FINAL REPORT

SAMPLING OF WASTESTREAMS

at the

LOS ANGELES JEWELRY MART

Conducted for the

Department of Toxics Substances Control
California Environmental Protection Agency

by

University Extension
University of California Riverside

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A field study of this magnitude and complexity obviously could not have been possible without the active and positive participation of numerous people: in this instance, the members of the Los Angeles Jewelry Mart (LAJM), including building owners and their representatives, building managers, individual manufacturing facility owners and their representatives, and in some cases individual facility workers who, with the use of creative problem-solving abilities, greatly contributed to the successful completion of this study.

The initial planning meetings with the various building owners were especially useful.

Field sampling in active manufacturing locations is always subject to last-minute surprises which can stymie the best of plans. This project was no exception. While project confidentiality considerations prevent the author from citing each and every individual who, at critical moments, provided vital support (you know who you are!), he nonetheless wishes to acknowledge and thank them.

DISCLAIMER

While all possible care was taken during this study to select representative facilities and accurately sample all of the various streams, the reader should still use his or her professional judgment to ensure that the manner in which the study results are used in other situations is appropriate for those situations. While manufacturing practices in the jewelry manufacturing industry are generally stable, they are not forever static. Whether motivated by manufacturing efficiencies or due to regulatory oversight and compliance considerations, certain operations have changed and will continue to change.

Due to its dominance in the LAJM, the primary focus of the study was on gold jewelry manufacturing. Though some silver and other (electroplating) facilities were also sampled (and are identified as such), the data on these other facilities are more limited.

Finally, while the authors of this study have no reason to believe that the results are influenced by seasonal factors, this study was conducted over a roughly one-month duration and this should be kept in mind.

SECTION 1

INTRODUCTION AND PURPOSE

The Los Angeles Jewelry Mart (LAJM) consisting of roughly over 1500 individual manufacturing locations housed in many buildings in downtown Los Angeles is thought to be one of the largest jewelry manufacturing locations in the country and arguably one of the most concentrated. While the LAJM facilities are engaged in all manner of jewelry manufacturing (from casting through retail sales) the Mart does not include supporting facilities such as metal reclamation or waste recycling facilities. The LAJM facilities span a broad range of sizes (i.e., number of personnel employed) and include a diverse group of owners and workers of many ethnicities.

The purpose of the field sampling study was to scientifically characterize, in a manner as representative of the entire collection of manufacturing facilities of the LAJM as a whole, the various waste or potential waste streams produced by manufacturing facilities. The goal is to use the results to make determinations as to the nature of specific waste streams (such as whether a particular stream is hazardous or not). A secondary goal was to determine, in a qualitative sense, the amounts of the various waste streams that are typically produced and the current fate of these waste streams.

The present study scope did not include an analysis of the results, which is expected to occur later.

It is important to note that this study was not concerned with regulatory compliance. Thus the sampling events were not “inspections” in a regulatory sense. It is also for this reason that the individual facilities or locations sampled in the study are identified only via project designations (alpha letters A, B, C, etc.) and not specifically identified.

Finally, it is assumed that the reader has a basic or rudimentary knowledge of the jewelry manufacturing process. No effort is made in this report to provide a primer on the manufacturing processes. Excellent fact sheets describing the various processes have been produced by the DTSC and are readily available.

In addition to this introduction, this report contains a brief description of the project team and project management (Section 2) followed by a discussion of how various facilities were selected (Section 3) and what waste streams were sampled (Section 4). The sampling methodology is described in Section 5 followed by laboratory quality control and quality assurance in Section 6. The report also contains several appendices – including the original Scope of Work (Appendix A), the actual list of facilities sampled (Appendix B) which is being provided separately and confidentially to the DTSC. Appendix C contains the completed questionnaires for each of the manufacturing facilities sampled based on observations with facility representatives during sampling as well as follow-up telephone calls as needed. Appendix D contains copies of various chain of custody forms and Appendix E contains copies of the laboratory analysis.

