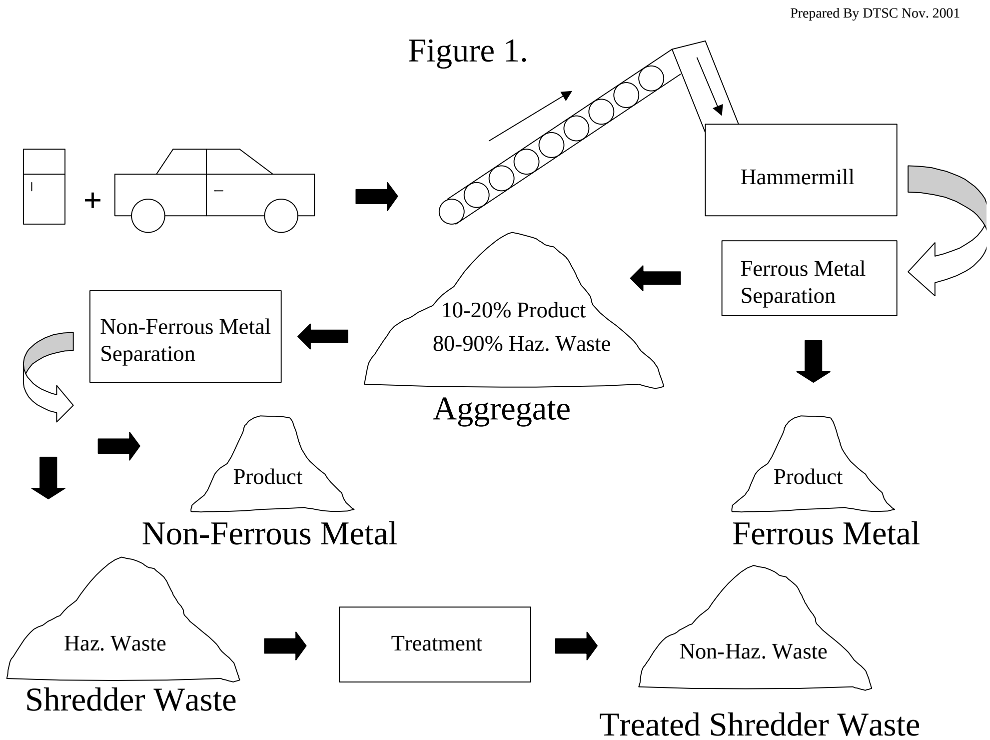
[2] Environmental Liability Management, Inc. 1991. Beneficial Use of Automotive Shredder Residue in Landfills. Prepared for the Recycling Research Foundation.

Figure 1.



However, on March 9, 1984, DHS[3] determined that shredder waste was a non-RCRA hazardous waste because it typically and frequently exceeded regulatory thresholds for several inorganic constituents. The then newly-established waste extraction test (WET) revealed that shredder waste generally exceeded the soluble threshold limit concentrations (STLCs) for lead, cadmium, and zinc. Additionally, it was found that shredder waste exceeded the total threshold limit concentrations (TTLCs) for lead, copper and zinc. These findings subjected shredder waste to statutory and regulatory requirements for hazardous waste management, including permitting, transportation and disposal. Furthermore, it was determined that shredder waste also exhibited the presence of PCBs at concentrations which occasionally exceeded the federal and State regulatory threshold of 50 ppm. At that time, the source of PCBs in shredder waste was unknown but appeared to be somehow associated with major household appliances that are shredded together with automobiles and other scrap for their metal content. The amount of shredder waste generated by shredders prompted DHS to search for solutions to the permitting and disposal issues.

[3] Letter Dated March 9, 1984, from DTSC to Dr. Kenneth Hekimian RE: Disposal of Automobile Shredder Wastes from Hugo Neu-Proler and Clean Steel, Inc.

In 1986, DHS's Alternative Technology Section (ATS) began working with a shredder in Los Angeles to determine if shredder waste could be treated so that it would qualify for a nonhazardous waste classification pursuant to California Administrative Code section 66305(e) [predecessor to Title 22, California Code of Regulations (Cal. Code Regs.) section 66260.200(f)]. ATS determined that if the treatment of shredder waste was "in-line" with the shredding operation, a hazardous waste treatment variance or permit would not be required. To qualify for this interpretation, the shredder was required to conduct a final metals extraction step after treatment which, in most cases, consisted of a magnet positioned above the end of a conveyor belt transporting the treated shredder waste to a location where it could be consolidated into a waste pile. At that time, DHS did not have a multi-tiered permitting program. Policy makers within DHS believed that allowing "in-line" treatment without requiring a permit was the only viable solution. Although the various metals fixation treatment technologies were successful in bringing the soluble inorganic constituents below regulatory thresholds, the total inorganic contaminants (i.e. lead, copper and zinc) were still present in the waste *above* the regulatory thresholds. ATS' approach to regulating treated shredder waste was later formalized in DHS Policy and Procedure 88-6.

Between 1986 and 1992, seven of the eight shredders operating in California applied for and received nonhazardous waste classifications for treated shredder waste using essentially the same treatment technology. The metals fixation treatment technology employed by the shredders allowed the treated waste to pass the WET for all inorganic constituents of concern, with the exception of lead.

Section 2: California's Automobile Shredder Waste Initiative

I. Introduction

In early 2000, DTSC's Hazardous Waste Management Program (HWMP) initiated a comprehensive review of its past policies to ensure that the policies conform to current laws and regulations, and are still valid considering current scientific knowledge. One of the policies that came under review was Policy and Procedure 88-6 entitled "Auto Shredder Waste Policy and Procedures" and addressing DTSC's regulation of both untreated and treated shredder waste. As part of reviewing the subject policy, it was determined that on-site surveys would provide the most up-to-date information regarding the current status of the State's shredder industry.

II. Objectives

Between January 23 and February 20, 2001, staff from HWMP's Statewide Compliance Division (SCD) completed on-site surveys at each of the seven shredder facilities operating in California. Based on the results of the survey, three shredder facilities were selected for sampling investigations. The sampling investigations took place between May 14 and May 22, 2001. The objectives of both the surveys and subsequent sampling investigations were to:

- Determine how California's shredder industry has changed during the past 15 years;

- Determine how much shredder waste is being treated and disposed as non-hazardous; and

- Investigate the presence of lead, cadmium, copper, zinc and polychlorinated biphenyls in samples of untreated and treated shredder waste.

III. Site Surveys

At the start of the Initiative, the number of active shredders operating in California was unknown. DTSC staff therefore began by identifying whether previously known shredder facilities were still active and whether any new shredders had been constructed during the past 15 years. It was determined that there are currently seven shredder facilities operating within the State. Two facilities are located in the San Francisco Bay area; one facility is located in Central California; and four facilities are located in Southern California. One facility that was previously located in National City, near San Diego, was partially dismantled and the hammermill was moved across the United States/Mexico border to Mexicali, Mexico.

