

**PERIMETER AIR MONITORING PLAN
FACILITY DEMOLITION**

**FOR THE
EXIDE TECHNOLOGIES FRISCO RECYCLING CENTER
FRISCO, TEXAS**

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REVISION 2

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A	Descriptive Literature on E-BAM Particulate Monitors
B	NIOSH Method 7303

1.0 INTRODUCTION

Remediation Services, Inc. (RSI) and Pastor, Behling & Wheeler, LLC (PBW) have prepared this Air Monitoring Plan (AMP) to identify the measures that will be taken to monitor and minimize emissions associated with demolition activities at Exide Technologies' Frisco Recycling Center. Specifically, this Plan outlines the requirements and methods for monitoring ambient air quality during planned demolition activities for particulate matter (dust), lead and cadmium. This plan works in conjunction with the Dust Control Plan which describes operational controls to reduce dust emissions during demolition activities.

The project consists of the decontamination of buildings and equipment used in the battery recycling process, demolition of the various buildings, infrastructure and associated equipment (the Site), and transport of materials to the on-site landfill (Class 2 non-hazardous waste) or authorized off-site disposal facilities (hazardous materials). The Site contains numerous operating areas, including smelting furnace, oxide manufacturing, battery breaking, maintenance, slag stabilization, waste water treatment, and crystallizer buildings. The support equipment to be decontaminated and demolished includes 18 bag houses, an above ground diesel fuel storage tank, a cooling tower, aboveground storage tanks associated with a stormwater pond and waste water treatment facility, storage tanks associated with the crystallizer, and additional ancillary piping, conduit and equipment.

Air quality monitoring will consist of exposure monitoring by NIOSH Method 7300 for on-site workers, addressed in the Site Safety and Health Plan, and ambient air monitoring to measure off-property impacts, addressed in this Plan. Air quality will be monitored by RSI.

The primary objectives of the perimeter air monitoring are to:

- Develop a relationship between particulate (dust) levels and concentrations of lead and cadmium, so that the particulate measurements can be used as a surrogate;
- Determine if concentrations of lead and cadmium and particulate emissions are in excess of air "Take Action" or "Stop Work" levels established for the Site; and
- Ensure that engineering controls and work practices help minimize potential off-site impacts.

The monitoring plan will help ensure that RSI reacts quickly and makes appropriate changes to dust control measures as needed. Air quality will be measured and documented at air quality monitoring stations during demolition activities in accordance with this plan.

2.0 ORGANIZATION OF PLAN

This plan addresses continuous perimeter monitoring for particulates (PM_{10}), explains how the relationship between particulate, lead, and cadmium will be established and describes how the "Take Action" and "Stop Work" levels will be identified and implemented for particulates. In addition, the plan describes how samples will be collected to directly measure lead and cadmium and how those data will be used.

3.0 PARTICULATE MONITORING

3.1 Equipment

Real-time particulate air monitors (e.g., E-BAM Particulate Monitor or equivalent) equipped with an omni-directional air intake device and a “PM₁₀” impactor head will be used at the Site to monitor dust levels at or near the property boundaries during demolition activities that could generate dust. Real-time data from the downwind particulate monitors is evaluated in 30-minute and 60-minute averaged blocks to provide immediate comparison to “Take Action” and “Stop Work” level criteria. The data collection and reporting system which utilizes data generated by this equipment is described further in Section 3.5. Appendix A provides specific information regarding the E-BAM Particulate Monitors that will be utilized at the Site.

3.2 Monitoring Locations

One upwind and three downwind monitoring locations will be established each day demolition activities are to be performed, and monitors will be placed at or near the property line to ensure adequate coverage to minimize the potential for off-site impacts. In the event that multiple activities are being conducted concurrently (i.e., other remediation activities), the downwind monitoring network will be used to monitor all activities. If “Take Action” or “Stop Work” criteria are exceeded, dust mitigation procedures outlined in the Air Monitoring and Dust Control Plans applicable to each activity will be implemented. RSI will utilize National Weather Service forecasts and review current conditions and recent trends from an onsite meteorological station to position the monitors each morning prior to the start of any demolition activities. Monitor location information will be determined by GPS and recorded. Wind speed and direction will be recorded and the data sent to onsite personnel as described in Section 3.5. If there is a 90 degree change in the prevailing wind direction averaged over a 30-minute period during the work day, the downwind monitors will be appropriately relocated and dust-generating work will be suspended until the monitors resume operation.