SECTION 2

PROJECT TEAM AND PROJECT MANAGEMENT

Although numerous individuals were initially involved during the planning stages of the project, the actual field sampling project involved the following project team:

<u>DTSC Project Management and Direction</u>

Mr. Mickey Pierce
Mr. Matthew Peterson
Mr. Edward Binelli

<u>DTSC Hazardous Materials Laboratory</u>

Mr. Russ Chin

<u>University of California, Riverside (UCR) Project Oversight</u>

Mr. Jon Kindschy
Ms. Jennifer Campbell

<u>Sampling Team (Onsite, Contractors to UCR)</u>

Mr. Christopher Diggs
Ms. Jakiesha Smith

<u>Project Laboratory (Anachem Laboratories, El Segundo, CA)</u>

Mr. Navan Krishnan
Mr. Carey Matthews

<u>Project Management</u>

Dr. Ranajit (Ron) Sahu, Consultant to UCR was the Project Manager for the study and provided day-to-day project management as well as field sampling oversight and management for the study.

SECTION 3

SELECTION OF FACILITIES

One of the more difficult aspects of a sampling study is the selection of facilities to be sampled such that, collectively, they are “representative” of the universe of facilities represented in the target population.

DTSC representatives for the project, along with local agencies such as the Los Angeles Fire Department, Los Angeles Building and Safety Department, local CUPAs, local DTSC staff from the Glendale CA office, and the UCR Project team collectively developed the initial list of manufacturing buildings to be sampled. This was based on prior knowledge of the types of manufacturing in the various building within the LAJM, the diversity of manufacturing, the diversity of sizes of facilities, the types of manufacturing, and other factors subjective factors.

Thereafter, the choice of the actual manufacturing facility(ies) to be sampled within a particular manufacturing building was made by pre-sampling visits by DTSC and the Project Manager in consultation with the building owner or the latter’s representatives. The final choices were based on assuring that a broad range of facility sizes (small or less than 5 employees to large employing over 30 employees), manufacturing complexities (conducting all operations beginning with casting through plating versus conducting only a few operations), technologies (older style operations in refining and tumbling versus more recent technologies and equipment), and general house-keeping characteristics (neat and well kept versus disorganized and poor housekeeping) were included in the overall sampling pool. Of course, the goal of assuring numerous samples of each of the various waste streams was also paramount.

Table 3-1 contains a list of the facilities sampled, identified by project designations. A total of 17 facilities and 8 building wastewater systems were sampled. Appendix B, provided confidentially to the DTSC, contains a full identification list of each of the facilities sampled.

Table 3-1 – List of Facilities Sampled

Facility	Type	Facility	Type	Facility	Type
A	Gold Mfg.	J	Gold Mfg.	S	Gold Mfg.
B	Building	K	Gold Mfg.	T	Gold Mfg.
C	Building	L	Gold Mfg.	U	Gold Mfg.
D	Gold Mfg.	M	Gold Mfg.	V	Gold Mfg.
E	Gold Mfg.	N	Building	W	Gold Mfg.
F	Electroplating	O	Building	X	QA
G	Building	P	Building	Y	QA
H	Gold Mfg.	Q	Gold Mfg.	Z	QA
I	Gold Mfg.	R	Silver Mfg.		

Building = location of building wastewater and sludge samples
QA = a blind or pseudo facility designation for QA challenge samples for the project laboratory

SECTION 4

WASTE STREAMS

The project Scope of Work originally identified the various waste streams that were thought to be prevalent at the LAJM, based on prior DTSC knowledge with manufacturing operations at the LAJM. This is shown in Appendix A, Exhibit A. Prior to the initiation of the sampling project, it was decided to exclude the air-monitoring portion of the sampling from the project scope. Also, the relative prevalence of the various streams was unknown.

Table 4-1 shows the project designations for the various waste streams. It should be noted that while most of the expected streams (designated 1 through 16) were found at the various locations, additional streams were also found (designated 20 and higher) at various facilities. Since the Scope of Work in Appendix A identifies the types of analysis for the expected streams, Table 4-1 shows the expected stream which is closest to the additional stream.

One significant challenge for the sampling team was to obtain requisite amounts of samples for each stream. Specifically the amounts of grinding dust (which contains a high percentage of precious metal) and polishing dust (significant precious metal content as well) that were available (generally after much negotiation) were modest. In fact, grinding dust was not available from most locations since it is not considered to be a waste stream by the manufacturers. Most of the solid waste streams (including grinding and polishing dusts) and sludges (except the building sludge stream 16), due to their residual precious metal content, are generally recycled by the industry via offsite recyclers. Table 4-1 shows the current general fate of the waste stream in the LAJM.