Prior to surveying each shredder, DTSC conducted a file review to determine the regulatory history and current status of each facility. In addition to the file review, DTSC also examined hazardous waste manifest data to evaluate disposal trends. The file review indicated that one facility had stored a significant amount of treated shredder waste onsite since 1997. Furthermore, the hazardous waste manifest data revealed a major decline in the amount of shredder waste transported off-site and possibly generated at several facilities beginning in the mid-1990s.

At the conclusion of the file reviews and the hazardous waste manifest data evaluation, on-site surveys were conducted at each facility to obtain up-to-date information on operational activities. A questionnaire was developed and provided to each facility prior to the site visit so that facility representatives would have an idea of the types of information DTSC was interested in collecting. To minimize inconsistencies in the survey process, a single individual was tasked with conducting each on-site survey and completing the questionnaire for the facility.

A. Results

The surveys conducted by DTSC indicate that approximately 700,000 automobiles, an unknown number of discarded major household appliances and other scrap metals are currently being shredded each year in California, generating approximately 287,000 tons of shredder waste. Automobiles represent roughly 47% of the shredder feedstock. The remaining 57% comprise appliances and other steel-containing scrap. Furthermore, research indicates that the composition of automobiles has changed during the past two decades with the amount of plastics found in shredder waste increasing from approximately 6% by weight in 1980 to about 12% by weight in 1990[4].

All shredders now use some form of written “Acceptance Policy” that is provided to scrap dealers and identifies specific hazardous substances that will not be accepted if present in the scrap metal received for shredding. Each shredder also employs radiation detection devices at the facility’s weigh scale and workers that function as load checkers at various locations throughout the facility to examine incoming loads of scrap metal and ensure that all visibly detectable hazardous materials have been removed. Five shredders will only accept scrap metals from automobile dismantlers and “feeder yards” that have been “pre-prepared” by having associated hazardous substances removed. Over 90% of the scrap metals accepted by the remaining two facilities are also prepared off-site. All of the hazardous substances removed from automobiles and scrap metals delivered to the shredders are now being generated by off-site locations such as automobile dismantlers, scrap metal recyclers and “feeder yards”.

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[4] Baumgartner & Associates, Inc. 1992. Shredder Residue: Environmental Information and Characteristics under RCRA. Prepared for the Recycling Research Foundation, Washington, DC.

The “Eddy Current” systems currently employed by all of the shredders have increased the efficiency of the non-ferrous metals separation process from approximately 70%[5] to 90%, significantly reducing the amount of metals found in shredder waste. However, operational limitations associated with using Eddy Current technology appear to have resulted in an inability for most facilities to perform “in-line treatment” of the shredder waste and has led to a multi-step metals separation and shredder waste treatment approach. Six shredders currently store intermediate shredded material (also known as shredder aggregate) consisting of approximately 80%-90% shredder waste and 10%-20% recoverable non-ferrous metals for several days to weeks on-site until it is processed further. The amounts of the shredder aggregate stored at the six facilities range from 100 - 2,000 tons. One shredder is shipping intermediate shredded material to a second facility for further processing without using either a hazardous waste manifest or registered hazardous waste transporter.

Together, five shredders currently treat approximately 213,000 tons of shredder waste each year, however, only one facility operates a true “in-line treatment” process pursuant to Policy and Procedure 88-6. All five facilities are disposing of their treated shredder waste in California: three facilities at Class III landfills; one facility at a Class II landfill; and one facility at a monofill located at a former gypsum mine. The remaining two shredders are disposing an estimated 74,000 tons of untreated shredder waste each year at municipal waste landfills located in Arizona (57,000 tons) and Mexico (17,000 tons). One facility has stored approximately 8,000 to 10,000 tons of treated shredder waste on-site since 1997.

B. Additional Observations

Historically, environmental contamination resulting from the operation of shredders has been a concern. PCB contamination at one facility caused it to become listed as a State Superfund site in 1991. The remedial action at the site resulted in the removal of approximately 58,550 tons of PCB-contaminated shredder waste and soil and was completed in March 1999. Characterization of the soil underlying the waste pile indicated that the hazardous constituents found in shredder waste generally migrated to a depth of 18 inches below ground surface and were never found to exceed a depth of 30 inches. Currently, all of the shredder facilities have either completed, or are in the process of paving their sites with concrete to reduce further soil contamination, provide a safer environment for operating heavy equipment during the rainy season, and capture rainfall for on-site reuse in the shredding operation.

C. Conclusions

It is estimated that approximately 300,000 fewer automobiles are shredded and 13,000 fewer tons of shredder waste are generated each year in California today as compared to the mid-1980s. Automobiles now comprise 47% of the shredder feedstock as compared

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[5] Based on DTSC estimate in 1987.

to an estimated 60% - 80%[6] fifteen years ago. Although the overall amount of shredder waste being generated is sightly less today, the amount of shredder waste generated per automobile shredded appears to have risen. The proportional increase in the amount of shredder waste generated today is probably due to increases in the amount of other scrap metal shredded (e.g appliances, light gauge metal, etc.) and the expanded use of plastics in newer automobiles. It is not known if the increased percentage of appliances and other light gauge metals in the feedstock have altered the characteristics of the waste by introducing previously unknown hazardous constituents.

All seven of the shredders currently operating within California have previously been issued non-hazardous waste classifications for treated shredder waste. Five shredders are treating a combined 213,000 tons of shredder waste each year in apparent compliance with the requirements of their non-hazardous waste classifications. However, four out of five shredders treating their shredder waste are not in compliance with the "in-line treatment" provisions of DTSC Policy and Procedure 88-6.

California's shredder industry appears to have made significant progress during the past decade toward removing hazardous materials from the scrap metals that they shred and increasing the efficiency of their non-ferrous metal separation systems. Together, both changes have the potential to reduce both the hazardous characteristics and amount of shredder waste generated in the State. Sample analytical data provided by two facilities characterizing untreated and treated shredder waste indicate compliance for all hazardous constituents regulated under federal and State hazardous waste laws. However, in the absence of data from samples collected and analyzed by DTSC, it is difficult to make general statements regarding the hazardous characteristics of all shredder waste currently generated in California. Furthermore, the management and disposal of hazardous substances removed from automobiles and other scrap metals prior to shredding has been transferred from the shredders to off-site locations such as automobile dismantlers, scrap metal recyclers and "feeder yards". California recently passed Senate Bill (SB) 633 to aid in reducing the use of mercury, a persistent bioaccumulative toxic metal, through education and information. SB 633 requires DTSC to provide, to those businesses engaged in the dismantling or crushing of motor vehicles, technical assistance regarding the safe removal and proper disposal of mercury-containing light switches.

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[6] Based on DTSC estimate in 1987.