3.3 “Take Action” and “Stop Work” Levels Using Particulates as a Surrogate for Lead and Cadmium

The 2008 National Ambient Air Quality Standards (NAAQS) standard for lead, and the Texas Effects Screening Level (ESL) for cadmium have been utilized to establish “Take Action” and

“Stop Work” levels for real-time particulate monitoring that will minimize off-site property impacts associated with the demolition activities. The lead and cadmium-based PM₁₀ surrogate levels will be calculated based upon correlations derived from project monitoring data and the more stringent of the two surrogate levels will be used to establish the ongoing “Take Action” and “Stop Work” levels for PM₁₀.

3.3.1 Establishing Particulate “Take Action” and “Stop Action” Levels for Lead

The target level for lead on a one-hour basis, TPb, has been derived from the current (2008) NAAQS for Pb, 0.15 µg/m³, which is expressed as a three-month rolling average. The AL^{Pb} derived from the NAAQS will be implemented on the basis of 30-minute and 60-minute block-averaged particulate readings. The particulate “Take Action” level notification will be based on a 30-minute downwind block average (TAL^{PM-30}). The particulate “Stop Work” level will be set on 30-minute (SWL^{PM-30}) and 60-minute (SWL^{PM-60}) downwind block averages.

According to Appendix D, “Averaging Period Concentration Estimates” in EPA-454/R-92-024 “Workbook of Screening Techniques for Assessing Impacts of Toxic Air Pollutants (Revised)” December 1992, the appropriate multiplying factor in converting one-hour averaged concentrations to three-month averages is 0.1. Therefore, to set an equivalent one-hour allowable concentration consistent with the three-month averaged Pb NAAQS, the NAAQS value of 0.15 µg/m³ is divided by 0.1, yielding 1.5 µg/m³ = 0.0015 mg/m³ Pb = TPb. Until the AL^{Pb} is established as described below, the default 30-minute block average “Take Action” level for lead will be the default TAL^{PM-30} of 0.1 mg/m³, and the 30-minute block average “Stop Work” Level (SWL^{PM-30}) for lead will be 0.2 mg/m³ (two times the default TAL^{PM-30}) value. The default 60-minute block average (SWL^{PM-60}) or 0.1 mg/m³.

The AL^{Pb} will be calculated by the following method:

The lead content fraction (FPb), taking into account downwind sampling stations, will be determined from project-collected particulate and lead concentration data based upon the following relationship in the measured downwind monitor data. Any sample results for lead which are reported from the laboratory as being below the detection limits will be entered into this calculation as ½ of the reported detection limit rather than as zero. The calculation of FPb

will be completed for the averaged data from each of the three downwind particulate monitor and air sampler pairs.

$\frac{\text{Pb mg/m}^3}{\text{Dust/PM}_{10} \text{ mg /m}^3}$	=	FPb (unitless)
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The highest of the calculated values from the three downwind particulate monitor and air sampler pairs will be the FPb. The AL^{Pb} for the dust monitors will then be calculated as follows:

$\frac{\text{TPb } 0.0015 \text{ mg/m}^3}{\text{FPb (unitless)}}$	=	AL ^{Pb} mg/m ³ (as particulates, PM ₁₀)
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3.3.2 Establishing Particulate “Take Action” and “Stop Work” Levels for Cadmium

The Texas Commission on Environmental Quality (TCEQ) short-term Effects Screening Level for cadmium is 0.0001 mg/m³. Until the AL^{Cd} is established as described below, the default 30-minute block average “Take Action” level (TAL^{PM-30}) for cadmium will be the default of 0.1 mg/m³, and the 30-minute block average “Stop Work” Level (SWL^{PM-30}) for lead will be 0.2 mg/m³ (two times the default TAL^{PM-30}). The default 60-minute block average “Stop Work” level (SWL^{PM-60}) will be 0.1 mg/m³.

In order to derive a comparable PM₁₀ “Take Action” level, the AL for cadmium based upon the content of cadmium in the measured dust (FCd) is determined from the downwind project-collected particulate and cadmium concentration data by the following equations. Any sample results for cadmium which are reported from the laboratory as being below the detection limits will be entered into this calculation as ½ of the reported detection limit rather than as zero. The calculation of FCd will be completed for the averaged data from each of the three downwind particulate monitor and air sampler pairs.

$\frac{\text{Cd mg/m}^3}{\text{Dust/PM}_{10} \text{ mg /m}^3}$	=	FCd (unitless)
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The highest of the calculated values from the three downwind particulate monitor and air sampler pairs will be the FCd. The AL^{Cd} for the dust monitors for the action levels described above will then be calculated as follows:

(ESL Cd 0.0001) mg/m ³	=	AL ^{Cd} mg/m ³
FCd		(as particulates, PM ₁₀)

3.3.3 Establishing Particulate Take Action and Stop Work Levels as Surrogate

The 30-minute block average “Take Action” level (TAL^{PM-30}) and 60-minute “Stop Action” level (SWL^{PM-60}) will be the LOWER of the calculated AL^{Pb} and AL^{Cd}. In no event will the TAL^{PM-30} and the SWL^{PM-60} be greater than 0.15 mg/m³. The 30-minute block average “Stop Action” level (SWL^{PM-30}) will be two times the TAL^{PM-30}.