<u>Table 4-1 – Waste Streams and Their Current Fate</u>

#	Type/Description	Analysis	General Fate
<u>Expected Streams</u>			
1	Investment slurry/sludge	See App A/Ex A	Building WW
2	Pickling solution w/sodium bisulfate/sodium sulfate dilutions	See App A/Ex A	Building WW
3	Spent ultrasonic bath solution	See App A/Ex A	Building WW // sludges to Recycler
4	Spent HF or other acids	See App A/Ex A	Building WW
5	Spent ultrasonic bath solutions w/ammonium phosphate or hydrogen peroxide	See App A/Ex A	Building WW // sludges to Recycler
6	Grinding dust	See App A/Ex A	Recycler / Onsite Remelting
7	Solvents: Acetone, methylene chloride, etc.	See App A/Ex A	[b]
8	Aqueous cleaners, soaps, detergents, etc.	See App A/Ex A	[c]

9	Cyanide bombing solutions [a]	See App A/Ex A	Building WW
10	Magnetic tumbler solutions w/soap and chelators	See App A/Ex A	Building WW // sludges recycler
11	Automated mass finishing solutions w/soap and chelators	See App A/Ex A	[d]
12	Polishing dust	See App A/Ex A	Recycler
13	Pickling with acid solutions like trisodium phosphate	See App A/Ex A	Building WW
14	Electroplating acidic or basic solutions	See App A/Ex A	[e]
15	Building wastewater influent to onsite treatment system	See App A/Ex A	To the sewer after treatment
16	Sludge from building waste water onsite treatment system	See App A/Ex A	To outside licensed disposal firm
Additional Streams (generally found at specific locations)			
20	Waste oil from drying machine	TPH	To building for recycling
21	Platinum devestment remover solution	Like stream 2	Building WW
22	Combined magnetic tumbler and ultrasonic bath solution	Like stream 10	Building WW
23	Combined wastewater from two tanks	Like stream 15	Building WW
24	Combined wastewater from two tanks	Like stream 15	Building WW
25	Sandblasting compound	Like stream 12	Recycler
26	Boric acid flux	Like stream 2	Building WW
27	Caustic soda solution	Like stream 2	Building WW
28	4% cyanide pickling solution	Like stream 9	Building WW
29	Pickling rinse	Like stream 2	Building WW
30	Ceramic tumbling solution	Like stream 10	Building WW
31	Metallic ball bearing tumbling solution	Like stream 10	Building WW
32	Waste water	Like stream 15	Building WW
33	Combined magnetic tumbler and ultrasonic bath solution	Like stream 10	Building WW
34	Burnt polishing dust from recycler	Like stream 12	Trash
35	Fresh cyanide bombing	Like stream 9	Building WW

[a] found at one location only.
[b] no waste stream found. Generally very minor solvent uses, if any.
[c] streams from handwashing etc. were not collected – they go into the building wastewater systems
[d] no waste stream found.
[e] generally very small quantities at most locations with the exception of facility F.

SECTION 5

SAMPLING METHODOLOGY

Once the facilities and wastestreams to be sampled were identified as discussed in earlier sections, the sampling methodology was as follows:

(a) Initial Facility Survey. The Project Manager and DTSC representatives met with building owners or their staff and ascertained the mix of manufacturing facilities in the particular building along with typical manufacturing facility characteristics. Based on this, site visits were conducted to promising manufacturing facilities. Having the building representative accompany the project team members on these initial visits greatly increased the comfort level of the facility owners with regards to the sampling. At this initial visit, the overall objectives and nature of the sampling effort were explained to the facility owner or representative. If the facility was deemed to be a promising candidate, permission to sample various waste streams at the facility was sought.

Not all facilities visited were deemed promising based on considerations of the nature of operations, the size of the facility and the level of activity at the facility. However, whenever requested, permission to sample was always granted by the facility. Thereafter, logistical arrangements were made so as to sample on the appropriate day and time consistent with facility production operations.

While most of the facility representatives did not speak English as their primary language, there was enough English proficiency in all cases so as to not require translators.