IV. Sampling Investigation Methods and Design

A. Site Selection
A primary recommendation arising from the site surveys was the need to obtain samples of untreated and treated shredder waste and analyze them for the presence of constituents regulated under federal and State hazardous waste laws. Due to logistical and staffing considerations, DTSC decided to conduct sampling investigations at two San Francisco Bay area shredder facilities and one Central California shredder in May 2001.

B. Sample Collection and Analysis
As previously indicated, the shredding of automobiles and major household appliances results in a mixture of ferrous metal, nonferrous metal, and shredder waste. Untreated shredder waste is a highly heterogeneous waste stream consisting of glass, fiber, rubber, automobile fluids, dirt and plastics found in shredder feedstock that remain after the recyclable metals have been removed. Shredder waste is generally screened prior to treatment resulting in treated shredder waste exhibiting a particle size distribution <1.5" making it more homogeneous in nature. The intermediate shredded material or "shredder aggregate" (aggregate) represents a mixture of 80-90% shredder waste and 10-20% nonferrous metal that is generated after the initial ferrous metal separation step of the metal recycling process. Many shredders store aggregate on-site for a few days to several weeks before processing it further to remove the nonferrous constituents from the mixture. To address the goals of the Initiative, it was necessary to collect samples of untreated shredder waste, aggregate and treated shredder waste.
The heterogeneity and physical characteristics of shredder waste present a number of challenges to sampling this waste stream. Although DHS had previously developed a sampling and analytical protocol specific for shredder waste in 1987, DTSC determined that an updated version was needed to meet the needs of the Initiative. Standard procedures for collecting samples were developed using methods found in Arizona Administrative Code, Title 18 (Environmental Quality), Chapter 13 (Department of Environmental Quality), Article 13 (Special Waste), Section R18-13-307 (Best Management Practices for Waste from Shredding Motor Vehicles) as a model. All sampling and analytical procedures presented in DTSC's revised sampling and analytical protocol (Appendix 1) were designed to obtain representative samples for waste characterization purposes and were consistent with the U. S. Environmental Protection Agency's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", 3rd Edition (SW-846).

C. Statistical Analysis of the Data
In almost every instance, the sample variance for specific constituents of concern, characterizing samples of both untreated and treated waste collected from each facility, exceeded the sample mean. In all instances where the variance exceeded the mean of a sample population, the data were transformed via the arcsine transformation method pursuant to SW-846 as required by State law. All subsequent statistical evaluations were

performed on the transformed scale and the calculated mean, standard deviation and 90% upper confidence interval (UCI) were back-transformed in order to express this information in the proper units of measure and complete the calculation for the appropriate number of samples.

V. Results

The results of the shredder waste sampling investigations provide valuable information regarding California's shredder industry. However, data characterizing samples of untreated (including samples of aggregate) and treated shredder waste may not necessarily reflect similar wastes generated by other shredders operating within the State. Table 1 presents the regulatory thresholds (RT) for the contaminants of concern.

Table 1.
State and Federal Regulatory Thresholds

Contaminant	TTLC(mg/kg)	STLC (mg/l)	TCLP (mg/l)
Cadmium	100	1.0	1.0
Copper	2,500	25	N/A
Lead	1,000	5.0	5.0
PCBs	50	5.0	N/A
Zinc	5,000	250	N/A

A. Total Concentrations of Lead

Total concentrations of lead in untreated and treated shredder waste ranged between 900 mg/kg and 53,000 mg/kg. Table 2 reveals that in all cases, the 90% UCI exceeds the RT for total lead in untreated and treated shredder waste. In all cases the calculated mean for total lead in samples of untreated and treated shredder waste also exceed the RT for total lead.

B. Total Concentrations of Copper

Total concentrations of copper in untreated and treated shredder waste ranged between 433 mg/kg and 53,300 mg/kg. Table 2 reveals that in all but one case, the 90% UCI exceeds the RT for total copper in untreated and treated shredder waste. In all but one case, the calculated mean for total copper in samples of both untreated and treated shredder waste also exceed the RT for total copper. However, additional samples need to be collected (see Appendix 4) and analyzed before a definitive conclusion can be reached regarding whether treated shredder waste at one facility exceeds the RT for total copper.

C. Total Concentrations of Zinc
Total concentrations of zinc in untreated and treated shredder waste ranged between 583 mg/kg and 19,300 mg/kg. Table 2 reveals that in all cases, the 90% UCI exceeds the RT for total zinc in untreated and treated shredder waste. In all cases the calculated mean for total zinc in samples of untreated and treated shredder waste also exceed the RT for total zinc.

D. Soluble Concentrations of Lead
Soluble concentrations of lead in untreated shredder waste ranged between 56.4 mg/l and 342 mg/l while soluble concentrations of lead in treated shredder waste ranged between 0.25 mg/l and 68.3 mg/l. Table 3 indicates that in every case the 90% UCI exceeded the RT for soluble lead in untreated and treated shredder waste. However, in all cases the 90% UCI for soluble lead in treated shredder waste was well below the 50 mg/l limit for soluble lead required for the issuance of nonhazardous waste classifications for treated shredder waste. In every case the calculated mean for soluble lead in untreated shredder waste exceeded 50 mg/l.

The calculated appropriate number of samples for Facility B (see Appendix 5) exceeds the actual number of samples collected with respect to soluble lead concentrations. Therefore, additional samples need to be collected and analyzed before a definitive conclusion can be reached regarding whether treated shredder waste at Facility B exceeds the RT for soluble lead.

E. Soluble Concentrations of Cadmium
Soluble concentrations of cadmium in untreated shredder waste sampled ranged between 0.66 mg/l and 5.37 mg/l while soluble concentrations of cadmium in treated shredder waste ranged between 0.13 mg/l and 2.15 mg/l. Table 3 demonstrates that both the 90% UCI and calculated mean for untreated shredder waste from each facility exceed the RT for soluble cadmium. However, Table 2 also demonstrates that in only one case did the 90% UCI and calculated mean exceed the RT for soluble cadmium in treated shredder waste.

F. Soluble Concentrations of Zinc
Soluble concentrations of zinc in untreated shredder waste ranged between 325 mg/l and 1,280 mg/l while soluble concentrations of zinc in treated shredder waste ranged between 1.34 mg/l and 1,150 mg/l. Table 3 reveals that both the 90% UCI and calculated mean for untreated shredder waste exceed the RT for soluble zinc. However, Table 2 also indicates that in only one case was the 90% UCI and calculated mean below the RT for soluble zinc in treated shredder waste.

G. Total Concentrations of PCBs
Total concentrations of PCBs in untreated shredder waste sampled ranged between 0.59 mg/kg and 129 mg/kg while total concentrations of PCBs in treated shredder waste ranged between 2.57 mg/kg and 45.1 mg/kg. Table 2 reveals that in no case did either the

90% UCI or the calculated mean for untreated and treated shredder waste exceed the RT.

H. Federal Lead Concentrations

Thirteen samples were selected to be analyzed for soluble lead and cadmium using the federal Toxicity Characteristic Leaching Procedure (TCLP) method. Several samples exhibiting both high total and soluble (as determined by the Waste Extraction Test) lead and cadmium concentrations were selected for TCLP analysis.

