SOP Status: Operational	Approved by:
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Procedural SOP No. 916-S

Preparation of consumer electronic devices containing Liquid Crystal Displays (LCDs) for Metals, California Waste Extraction Test and Toxicity Characteristic Leaching Procedure

1 Scope and Application

1.1 This procedure is applicable to the preparation of samples of consumer electronic devices containing liquid crystal displays (LCDs) to determine the total metal content, California Waste extraction test (WET) and Toxicity Characteristic Leaching Procedure (TCLP) extractable metals in various components. For Hg testing in cold cathode fluorescent lamps (CCFLs) use HML, SOP No. 914-S.

1.2 This SOP describes the procedure to disassemble waste products, segregate components, and prepare samples prior to extraction or digestion procedures for subsequent analyses.

1.3 This procedure is recommended for use by laboratory assistants and/or technicians working under the close supervision of chemists experienced in the sample preparation requirements for inorganic analyses, and by chemists working independently.

2 Summary

2.1 Two product types of consumer electronic devices are identified: laptop computers and liquid crystal display (LCD) monitors.

2.2 The total weight of each device (sample) is recorded on Form 1. The samples are then photographed, disassembled and segregated into six major component fractions for subsequent preparation and possible analysis. These fractions are:

- 2.2.1 LCD panel
- 2.2.2 Cold Cathode Fluorescent Lamp (CCFL)
- 2.2.3 Printed circuit board
- 2.2.4 Plastics
- 2.2.5 Metal fractions
- 2.2.6 Batteries

2.3 Each component fraction is photographed, weighed and stored in separate labeled containers.

2.4 The required component fraction of a sample is shredded, milled to pass through a No.18 (1 mm) sieve, mixed for homogeneity, and then representatively sub-sampled to obtain aliquots for analysis.

Note: A No.10 (2 mm) sieve may be used for total, WET and TCLP if a No.18 (1 mm) is not available.

2.5 Particle size reduction is achieved by grinding to the required mesh size. An appropriate shredder and mill or grinder is used for this process (Retsch, Model #SM-2000, or equivalent).

2.6 Interferences from carryover from one sample to another must be minimized by thoroughly cleaning the equipment as needed. All containers must be clean and free of organic and inorganic substances. Small milling or grinding units may be cleaned as described in HML SOP 704-S.

3 Safety

3.1 Sample preparation should be performed in a well ventilated room.

3.2 Nitrile gloves may be worn for hand protection, but they must not come in contact with the sample, or the interior of the sample containers, to avoid any organic and inorganic contamination.

3.3 Use safety glasses or goggles when shredding, milling or grinding the samples.

3.4 The operator may wear a dust mask and coveralls if necessary during the process.

3.5 The work area (counters, balances, mills, equipment, tools) should be kept clean at all times.

3.6 Operating instructions must be followed while using the shredder and/or the grinder.

4 Apparatus and Materials

4.1 Hand tools: screwdrivers, electric drill/saw, cutters and pliers, etc.

4.2 Rotary mill or an automatic grinder capable of grinding hard plastics and printed circuit boards.

4.3 Sieve No. 18 (1 mm).

4.4 Electric cutter or a shredding machine capable of reducing particle size of the material into small pieces.

4.5 Top loading balance 20 Kg capacity (accurate to +/-1.0 g).

4.6 Top loading balance 1 Kg capacity (accurate to +/- 0.2 g).

4.7 Dust masks, face shields or eye goggles.

4.8 Nitrile gloves.

4.9 Teflon or glass containers of appropriate size for storing the prepared samples.

4.10 Liquid nitrogen

4.11 De-ionized water

4.12 Nitric acid, 5 percent

4.13 Acetone

5 Disassembly/Separation Procedure

5.1 Remove all external electrical cords and computer cables.

5.2 Label each sample, photograph, weigh and record weight using Form 1.

5.3 Unhinge and separate computer laptop samples into two samples, the LCD panel (i.e. the top part) and the Computer Processing Unit (i.e. the bottom part). Note: This may require disassembly and reassembly of the top portion of the laptop. Keep all component fractions of top and bottom parts separately.