Similar to the manufacturing facility survey, building basement wastewater treatment systems were also inspected initially to determine the likely sampling locations at the influent to the treatment systems. In almost all cases, special arrangements had to be made to obtain these samples. The cooperation of building management and the respective wastewater system operators was critical to obtaining these samples.

(b) Facility Sampling. After a decision had been made to sample at a particular location, and knowing the likely waste streams present at the location, the sampling team (project manager, samplers, and, typically, a building representative) arrived at the location by prior appointment. The sampling team came equipped with the necessary sampling devices (spoons, pipettes, drum thieves, etc.) containers (of appropriate size), sample bags, labels, sample preservation tools (such as ice), and coolers etc. The team also took care to use the appropriate personnel protection necessary for sampling such as using gloves, glasses, etc.

In most cases, the team collected the samples directly from the various sources. Invariably there was some negotiating for the more valuable samples such as the grinding and polishing dusts. In several cases, the permission to sample grinding dust was not granted because the facility representatives believed that this dust was not a waste stream. Whenever possible multiple samples (typically three or four) were collected for each waste stream per the Scope of Work.

In certain cases, such as for the cyanide and HF wastes, facility operators offered to collect the samples and this was done in the presence of the project manager and the sampling team.

Sampling was conducted in a professional manner with the least possible disruption to manufacturing operations and generally required only one visit per facility. For some facilities multiple visits were made to ensure that the proper sample or sufficient quantity of was obtained. Depending on the complexity of the facility, sampling operations lasted from half hour to roughly two hours at a given location.

Depending on scheduling, roughly three to four facilities were sampled on some days and fewer on others.

The building wastewater influent samples were collected as 24-hour averages. ISCO samplers were used for collecting these samples. Typically, an ISCO sampler would be set up in the morning, allowed to run for that day, and a sample would be collected the next day. ISCO samples were then composited in clean plastic pails representing average daily wastewater influent for the prior day. This composite was then sampled and sent to the laboratory for analysis. Here again, three samples were collected at each of the eight building wastewater influents points.

(c) Sample Delivery. After completion of sampling on a given day, the appropriate chain of custody forms were completed and the samples were then delivered to the project laboratory on the same day. Field duplicate samples were collected and preserved at the project laboratory and submitted later to the DTSC laboratory for quality control purposes.

(d) Facility Questionnaire. During the facility sampling, the project manager attempted to inquire about most of the questionnaire items including the use of various chemicals and the fate of the various waste streams. Generally, the project manager inspected the various flammable and other chemical lockers. However, no attempt was made to review regulatory documents such as Business Plans, etc. The questionnaire was then completed later for that facility. Occasionally, later telephone inquiries were made to certain locations to complete certain details.

SECTION 6

LABORATORY QUALITY CONTROL AND QUALITY ASSURANCE

All of the analyses for the study were conducted by Anachem Laboratories located at 13 Penn Street in El Segundo, California, 90245 (and their subcontractors). Anachem Laboratories was independently selected by the DTSC for this project. Quality control samples such as duplicates were analyzed at the Hazardous Materials Laboratory (HML) of the DTSC located at 1449 West Temple Street, Los Angeles, California 90026. Quality assurance samples for Anachem Laboratories were developed by the DTSC HML.

The greatest possible care was taken throughout the field sampling, sample handling, as later laboratory analysis to ensure that the results from this sampling are of the highest quality.

Extra care was taken during the actual field sampling to ensure that there was no sample contamination or cross-contamination. Sample labeling occurred at the same time as the sampling itself. All necessary sample-handling procedures (such as keeping samples for cyanide analysis in ice etc.) were followed. Sample chain of custody forms were filled out immediately on the same day as each sample was collected and all samples were delivered to the project laboratory on the day of the sampling. This ensured minimal degradation of any samples collected.

Next, the project laboratory implemented its own rigorous quality control procedures such as following the necessary method calibration procedures, analyzing sample duplicates, and sample spikes, etc. Full details of these procedures are available in the project laboratory's Quality Assurance Plans. Additionally, from a quality control perspective, numerous extra (i.e., field duplicate) samples covering the entire range of sampled waste streams were collected during the sampling itself. These field duplicate samples were provided to the DTSC HML for independent analysis.