Table 4 indicates that soluble lead concentrations as measured by TCLP ranged between 0.51 mg/l and 24.6 mg/l. Five of the thirteen samples analyzed using TCLP were found to exceed the federal RT for lead of 5.0 mg/l.

I. Federal Cadmium Concentrations

Table 5 demonstrates that soluble cadmium concentrations as measured by TCLP ranged between Not Detected and 1.17 mg/l. Only two of the twelve samples analyzed using TCLP were found to exceed the federal RT for cadmium of 1.0 mg/l.

J. Total Semi-Volatile Organic Compounds (SVOC)

Two samples from each facility were selected for SVOC analysis. The data indicated the presence of phthalates in five of the six samples analyzed for SVOCs. Naphthalene was detected in one sample.

VI. Conclusions

- Approximately 700,000 automobiles, an unknown number of major household appliances, and other scrap metal are currently being shredded in California each year generating an estimated 287,000 tons of shredder waste. These totals reflect a decrease[7] of 300,000 automobiles shredded and 13,000 tons of shredder waste annualy generated within the State today as compared to the mid-1980s.

- Although all seven shredders currently operating in California have been issued nonhazardous waste classifications for their treated shredder waste, two facilities are not currently treating their shredder waste. Five shredders treat a combined 213,000 tons of shredder waste each year which is all disposed in California as nonhazardous waste. The remaining two facilities are disposing 74,000 tons of untreated shredder waste at landfills in Arizona (57,000 tons) and Mexico (17,000 tons).

- The majority of shredders operating in California are in violation of in-line treatment provisions of DTSC's auto shredder policy and procedure. Four of the five shredders that treat their shredder waste are <u>not</u> in compliance with the "in-line treatment" provisions of the policy and procedure. Two shredders are engaged in illegally transporting and accepting aggregate, and one of these facilities has also stored between 8,000 and 10,000 tons of treated shredder waste on-site since 1997.

- The analytical data from the three facilities selected for sampling indicate that all samples of untreated shredder waste (including all samples of aggregate obtained at one facility) exceeded the State RTs for total lead, copper and zinc. Furthermore, analytical data characterizing all samples of untreated shredder waste and aggregate exceeded the State RTs for soluble lead, cadmium and zinc. Selected samples of untreated shredder waste and aggregate were analyzed by the federal TCLP test method where less than one-third failed the RT for soluble lead and cadmium.

- The data also indicate that the treated shredder waste from each facility also exceeded the State RTs for total lead and zinc. Samples of treated shredder waste from two facilities also exceeded the California RT for total copper. Furthermore, treated shredder waste from two facilities exceeded the State's soluble RT for zinc, and one of the facilities also exceeded California's soluble RT for cadmium, thereby disqualifying those wastes from classification as nonhazardous.

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[7] Based on DTSC estimates in 1987.

- Although PCBs were found in all samples collected, only two samples exceeded the regulatory threshold. Additional testing for SVOCs indicated the presence of phthalates in five of the six samples analyzed, and naphthalene was detected in one sample. The presence of phthalates[8] is not unexpected as they are commonly used in the manufacture of plastics found in automobiles and other products such as major household appliances.

- A comparison of data characterizing untreated shredder waste generated in 1986 with recently acquired samples of untreated shredder waste indicate a downward trend in the total concentration of PCBs. This finding is probably the result of increased efficiency in the removal of PCB-containing capacitors from appliances prior to shredding. However, the data also demonstrate an upward trend in the total concentration of lead and the soluble concentration of cadmium. The increased concentrations of these metals in shredder waste may be the result of shredding increased amounts of major household appliances which contain a higher percentage of galvanized steel as compared to automobiles. The galvanization process uses zinc to coat steel for corrosion protection and zinc normally contains trace amounts of lead and cadmium. It is possible that the increased levels of these metals in shredder waste is the result of the zinc layer being removed during shredding.

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[8] Baumgartner & Associates, Inc. 1992. Shredder Residue: Environmental Information and Characteristics under RCRA. Prepared for the Recycling Research Foundation, Washington, DC.

VII. Recommendations

Based on the results of the on-site surveys and sampling investigations, DTSC has evaluated a number of options in order to develop recommendations that address the following goals of the Initiative:

A. Evaluate the adequacy of DTSC's automobile shredder waste policy; and

B. Ensure compliance with the existing statutes and regulations.

A. Evaluate the adequacy of DTSC's automobile shredder waste policy.
The options concerning the adequacy of DTSC Policy and Procedure 88-6 include:

1. Status quo
2. Revise DTSC Policy and Procedure 88-6
3. Rescind DTSC Policy and Procedure 88-6

<u>1. Status Quo</u>

Pros:
- Has no impacts to the existing regulatory structure.
- Does not require the expenditure of additional resources by either DTSC or California's automobile shredder industry.
- Continues to allow the disposal of treated shredder waste in Class III landfills.

Cons:
- Allows California's automobile shredder industry to continue on-site treatment of shredder waste without authorization.
- Continues a policy whereby California's automobile shredder industry does not pay hazardous waste generator fees for shredder waste that is treated.

<u>2. Revise DTSC Policy and Procedure 88-6</u>

Pros:
- Allows DTSC to update its regulation of California's automobile shredder industry by identifying the appropriate regulatory structure for automobile shredders treating their shredder waste.

Cons:
- On-site treatment authorization options that currently exist may not adequately address the needs of California's automobile shredder industry.

3. Rescind DTSC Policy and Procedure 88-6

Pros:

- Removes a DTSC policy and procedure that is inconsistent with current California law.

Cons:

- May create confusion within California's automobile shredder industry regarding the continued treatment of shredder waste and the regulation of their facilities by DTSC.

Recommendation: Option 3. Rescind DTSC Policy and Procedure 88-6 entitled "Auto Shredder Waste Policy and Procedures."

B. Ensure compliance with the existing statutes and regulations.
The options for DTSC to regulate California's auto shredder industry pursuant to existing statutes and regulations include:

1. Status quo
2. Require facilities that wish to continue treating their shredder waste on-site to obtain the appropriate authorization within a specified period of time
3. Rescind all previously issued nonhazardous waste classifications for treated shredder waste

1. Status Quo

Pros:

- Has no impacts to the existing regulatory structure.
- Does not require the expenditure of additional resources by either DTSC or California's automobile shredder industry.
- California's automobile shredders are not required to alter their operational activities.
- Requires no change in DTSC's regulation of California's automobile shredder industry.

Cons:

- Is inconsistent with DTSC's regulatory responsibility to enforce California's hazardous waste laws and regulations.

2. Require facilities that wish to continue treating their shredder waste on-site to obtain the appropriate authorization within a specified period of time

Pros:

- Consistent with DTSC's regulatory responsibility to enforce California's hazardous waste laws and regulations.

