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SAMPLING AND ANALYSIS OF CYBER MEDIA TO DETERMINE WHETHER IT MEETS THE DEFINITION OF A HAZARDOUS  
WASTE - 15208

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# INTRODUCTION

Sandia National Laboratories, New Mexico (SNL/NM) was tasked to support The Department of Energy (DOE) in the disposal of classified cyber media. Certain cyber media have lead and silver. Various cyber media types were identified because they may have a hazardous waste characteristic. The overall objective of this sampling effort is to obtain representative samples of specific types of cyber media and analyze those samples to collect data to determine definitively if the cyber media are hazardous waste.

Ten different samples were obtained from the unclassified waste stream and shredded to meet the sampling criteria. The samples were shipped to an offsite analytical laboratory with a Chain of Custody.

# OVERVIEW

Process knowledge indicates that cyber media may contain lead above RCRA TC concentration limits since circuit boards present in cyber media can potentially contain solder with lead. There is no analytical data, however, to determine definitively if RCRA TC or UHC metals are present in the waste above TC concentrations. Certain types of cyber media are currently assumed to be hazardous waste since they contain printed circuit boards that may contain solder with lead. Sandia National Laboratories/ New Mexico needs analytical data to determine conclusively if these types of cyber media are hazardous waste or if they are only solid waste. The cyber media to be sampled and analyzed was obtained from various line organizations throughout SNL/NM. The data provided by the offsite analytical laboratory would be used to determine if the types of cyber media sampled and analyzed are toxic as defined by RCRA. The analytical data also will support waste characterization requirements of potential treatment and disposal facilities, and ensure proper transportation of the waste, in accordance with applicable Federal, State and Local laws and regulations.

Certain types of classified cyber media are currently assumed to be hazardous waste since they contain printed circuit boards that may contain solder with lead. The analytical data is needed to determine conclusively if these types of cyber media are hazardous waste or if they are only solid waste. The cyber media to be sampled and analyzed was obtained from various line organizations throughout SNL/NM.

In order to obtain a representative sample, unclassified cyber media (the same types as found in classified media) from many different manufacturers were been collected from various organizations. This cyber media can be divided into nine types as shown in Table I below along with the types and quantities of electronic media to sample in Table II.

After collection and release, samples remained in control of the Sampling Project Leader until they were transferred to the SMO.

A chain of custody form accompanied the samples to SMO and the off-site laboratory. SMO personnel in accordance with company procedures perform packaging and shipping of off-site samples.

## Quality Control

Trip Blanks – None

Field Blanks – None

Field Duplicate – Nine

Equipment Blank – None

Matrix Spike/Matrix Spike Duplicate – As specified by contract

Sample Duplicate – As specified by contract

Method/Reagent Blank – As specified by contract

Surrogate Spikes – As specified by contract

Laboratory Control Samples – As specified by contract

NOTE: Laboratory QC sample requirements are specified by agreements between the SMO and contract analytical laboratories. Specific requirements are detailed in the Statement of Work for Analytical Laboratories, Sandia National Laboratories/New Mexico (SOW)

# Cyber Media Type

1	Desktop computer hard drives (20)
2	Blackberry phones (20)
3	Personal Digital Assistants (PDAs) (12)
4	Laptop computer hard drives (8)
5	Laptop computers (5)
6	Secure Digital (SD) cards (49)
7	Flash drives (87)
8	USB flash drives (Thumb drives) (71)
9	Memory boards (69)

# Hard Drives

## SD Cards

## Memory Boards

## Thumb Drives

## Flash Drive



# Sample Management

Sample No	Matrix	Preserv	Analysis	Container	Min size	Date	Cyber Media	Gross wt (g)	Net Wt (g)
95229	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Hard Drives	362.7	325.1
95229	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Hard Drives	375.9	338.3
95230	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Blackberrys	220.7	183.1
95230	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Blackberrys	203.2	165.6
95231	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	PDAs	190.5	152.9
95231	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	PDAs	190.6	153
95232	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Laptop HDs	310.9	273.3
95232	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Laptop HDs	306.5	268.9
95233	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Laptops	214	176.4
95233	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Laptops	225.2	187.6
95234	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	SD Cards	250.2	212.6
95234	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	SD Cards	249.6	212
95235	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Flash Drives	233.8	196.2
95235	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Flash Drives	236.3	198.7
95236	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Thumb Drives	220.8	183.2
95236	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Thumb Drives	228.8	191.2
95237	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Memory Boards	287.9	250.3
95237	Solid	None	TCLP Metals	Plastic	100 g	1/21/14	Memory Boards	314.4	276.8