The DTSC also independently prepared numerous challenge samples for various analytes such as metals, cyanide, and pH. These challenge samples were then designated as blind or pseudo facility samples by the sampling team and provided to the project laboratory for analysis.

Although it was not verified by the project team, it is assumed that the necessary audits of the project laboratory were conducted by DTSC and that the DTSC HML followed all internal quality control and assurance procedures.

APPENDIX A

SCOPE OF WORK

1. <u>Background</u>

This study is proposed to determine the hazardous characteristics, quantity, and ultimate dispositions of various waste streams generated by jewelry manufacturers in the Los Angeles Jewelry Mart. Jewelry manufacturers utilize a variety of physical and chemical processes that produce waste streams that may be hazardous. These processes include buffing and polishing operations that produce wastes containing metal dusts, and cyanide bombing operations that produce wastes containing cyanides. Many wastes from these processes contain precious metals and are not managed as hazardous wastes. These wastes are typically shipped to unpermitted reclamation facilities through normal carriers, often without manifesting or formal record keeping. Thus, many of the wastes generated by jewelry manufacturers in the Los Angeles Jewelry Mart are not managed in compliance with current statutes and regulations during storage and transportation.

In addition, it is believed that a significant portion of the waste streams generated by jewelry manufacturers are discharged through common sink drains to central treatment facilities located in the basements of the jewelry mart buildings. These treatment facilities are operated by the building owners to recover precious metals and reduce cyanide concentrations in order to meet local discharge requirements. The building owners have claimed that standardized permits are not required to treat these waste streams because they are not hazardous. It is believed that the common sink drains may allow significant dilution of the waste stream prior to the basement treatment facilities.

This proposed study would survey a representative number of manufacturers in the LA Jewelry Mart to characterize the hazardous waste streams produced and identify the current management practices for those wastes.

The results of this study will be used to develop educational materials to assist jewelry manufacturers statewide in complying with current statutes and regulations for hazardous waste management. This study will also be used to identify currently unregulated waste management practices to aid in developing policy and regulations regarding hazardous waste generation and management in the jewelry manufacturing industry.

2. <u>General Scope of Work</u>

   a. U.C. Riverside shall assist DTSC to determine the hazardous characteristics, amounts, and ultimate disposition of various waste streams generated by jewelry manufacturers in the Los Angeles Jewelry Mart. U.C. Riverside shall be able to provide the following services:

      1) UCR will contact various manufacturers' representative organizations in order to gather details of the various jewelry manufacturing facilities in the Jewelry Mart. These include the Manufacturing Jewelers and Suppliers of America (MJSA), the California Jewelers Association (CJA), and the Armenian Jewelers Association (AJA), West Coast Chapter. It is believed that all manufacturers in the Jewelry Mart are members of one of these organizations. UCR may also contact the Jewelry District Task Force – which has developed a Project Facilitation Team to assist manufacturers and building owners in environmental compliance

matters. Based on the membership characteristics from these organizations, a list of 25 candidate manufacturers will be identified and recommended to DTSC as being suitable for inclusion in the statistical study. Once finalized, these 25 manufacturers will be contacted and sent the questionnaire developed by DTSC. Every effort will then be made to obtain completed responses from each of these manufacturers.

2) Conduct a study to determine the hazardous characteristics, amounts, and ultimate disposition of various waste streams generated by jewelry manufacturers in the Los Angeles Jewelry Mart;

3) The study will include a statistical survey of businesses operating in the Jewelry Mart district. While surveying these businesses, the contractor will complete a questionnaire and collect representative samples of the various waste streams. These samples will be collected following standard protocol for sample collection, custody, handling, storage times, and transportation. The majority of the samples will be analyzed by a private laboratory and will be characterized by hazardous constituent. Additional samples will be submitted to Southern California Hazardous Materials Laboratory (HML) for quality control purposes.