Cons:

- Compliance with existing on-site treatment authorization requirements may result in many shredders ceasing their shredder waste treatment activities.
- May increase the amount of untreated shredder waste disposed in neighboring States.

<u>3. Rescind all previously issued nonhazardous waste classifications for treated shredder waste</u>

Pros:

- Allows DTSC to re-evaluate the efficacy of shredder waste treatment processes.

Cons:

- Effectively prohibits the disposal of treated shredder waste in Class III landfills within California.
- Eliminates any incentive for California's automobile shredder industry to treat shredder waste.
- Will result in higher waste disposal costs for California's automobile shredder industry.
- Will increase the amount of untreated waste disposed in neighboring States.

Recommendation(s): Options 2 and 3. Require facilities that wish to continue treating their shredder waste on-site to obtain the appropriate authorization within a specified period of time; and rescind all previously issued nonhazardous waste classifications for treated shredder waste.

TABLE 2.

Mean Total Concentration (mg/kg)
Untreated and Treated Shredder Waste

Facility (waste type)	Lead	Copper	Zinc	PCBs
A (Untreated)	1,739	2,170	11,850	14.0
A (Treated)	2,202	1,933	6,685	4.89
B (Untreated)	4,508	9,727	9,727	7.03
B (Treated)	1,653	4,346	5,806	8.91
C (Aggregate)	3,020	4,462	11,150	28.0
C (Treated)	2,026	1,343	8,089	22.7
Regulatory Threshold	1,000	2,500	5,000	50

Calculated 90% Upper Confidence Interval (mg/kg)
Untreated and Treated Shredder Waste

Facility (waste type)	Lead	Copper	Zinc	PCBs
A (Untreated)	1,842	3,116	12,460	16.0
A (Treated)	2,403	3,155	7,385	5.46
B (Untreated)	7,841	14,270	11,590	10.7
B (Treated)	2,058	9,353	8,182	13.7
C (Aggregate)	3,642	8,214	12,350	42.4
C (Treated)	2,285	1,887	9,320	27.6
Regulatory Threshold	1,000	2,500	5,000	50

TABLE 3.

Mean Soluble Concentration (mg/l)
Untreated and Treated Shredder Waste

Facility (waste type)	Lead	Cadmium	Zinc
A (Untreated)	77.7	3.05	911
A (Treated)	29.3	1.56	439
B (Untreated)	162	1.47	572
B (Treated)	4.39	0.33	33.8
C (Aggregate)	110	2.19	829
C (Treated)	18.9	N/A	304
Regulatory Threshold	5.0	1.0	250

Calculated 90% Upper Confidence Interval (mg/l)
Untreated and Treated Shredder Waste

Facility (waste type)	Lead	Cadmium	Zinc
A (Untreated)	84.9	3.34	965
A (Treated)	33.6	1.72	491
B (Untreated)	153	1.68	676
B (Treated)	10.3	0.58	132
C (Aggregate)	121	2.40	900
C (Treated)	26.9	N/A	327
Regulatory Threshold	5.0	1.0	250

TABLE 4.

Comparison of Total & Soluble **Lead** Concentrations in Individual Samples
Untreated Shredder Waste

Sample Location	Total Concentration (mg/kg) (Regulatory Threshold = 1,000 mg/kg)	Soluble Concentration (mg/l) **Waste Extraction Test (WET)** (Regulatory Threshold = 5.0 mg/l)	Soluble Concentration (mg/l) **Toxicity Characteristic Leaching Procedure (TCLP)** (Regulatory Threshold = 5.0 mg/l)
Facility A	1,700	68.6	3.56
Facility A	1,590	71.4	5.90
Facility B	6,640	90.8	*6.46/3.57
Facility B	3,220	342	7.91
Facility B	2,570	118	5.24
Facility B	2,970	163	4.34
Facility B	3,260	179	1.92
Facility B	53,400	287	24.6
Facility C	3,600	95.1	2.28
Facility C	2,520	106	1.42
Facility C	2,080	97.5	0.51
Facility C	5,640	137	1.04
Facility C	5,240	150	3.85

* Sample tested twice

TABLE 5.

Comparison of Total & Soluble **Cadmium** Concentrations in Individual Samples
Untreated Shredder Waste

Sample Location	Total Concentration (mg/kg) (Regulatory Threshold = 100 mg/kg)	Soluble Concentration (mg/l) **Waste Extraction Test (WET)** (Regulatory Threshold = 1.0 mg/l)	Soluble Concentration (mg/l) **Toxicity Characteristic Leaching Procedure (TCLP)** (Regulatory Threshold = 1.0 mg/l)
Facility A	45.0	5.37	1.04
Facility A	33.2	2.10	1.17
Facility B	35.7	1.05	0.17
Facility B	126	2.01	0.17
Facility B	123	1.38	0.17
Facility B	42.6	2.24	0.36
Facility B	49.5	1.97	0.34
Facility C	33.3	2.88	0.37
Facility C	32.3	1.94	0.37
Facility C	30.9	2.33	0.43
Facility C	Not Detected	Not Tested	0.37
Facility C	Not Detected	Not Tested	0.36

Appendix 1.

Shredder Waste
Sampling and Analytical Protocol
(April 2001)

VIII. Background

The shredding of automobiles results in a mixture of ferrous metal (e.g. iron containing scrap), nonferrous metal (e.g. non-iron containing metal alloys), and shredder waste. Untreated shredder waste is a highly heterogeneous waste stream consisting of glass, fiber, rubber, automobile fluids, dirt and plastics found in automobiles that remain after the recyclable metals have been removed. Treated shredder waste is generally screened prior to treatment resulting in a particle size distribution < 1.5" and is more homogeneous in nature. Automobile "shredder aggregate" (aggregate) represents a mixture of 80%-90% shredder waste and 10%-20% nonferrous metal that is generated after the initial ferrous metal separation step of the metal recycling process. Many shredders store aggregate on-site for a few days to several weeks before processing it further to remove the nonferrous constituents from the mixture.

IX. Purpose of Sampling and Analytical Protocol

The heterogeneity and physical characteristics of shredder waste present a number of challenges to sampling this waste stream. All sampling procedures presented in this sampling and analytical protocol are designed to obtain representative samples for waste characterization purposes and are consistent with the U. S. Environmental Protection Agency's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", 3rd Edition.

III. Sampling Team

The sampling team will be comprised of four[9] (4) field certified, Department of Toxic Substances Control (DTSC) staff. A DTSC Industrial Hygienist will provide additional technical support as needed and may be present during the sampling event. Two team members will be responsible for sample collection, packaging and shipping. A third team member will be responsible for processing necessary paperwork, completing Chain-of-Custody forms, maintaining a field log, and labeling containers for waste pile sampling. The fourth team member will be the

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[9] Except in those situations where only on-line generated shredder waste is being sampled and the activities of the third and fourth team members are combined.

designated “Team Leader” and will be responsible for coordinating with facility personnel, getting help in case of an emergency and performing other support tasks. Where appropriate, facility personnel may be asked to collect a sample in the presence of the sampling team.