# Sampling Results (milligrams/liter)

Cyber Media	Analyte	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Nickel	Selenium	Silver	Thallium
Hard Drives	95229-01	0.07	ND	0.87	ND	ND	0.20	3.52	1.55	ND	0.02	ND
Hard Drives	95229-02	0.06	ND	0.86	ND	ND	0.15	2.25	1.29	0.12	0,017	ND
Blackberrys	95230-01	ND	ND	1.67	ND	ND	0.08	1.06	3.04	ND	ND	ND
Blackberrys	95230-02	ND	ND	1.80	ND	ND	0.07	1.66	3.05	0.11	ND	ND
PDAs	95231-01	ND	0.11	2.32	ND	ND	0.05	9.05	3.21	ND	ND	ND
PDAs	95231-02	ND	0.08	2.02	ND	ND	0.05	6.69	4.43	ND	ND	ND
Laptop HDs	95232-01	0.08	ND	1.57	ND	ND	0.09	3.70	3.32	0.07	0.01	ND
Laptop HDs	95232-02	0.07	ND	1.59	ND	ND	0.13	2.88	3.24	0.08	0.01	ND
Laptops	95233-01	ND	ND	3.46	ND	ND	ND	0.04	ND	ND	ND	ND
Laptops	95233-02	ND	ND	3.38	ND	ND	ND	0.05	ND	0.11	ND	ND
SD Cards	95234-01	0.06	ND	3.36	ND	ND	0.10	2.28	1.10	0.11	ND	ND
SD Cards	95234-02	0.07	ND	3.33	ND	ND	0.09	3.04	1.16	0.10	0.01	ND
Flash Drives	95235-01	ND	0.07	2.05	ND	ND	0.02	105.00	1.09	0.08	ND	ND
Flash Drives	95235-02	ND	ND	1.95	ND	ND	0.02	106.00	1.02	0.08	ND	ND
Thumb Drives	95236-01	0.05	ND	3.29	ND	ND	0.03	3.14	1.09	ND	0.01	ND
Thumb Drives	95236-02	0.05	ND	3.46	ND	ND	0.03	2.99	0.96	0.10	0.01	ND
Memory Boards	95237-01	0.04	ND	4.30	ND	ND	0.04	52.10	2.19	0.09	ND	ND
Memory Boards	95237-02	0.05	ND	4.29	ND	ND	0.03	33.70	2.08	ND	ND	ND

## CONCLUSIONS

It is important that used electronic equipment be managed properly. Used electronic equipment contains hazardous elements and compounds, including lead, mercury, and cadmium, which can be toxic if released into the environment when disposed. Lead is found in circuit boards, and in the glass panels and funnels of Cathode ray Rube (CRT) monitors and televisions, etc. Mercury is found in switches and relays of older computer central processing units (CPUs) and backlighting lamps. Older sets use CFLs, or compact fluorescent tubes, which contain mercury. Cadmium is found in laptop batteries, semiconductors, and various cables and wires, etc. Sandia National Laboratories typically does not keep computer equipment beyond 3 years so the majority of the older items are not currently being used so mercury was not included in the sampling and analyses. There could possibly be older units still in inventory. If these happen to show up for disposal they will be treated as if they have mercury and be managed accordingly.

One difficulty in testing used electronics items lies in the sample preparation requirements for the TCLP. There are two ways the test could be run for used electronics equipment: (1) Each individual material in an item can be individually tested, and a mass balance run to determine the assumed concentration mathematically; (2) The unit as a whole could be reduced in particle size and a composite sample taken. Test results from these two methods can differ significantly, and may not accurately represent the environmental risk of disposal. Additionally, the results from one model of one particular piece of equipment may differ significantly from other models even from the same manufacturer. Generalized tests results are further complicated because there are hundreds of current and historical manufacturers of equipment, and models change regularly. Instead of testing every component, handling used electronic equipment under the hazardous scrap metal exemption is a cost-effective alternative that allows generators to be in compliance whether or not their used electronics items fail the TCLP. The best options for us, was to reduce the unit as a whole in particle size and a composite sample was taken.

The concentrations of Pb in the TCLP extracts of certain samples were found higher than the regulatory level of 5 mg / L. However, the concentrations of the other TCLP metals in all the TCLP extracts were below the regulatory limit. Among the eight heavy metal elements Ag, As, Ba, Cd, Cr, Hg, Pb, and Se on the EPA D list, Pb is the predominant one that causes the toxicity characteristic of PC components. Although Ag exists in large amounts in most IC packages and CPUs and Ba exists in certain amounts in some boards, they are not leachable under the TCLP test conditions and do not pose toxicity characteristic hazards. The other five elements are very insignificant in total contents and do not have the potential to cause a toxicity characteristic concern. The results indicate that PDAs, SD Cards and Memory Boards fail TCLP for lead by a substantial amount. The reason may be due to the small item size relative to the circuit board. The Pb concentrations in the TCLP extracts of the PDAs was 6.69 and 9.05 mg / L which is 1.5 – 2.0 times the regulatory level of 5 mg / L. The Pb concentrations in the TCLP extracts of the memory boards was 33.72 and 52.10 mg / L which is 6 – 10 times the regulatory level of 5 mg / L. The Pb concentrations in the TCLP extracts of the flash drives was 105 and 106 mg / L which is 20 times the regulatory level of 5 mg / L for classifying them as hazardous wastes. The contents of barium and silver were found to be low in concentration in the cyber media components. The contents of other four elements in all the PC components were hardly detectable or were non-detectable. As discussed above there was no need to include mercury in this sampling plan.

# QUESTIONS?