4) A minimum of ten locations will be sampled for each waste stream identified. At each sampling location a minimum of three samples from each waste stream will be collected. This will ensure that variability within the processes at each facility is addressed, as well as variability between different facilities. Ultimately, an average and range will be reported for each waste stream identified which will represent typical values that can be expected from the jewelry manufacturing industry as a whole. Sample collection will follow the "Authoritative Sampling" model, where the person collecting the sample is required to be familiar and knowledgeable about the site, and to employ biased, targeted, or judgmental sampling to establish whether the waste streams exceed hazardous waste level criteria. Wastewater collection from the basement treatment units will utilize an ISCO or equivalent automatic sampler to collect periodic samples over a typical working day (time based sampling regime). Grab samples will be taken from the basement treatment units to determine cyanide concentrations.

5) Field spikes, travel blanks, and duplicates will be prepared as a requirement for QA/QC to ensure data usability. Stock solutions to spike the samples and travel blanks will be prepared by HML. HML will analyze duplicates, prepared by collecting two samples from a homogeneous waste stream such as a liquid, or by splitting solid samples that exhibit some degree of variability. Field spikes will be submitted to the contract laboratory as blind control samples and an acceptability level of 80 to 120 percent recovery will be used. Blanks will be deemed acceptable when they show no appreciable ionic contamination. Duplicates will be deemed acceptable when they exhibit relative percent differences of no greater than 20 percent.

6) UCR will develop appropriate protocols for the collection of samples of the waste streams identified in Exhibit A and submit them to DTSC for approval. Upon approval, these protocols will be used for sample collection, handling, and shipment to the various laboratory facilities.

7) Based on the results of the survey, at least 10 facilities will be identified for each waste stream to be studied. The identification of the waste streams is provided in Attachment A. It is anticipated that more than 10 facilities will be necessary to accomplish this since not every facility may have every waste stream. Once facilities are identified, DTSC will be contacted in order to approve the list. At this stage, DTSC will also be solicited as to specific facilities that they may want to include in the study.

8) Selected individual facilities will then be contacted and the logistics of actual sampling will be worked out. The various labs (private lab selected by DTSC for the analysis and well as the Southern California HML) will also be contacted and kept informed of the sampling schedule. Necessary materials will be procured from the labs at this stage. It is assumed that DTSC will separately select the private lab for this study and that all sampling supplies will be provided by DTSC and/or the private lab. UCR anticipates that its Project Coordinator and/or Field Supervisor and one or two field technical specialists will be involved in each facility sampling in order to ensure that it meets the Authoritative Sampling intent. The sampling requirements in Exhibit A (3 samples at each waste stream at each location, QA/QC samples, etc.) will be followed.

9) UCR will coordinate as needed with the private lab and the HML in order to ensure that the requisite analyses (including QA/QC analyses) are conducted and that the results are appropriately transmitted to UCR.

10) Once the sampling results are completed, UCR will develop a study report to document the purpose, approach, and methodology of the study. A draft report will be prepared. After review by DTSC, it will be finalized.

b. DTSC shall perform the following activities:

1) Review and approve U.C. Riverside's draft Sampling Plan;

2) Draft the questionnaire to be used by U.C. Riverside;

3) Contract with a Laboratory to analyze the samples taken at the Jewelry Mart;

4) Ensure that U.C. Riverside has access as needed to conduct the study;

5) Provide the name and contact information of the most knowledgeable staff and designate staff to review each deliverable. (Only limited DTSC staff will be available to assist and answer questions during development of the training and materials).

3. Project Schedule

The UCR team (or project coordinator) will meet with DTSC staff to review this approach, reaffirm the goals of the study (or note any adjustments), establish the project coordination interface(s) and reporting details, meet with other members of the team (such as the laboratories which will conduct the analyses), and discuss the overall schedule for the study. It is anticipated that this meeting would be held in Southern California within 10 days of the notice to proceed based on schedule constraints. The project study shall be completed by June 30, 2003. The Final Report will be provided to DTSC by June 30, 2003. A detailed schedule will be presented at the Kick-off meeting.