IV. Sampling Protocol

A. On-line Generated Waste

1. Untreated Waste - As the untreated shredder waste is generated, one 500-gram sample will be collected every thirty (30) minutes over a three hundred (300) minute time frame while the facility is in operation generating ten (10) discreet composite samples. Care should be taken to collect samples that reflect the particle size distribution of the waste being generated. Two (2) duplicate samples will also be collected for a total of twelve (12) samples.

2. Treated Waste - When the average amount of treated shredder waste generated from one-half to a full day’s operation has fully cured (approximately 3 days after treatment), the appropriate waste pile sampling protocol from Section C. below will be selected to obtain samples.

B. Aggregate

1. On-line Generated - As the aggregate is generated, one 500-gram sample will be collected every thirty (30) minutes over a three hundred (300) minute time frame while the facility is in operation generating ten (10) discreet composite samples. Care should be taken to collect samples that reflect the particle size distribution of the aggregate being generated. Two (2) duplicate samples will also be collected for a total of twelve (12) samples.

2. Stored Piles - The average amount of aggregate generated from one-half to a full day’s operation must be formed into a square for sampling purposes. One 2,000-gram sample will be collected from each sample point as indicated in Exhibit 1. Samples from sample points A-1, B-1, and C-1 will be collected from the top of the pile. Samples from sample points A-2, B-2, and C-2 will be collected from the base of the pile. A sample from point C-3 will be collected at the vertical midpoint at the center of the pile. The seven (7) samples will be numbered consecutively. Three (3) of the 2,000-gram samples will the be chosen at random by selecting numbers from a table of

random numbers or a calculator programmed to generate random numbers. Two (2) duplicate samples will also be collected for a total of five (5) samples.

C. Waste Piles

1. Small Waste Pile (< 1,000 tons) - If possible, the waste pile should be formed into a square for sampling purposes. One 2,000-gram (500-gram for treated shredder waste) sample will be collected from each sample point as indicated in Exhibit 1. Samples from sample points A-1, B-1, and C-1 will be collected from the top of the pile. Samples from sample points A-2, B-2, and C-2 will be collected from the base of the pile. A sample from point C-3 will be collected at the vertical midpoint at the center of the pile. The seven (7) samples will be numbered consecutively. Three (3) of the 2,000-gram samples will the be chosen at random by selecting numbers from a table of random numbers or a calculator programmed to generate random numbers. Two (2) duplicate samples will also be collected for a total of five (5) samples.

2. Medium Waste Pile (1,000 to 2,500 tons) - If possible, the waste pile should be formed into a square for sampling purposes. One 2,000-gram (500-gram for treated shredder waste) sample will be collected from each sample point as indicated in Exhibit 1. Samples from sample points A-1, B-1, and C-1 will be collected from the top of the pile. Samples from sample points A-2, B-2, and C-2 will be collected from the base of the pile. A sample from point C-3 will be collected at the vertical midpoint at the center of the pile. Seven (7) samples will be collected in the manner described above plus two (2) duplicate samples for a total of nine (9) samples.

3. Large Waste Pile (>2,500 tons) - If possible, the waste pile should be formed into a square for sampling purposes. One 2,000-gram sample will be collected from each sample point as indicated in Exhibit 2. Samples from sample points A-1, B-1, and C-1 will be collected from the top of the pile. Samples from sample points A-3, B-3, and C-3 will be collected from the base of the pile. Samples A-2, B-2, and C-2 will be collected at the vertical midpoint of each diagonal. Sampling points D-1, D-2, and D-3 will be selected at the discretion of the sampling team leader. Twelve samples will be collected in the manner described above plus two (2) duplicates for a total of fourteen (14) samples.

V. Field Quality Assurance/Quality Control

In addition to the samples collected from the designated sampling points, two duplicate samples will also be gathered during each sampling investigation. These duplicates can be collected from any of the sample locations at the same time as the corresponding “original” sample. The duplicate samples will be given a sample identification number different from the “original” so that laboratory personnel will not know the identity of the duplicates. The duplicate samples will be noted in the field notebook and will also be cross-referenced in the report of analysis which will follow the sampling event.

VI. Sampling Methodology

A. Equipment

Due to the physical nature of the shredder waste, conventional waste pile sampling equipment would not be expected to perform adequately for larger waste piles. The equipment of choice for these efforts should consist of a blade-equipped front-end loader, backhoe (e.g. Caterpillar 215), or dozer so the pile can be placed into the proper configuration prior to sampling and properly accessed during sampling.

The waste pile should be prepared for sampling by using heavy equipment to form it into a square of approximately uniform height. Depending on the size of the waste pile, Exhibit 1 or Exhibit 2 can be used to identify evenly distributed sampling locations. The collection of samples from the pile’s center is accomplished by creating one or more trenches so that a middle sampling point for a specific diagonal passes through the trench.

B. Decontamination

All sampling equipment is to be decontaminated prior to the processing of each sample. If a shovel, trowel or other type of sampling device is used to collect a sample, it must be decontaminated between each sample location.

C. Sample Retrieval, Containers and Preservation

Care should be taken to collect samples that reflect the particle size distribution of the waste being generated. Samples may be collected by selecting a number of sub-samples from each sample location until a total of either five (5) hundred grams or two (2) thousand grams of material has been obtained. Samples should be collected in one quart glass wide mouth I-CHEM jars (or equivalent) for five (5) hundred gram samples or one gallon glass wide mouth I-CHEM jars (or equivalent) for two (2) thousand gram samples. These are laboratory prepared and contain a Teflon liner within a plastic screw cap. The jars should be filled to the top. Glove covers used by the sampler will be replaced between each sample. All sample jars must be identified on a Chain-of-Custody form.

D. Documentation of Chain-of-Custody

All samples will be labeled and sealed upon collection. The sample number, date, time of collection, location, and signature of the sampler will be recorded. In addition, the samples will be entered on Chain-of-Custody forms before delivery to the laboratory. Log book entries for each sample will include as a minimum:

- Location of sampling point
- Sample numbers
- Date and time
- Field observations
- Samplers' signature(s)
- Photograph log
- Analyses to be done

VII. Analytical Protocol

A. Scope and Application

1. This procedure describes the preparation and analysis of shredder waste to determine the presence of metals and polychlorinated biphenyls (PCBs) for waste classification purposes. Other related samples may also be amenable to these procedures, but the reliability of the method should be established before analysis of samples for the purposes of waste classification. Other analyses may be done on samples prepared by these procedures, but appropriate sample handling and preservation procedures should be followed.

2. This method is recommended for use only by, or under the close supervision of, analysts experienced in hazardous waste preparation and analysis. Analysis done for the purpose of waste classification must be done in a California certified hazardous waste testing laboratory.
3. The details of analytical procedures can be found in the corresponding references. The sensitivity of this method for PCBs is

approximately 1 mg/kg. The sensitivity of the method for metals depends primarily on the choice of analytical techniques, but in no case should the detection limits exceed the corresponding Soluble Threshold Limit Concentrations (STLCs) listed in Article 11, Title 22 of the California Code of Regulations.