Assign suffix “B” for bottom and “T” for top parts to the ID number assigned to the device. From this point forward the top part (the LCD panel) will be analyzed as an LCD device sample.

5.4 Dismantle each sample and separate into its major component fractions, namely:
- 5.4.1 LCD panel
- 5.4.2 Cold Cathode Fluorescent Lamp (CCFL)
- 5.4.3 Printed circuit board
- 5.4.4 Plastics
- 5.4.5 Metal fractions
- 5.4.6 Batteries

5.5 Remove extraneous material, like nuts, screws, loose wires, and metal brackets and include with the metal component fraction.

5.6 Cold Cathode Fluorescent Lamp (CCFL) component fractions are photographed, weighed and prepared in accordance with SOP 914-S and analyzed.

5.7 Printed circuit board fractions are photographed, weighed and stored in properly identified containers.

5.8 Plastic components are photographed, weighed and stored in properly identified containers.

5.9 Metal components (including metal brackets, screws and wires) are photographed, weighed and stored in properly identified containers.

5.10 Batteries are weighed and stored separately.

6 Size Reduction Procedure

6.1 The entire sample component fraction slated for analysis (i.e., LCDs or circuit boards) is size-reduced by cutting/shredding and milling.

6.2 The milling equipment is fitted with a 1 mm sieve (2 mm sieve may be substituted) and the entire sample component fraction is processed.

6.3 Clean the shredder (wear mask and/or goggles) after processing each component fraction. Inspect to ensure the shredder is completely free of particles.

6.4 Process at least 10g of plastic chips, or other equipment blank material, for analysis to check for cross-contamination.

6.5 Collect the sieved sample, record weight on Form 1 and store in a properly labeled container.

6.6 Appropriate aliquots of the milled material are taken for metals, TCLP and WET determinations.

7 Quality Control

7.1 Although most of the QC requirements are defined in the respective analytical procedures, at a minimum, the following quality checks are required.

7.2 A sample batch is defined as a group of 10 samples [excluding LCS (laboratory control sample), MS (matrix spike) and MSD (matrix spike duplicate)] or less, that is processed together and that is comprised of similar component fractions (i.e. circuit board fractions or LCD Panel fractions).

7.3 A sample batch must consist of samples of the same matrix processed and digested/extracted and analyzed at the same time. Any other type of matrix QC included with the samples is not acceptable.

7.4 Each batch shall contain one method blank. The blank shall contain all reagents processed with that batch.

7.5 Each batch must include a replicate (sample duplicate).

7.6 Each batch shall contain an MS and an MSD.

7.7 Each batch shall contain a method standard or LCS containing all elements/compounds of concern.

7.8 Either the LCS or the MS/MSD (or both) must be prepared from secondary source standards. (i.e., the source must differ from the calibration standards by lot # at a minimum.)

8 References

8.1 California Code of Regulations, Title 22, Section 66261.20

8.2 HML, SOP 914-S

8.3 HML, SOP 704-S

8.4 Toxicity Characteristic Leaching Procedure, Federal Register, Method 1311, SW-846.

8.5 Test Methods for Evaluating Wastes: Physical/Chemical methods, US Environmental Protection Agency, Office of Solis Waste, Washington, DC, SW-846, Vol.1A, 3rd Edition, Update III.

9 Acknowledgement

This procedure was developed by the Hazardous Materials Laboratory, and the Waste Identification and Recycling Unit of the Department of Toxic Substances Control. For more information please contact Jarnail Garcha at (510) 540-3468.

Form 1. Weights of entire device and components in grams

HML or LAB ID#	Collector's ID#	Device (before disassembly)	Glass Panel	CCFL	PC Boards	Plastics	Metals	Batteries	Sum of Components	NOTES