EXHIBIT A – WASTE STREAMS

Process Step	Expected Waste Stream(s)	Data Needed	Lab Methods
Knockout/ Devestment Step 1: Water Quenching	Investment slurries and sludges resulting from water quenching.	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 3050 A for solids digestion U.S. EPA 6010 A for CAM 17+2 metals HML 910 (WET) followed by U.S. EPA 6010 A for CAM 17+2 metals U.S. EPA 1311 (TCLP) followed by U.S. EPA 6010 A for CAM 17+2 metals
	Spent pickling solutions such as sodium bisulfate/sodium sulfate dilutions.	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 9040 for pH HML 66708 for corrosivity U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals
	Spent ultrasonic bath cleaning solutions.	Typical constituents; Volumes generated; Disposal practices	U.S. EPA 9040 for pH U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals
Knockout/ Devestment Step 2:	Spent hydrofluoric acid, dilute hydrochloric acid, or other acids used to remove residual investment.	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 9040 for pH HML 66708 for corrosivity U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals
	Spent ultrasonic bath solutions containing ammonia phosphate or hydrogen peroxide	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 9040 for pH U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals
Grinding, Deburring, and Polishing	Filings, grindings, polishing compounds, and metal dusts resulting from grinding, deburring, and other polishing operations.	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 3050 A for solids digestion U.S. EPA 6010 A for CAM 17+2 metals
	General air monitoring of work spaces around polishing stations to be conducted while work is in progress. Air monitoring will determine the effectiveness of fully enclosed polishing stations compared to standard units.	Degree of metal contamination by airborne particles, particulate matter, dusts.	Not Included in Study
Cleaning	Acetone, Ammonia, Methylene chloride, Mineral spirits	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 9040 for pH U.S. EPA 1020 for ignitability U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals
	Aqueous cleaners, soaps, detergents. Spent solutions from Ultrasonic baths;	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 9040 for pH HML 66708 for corrosivity U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals
Fire scale and oxide removal	Cyanide bombing solutions of cyanide salts of sodium or potassium mixed with hydrogen peroxide with precious metals present.	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 9040 for pH HML 66708 for corrosivity U.S. EPA 9010 A for cyanides HML 66705 for reactivity U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals
	Magnetic tumbler solutions containing soap and chelators with metals present.	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 9040 for pH U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals
	Automated mass finishing solutions containing soap and chelators with metals present.	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 9040 for pH U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals
	Automated mass finishing polishing compound media such as plastic or wood products or other abrasive media with metal dusts present.	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 9040 for pH U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals

Process Step	Expected Waste Stream(s)	Data Needed	Lab Methods
	Acid pickling solutions containing bisulfate of sulfuric acid. Trisodium phosphate	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 9040 for pH HML 66708 for corrosivity U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals
Electroplating operations	Corrosive acidic or basic solutions containing metal salts. Acid and alkaline cleaning solutions. Concentrated plating solutions. Spent process baths. Waste rinse waters from electroplating operations.	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 9040 for pH HML 66708 for corrosivity U.S. EPA 9010 A for cyanide U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals
Building Basement Waste Treatment Systems	Influent waste stream including a range of potential wastes such as metals, cyanide, acid/base, and organic chemicals	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 9040 for pH U.S. EPA 3010 A for aqueous digestion U.S. EPA 6010 A for CAM 17+2 metals U.S. EPA 9010 A for cyanide U.S. EPA 600/4-90/027F for fish bioassay

	Waste sludge from pH adjustment and metal precipitation.	Typical constituents; Volumes generated; Disposal practices;	U.S. EPA 3050 A for solids digestion
			U.S. EPA 6010 A for CAM 17+2 metals
			HML 910 (WET) // U.S. EPA 6010 A for CAM 17+2 metals
			U.S. EPA 9010 A for cyanide
			U.S. EPA 1311 (TCLP) // U.S. EPA 6010 A for CAM 17+2 metals

(CAM 17 + 2 Metals include Cd and Au in addition to Sb, As, Ba, Be, Ce, Cr, Co, Cu, Pb, Hg, Mo, Ni, Se, Ag, Tl, V, Zn)

EXHIBIT B: BUDGET SUMMARY

This portion of the Scope of Work is not included in the report. It is available from the DTSC for those readers that may be interested.

APPENDIX B

CONFIDENTIAL LIST OF FACILITIES AND DESIGNATIONS

This section is being provided only to the DTSC in order to preserve the confidentiality of the facilities whose waste streams were sampled as part of this study. This Appendix is intentionally blank in the public version of this report.

APPENDIX C

FACILITY QUESTIONNAIRRES

APPENDIX D

CHAIN OF CUSTODY FORMS

APPENDIX E

COPIES OF LABORATORY ANALYSES