B. Safety

Unless the samples are known to be free of volatile substances, all samples should be handled in a well functioning hood. If some sample handling cannot be done in a hood, personal protection should be consistent with the field sampling safety plan.

C. Apparatus and Materials

1. Sieves, polyethylene or stainless steel, No. 10 (2 mm opening) and other sizes as required by the option used.

2. Mill, mechanical. The mill must be demonstrated to not contaminate samples. This can be demonstrated by a combination of (i) Analysis of equipment blanks (e.g. , wipes with hexane-soaked filter paper for PCB analysis, and wipes with de-ionized water-soaked filter paper for metal analysis; (ii) Analysis of method blanks (e.g. milling material known to be free of contamination prior to and after grinding samples). A variety of mills may be used, although machines with a cutting action may be more successful than grinders for samples containing significant amounts of rubber or plastic. Freezing samples with liquid nitrogen prior to grinding may improve the effectiveness of the mill.

D. Sample Handling and Preservation

Samples must be collected in accordance with procedures approved by DTSC (see Section IV.). No sample preservation is required for PCBs or metals in shredder waste.

E. Procedures

Prepare samples according to either of the two options below. Other procedures must be approved by DTSC. A minimum size sample of 10 grams is to be analyzed according to the procedures listed in Table 1.

1. Option A - Procedure for the preparation of shredder waste prior to analysis for total metals and the Waste Extraction Test: The representative composite sample is mixed throughly then reduced by coning and quartering, or an equivalent method, to yield a sub-sample which can be easily managed (ca. 500 grams). The sample shall be passed directly, or shall be milled to pass, through a No. 10 (2 mm) standard sieve before it is analyzed. If the sample contains non-friable solid particles which do not pass directly through a No. 10 sieve and which are extraneous to the waste or other material, they shall be removed to the extent feasible by mechanical means and discarded. The following are examples of these extraneous particles that shall be removed and discarded:

   a. Non-friable metal fragments
   b. Rocks, pebbles and plant debris

   Solids which remain after removal of these extraneous materials shall be milled to pass through the No. 10 sieve and shall be combined and mixed well with the solids which passed through the sieve without milling. The combined solids shall be analyzed or extracted as prescribed.

2. Option B - If prior analysis has demonstrated that there is no significant difference in the contaminant concentrations in the various size fractions for a particular waste, then the grinding of samples may be omitted and the analysis may be done on the fraction passing through a No. 10 (2 mm) sieve. The demonstration of homogeneity must include at least four (4) samples separated into four (4) fractions, using No. 2, No. 4 and No. 10 sieves. The results must be evaluated using a t-Test or other statistical test.

F. Quality Control (QC)

A minimum of 10% of the samples are to be analyzed in duplicate. For highly heterogeneous samples, triplicate samples should be analyzed. All QC requirements of the certification program and the referenced analytical methods must be followed. The final report will include results for field replicates, lab replicates, lab method blanks, lab spikes, and lab QC samples, if used.

VIII. Health and Safety

Adherence by the sampling team to the following activities will ensure proper health and safety in the field:

- Proper training of the sampling team;
- Coordination with a DTSC Industrial Hygienist in assessing any potential hazards prior to the site visit;
- Use of proper personal protective equipment (PPE); and
- Designating a team member to be responsible for getting help in case of an emergency situation.

PPE used by the sampling team should include: hard hat, Tyvek suit, air purifying respirator (APR), extra cartridges for the respirator, eye protection, steel toed boots, nitrile gloves, hearing protection, and a first aid kit.

Prior to each sampling investigation, a DTSC Hazard Appraisal and Recognition Plan (HARP) Pre-Site Visit form will be completed and approved by a DTSC Industrial Hygienist. The HARP form identifies potential health hazards posed at each facility to be sampled, the PPE to be used, and the location of the nearest hospital.

Table 1 - Analytical Methods

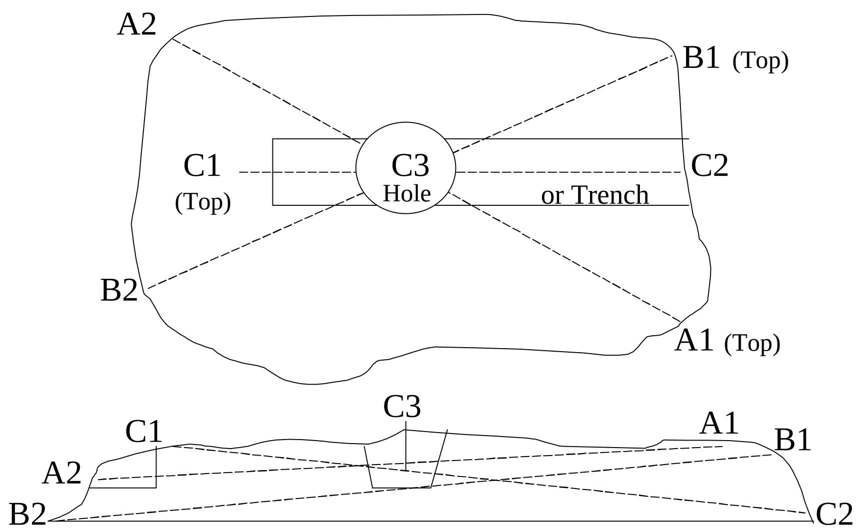
Test Category	Method Number
Cadmium*	6010, 7130, 7131
Chromium, Total*	6010, 7190, 7191
Copper	6010, 7210, 7211
Lead*	6010, 7420, 7421
Mercury*	7470, 7471
Nickel	6010, 7520, 7521
Zinc	6010, 7950, 7951
PCBs	8080, 8081, 8082

* U.S. EPA Method 1311 (Toxicity Characteristic Leaching Procedure).

Note: A modified Method 6010 using ICP/MS is acceptable as equivalent to Method 6010. Methods are from SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods”, 3rd Edition.

Exhibit 1

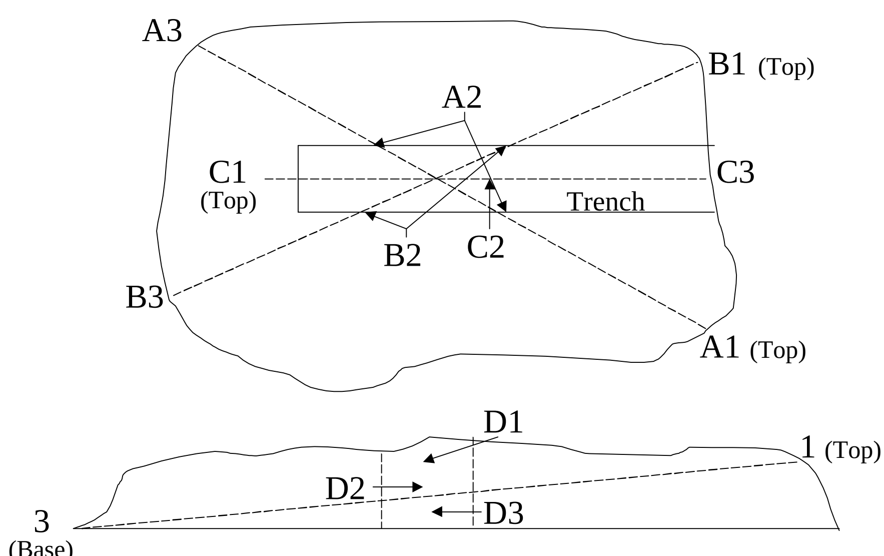
Selection of Sample Points for Small and Medium Waste Piles



Auto Shredder Waste Pile

Exhibit 2

Selection of Sample Points for Large Waste Piles



Auto Shredder Waste Pile

Appendix 2.

UNTREATED SHREDDER WASTE

Summary of Total **Lead** Concentrations (mg/kg)
(Regulatory Threshold = 1,000 mg/kg)

Location	Mean	Standard Deviation	90% Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	1,739	11.8	1,842	1,700	1,250	2,270	14	<1
Facility B	4,508	2,940	7,841	3,095	900	53,400	12	1
Facility C	3,020	137	3,642	2,520	2,070	5,640	9	<1

Summary of Total **Copper** Concentrations (mg/kg)
(Regulatory Threshold = 2,500 mg/kg)

Location	Mean	Standard Deviation	90% Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	2,170	658	3,116	1,415	594	13,500	14	7
Facility B	9,727	2,810	14,27	5,400	1,309	42,000	12	<1
Facility C	4,462	2,630	8,214	2,720	492	27,500	9	4

Summary of Total **Zinc** Concentrations (mg/kg)
(Regulatory Threshold = 5,000 mg/kg)

Location	Mean	Standard Deviation	90% Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	11,852	61.9	12,464	11,600	8,530	14,000	14	<1
Facility B	9,727	531	11,589	8,855	3,030	16,800	12	<1
Facility C	11,145	140	12,348	10,600	9,310	17,000	9	<1

Appendix 3.

UNTREATED SHREDDER WASTE

Summary of Soluble **Lead** Concentrations (mg/l)
(Regulatory Threshold = 5.0 mg/l)

Location	Mean	Standard Deviation	90% Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	77.7	1.28	84.9	76.4	54.6	141	14	<1
Facility B	162	10.1	153	143	86.4	342	12	<1
Facility C	110	1.24	121	106	72.0	150	9	<1

Summary of Soluble **Cadmium** Concentrations (mg/l)
(Regulatory Threshold = 1.0 mg/l)

Location	Mean	Standard Deviation	90% Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	3.05	0.78	3.34	2.94	2.10	5.37	14	<1
Facility B	1.47	0.54	1.68	1.55	0.66	2.24	10	3
Facility C	2.19	0.37	2.40	2.07	1.86	2.88	6	<1

Summary of Soluble **Zinc** Concentrations (mg/l)
(Regulatory Threshold = 250 mg/l)

Location	Mean	Standard Deviation	90% Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	911	5.97	965	922	671	1,120	14	<1
Facility B	572	27.4	676	501	325	1,280	12	<1
Facility C	829	7.41	900	880	529	1,010	9	<1

Appendix 4.

TREATED SHREDDER WASTE

Summary of Total **Lead** Concentrations (mg/kg)
(Regulatory Threshold = 1,000 mg/kg)

Location	Mean	Standard Deviation	90% Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	2,202	20.6	2,403	2,130	1,720	3,280	9	<1
Facility B	1,653	95.5	2,058	1,860	701	2,640	9	<1
Facility C	2,026	56.3	2,285	2,035	1,060	3,420	14	<1

Summary of Total **Copper** Concentrations (mg/kg)
(Regulatory Threshold = 2,500 mg/kg)

Location	Mean	Standard Deviation	90% Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	1,933	694	3,155	1,360	465	12,200	9	3
Facility B	4,346	4,44	9,353	2,210	433	53,300	9	11
Facility C	1,343	349	1,887	892.5	628	8,890	14	<1

Summary of Total **Zinc** Concentrations (mg/kg)
(Regulatory Threshold = 5,000 mg/kg)

Location	Mean	Standard Deviation	90% Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	6,685	79.2	7,385	6,820	4,200	9,420	9	<1
Facility B	5,806	943	8,182	5,160	583	19,300	9	3
Facility C	8,089	323	9,320	8,045	4,230	17,400	14	<1

Appendix 5.

TREATED SHREDDER WASTE

Summary of Soluble **Lead** Concentrations (mg/l)
(Regulatory Threshold = 5.0 mg/l)

Location	Mean	Standard Deviation	90 % Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	29.3	0.70	33.6	28.5	16.3	45.6	9	<1
Facility B	4.39	5.80	10.3	1.61	0.25	68.3	9	172
Facility C	18.9	5.39	26.9	15.3	3.55	34.3	14	<1

Summary of Soluble **Cadmium** Concentrations (mg/l)
(Regulatory Threshold = 1.0 mg/l)

Location	Mean	Standard Deviation	90 % Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	1.56	0.32	1.72	1.45	1.22	2.15	9	<1
Facility B	0.33	0.50	0.58	0.78	0.0	1.55	8	1
Facility C	N/A	N/A	N/A	N/A	0.70	0.70	1	N/A

Summary of Soluble **Zinc** Concentrations (mg/kg)
(Regulatory Threshold = 250 mg/l)

Location	Mean	Standard Deviation	90 % Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	439	6.85	491	445	308	659	9	<1
Facility B	33.8	129	132	3.39	1.34	1,150	8	<1
Facility C	304	63.5	327	314.5	171	396	14	3

Appendix 6.

Summary of Total **PCB** Concentrations (mg/kg) in Untreated Shredder Waste
(Regulatory Threshold = 50 mg/kg)

Location	Mean	Standard Deviation	90 % Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	14.0	0.56	16.0	14.7	5.3	22.5	14	<1
Facility B	7.03	1.81	10.7	5.59	0.59	32.7	12	<1
Facility C	28.0	6.85	42.4	18.6	14.2	129	9	<1

Summary of Total **PCB** Concentrations (mg/kg) in Treated Auto Shredder Waste
(Regulatory Threshold = 50 mg/kg)

Location	Mean	Standard Deviation	90 % Upper Confidence Interval	Median	Minimum	Maximum	Number of Samples	Appropriate Number of Samples
Facility A	4.89	1.57	5.46	4.5	3.0	7.2	9	<1
Facility B	8.91	2.36	13.7	9.14	2.57	45.1	9	<1
Facility C	22.7	1.88	27.6	26.5	10.2	41.1	14	<1

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