3.4 “Stop Work” Level for Wind

A wind speed “Stop Work” level notification will be set on a one-minute block average using data from the on-site meteorological station. If the sustained wind speed (the wind speed obtained by averaging the measured values over a one minute period) exceeds 20 miles per hour, all active facility demolition and debris/waste loading and placement must cease until the sustained wind speed declines to 20 miles per hour or lower. Non-dust producing activities (equipment maintenance, decontamination etc.) may still be conducted during these periods

3.5 Particulate Monitors, Wind Data Monitoring, and Notifications

3.5.1 Particulate Monitors

The data obtained from the particulate monitors will be monitored at a remote location by Field Data Solutions (FDS). FDS hosts and manages a computer based monitoring system which will provide Take Action and “Stop Work” level notifications to both field and management personnel on a real time basis as well as provide real time access to values from each instrument. Each of the E-BAM monitors will be equipped with a wireless modem to transmit data, and a cellular communication gateway will be installed at the site to act as a central communications hub.

3.5.2 Wind Speed and Direction Data Monitoring

Wind information (speed and direction) will be monitored using the on-site weather station. The data will be transmitted to FDS directly via telemetry or will be uploaded to the internet for access. The wind direction data will be integrated with the FDS monitoring system to provide “Stop Work” level notifications to both field and management personnel on a real time basis as well as provide real time access to the current wind direction.

3.5.3 Notifications

Notifications of exceedances of the particulate or wind speed “Take Action” or “Stop Work” levels will be sent via text message to field personnel. Notifications to RSI will be sent via email. The notifications will be sent to RSI’s on-site Project Manager, Air Monitoring/Dust Control Technician, and any designated PBW oversight personnel. The notifications will be sent as a “Take Action” level notification or a “Stop Work” level notification. The Dust Control Technician will be the primary individual responsible for monitoring the notifications and ordering implementation of dust mitigation procedures. However, all of these individuals will have the authority to order implementation of dust mitigation procedures, if needed.

3.5.4 Stop Work Criteria for Monitors

If the signal from either the downwind particulate monitors or the onsite weather system is lost for five minutes or more, all dust-generating activities will be suspended until the downwind particulate monitors and the on-site weather system are operational and the signal to the FDS system is re-established.

3.6 Dust Suppression Measures

3.6.1 Particulate “Take Action” Levels

If the 30-minute average PM₁₀ concentration exceeds the “Take Action” level (TAL^{PM-30}) provided in Table 1, RSI will immediately implement increased dust suppression activities. These increased dust suppression adjustment activities may include, but are not limited to the following:

- Increased wetting/misting of demolition work area(s)
- Adding surfactant to the water used for dust control
- Applying temporary cover (paper mulch with tackifier) to areas not being actively worked
- Adjusting the rate/speed and/or quantity of equipment in the work area(s)
- Covering active stockpiles with plastic sheeting or tarps during high wind

3.6.2 Particulate “Stop Work” Levels

If the one-hour (60-minute) average or thirty-minute (30-minute) average PM_{10} concentration exceeds the applicable “Stop Work” level presented in Table 1, RSI will immediately stop all facility demolition and debris/waste loading and placement activities. During the work stoppage period (minimum 15 minutes), RSI must make dust suppression adjustments to reduce airborne particulate matter concentrations below the “Take Action” level concentration for particulates. The dust suppression adjustment activities may include, but are not limited to the following:

- Increased wetting/misting of demolition work area(s)
- Adding surfactant to the water used for dust control
- Applying temporary cover (paper mulch with tackifier) to areas not being actively worked
- Adjusting the rate/speed and/or quantity of equipment in the work area(s)
- Covering active stockpiles with plastic sheeting or tarps during high wind
- Stopping specific dust-generating activities until wind directions and/or wind speeds are more conducive to reduced dust levels
- Mobilize additional dust suppression equipment and initiate its use

After dust suppression adjustments have been implemented (minimum 15-minute period), work may resume. After the dust suppression activities have been revised and work has resumed, the air monitoring technician will continuously monitor the dust levels for a 30-minute period utilizing the available real time data to ensure the dust suppression adjustments are effective. Adjustments to dust suppression activities will be made if needed. If particulate concentration “Stop Work” levels are exceeded at a downwind particulate monitor twice in one work day, RSI must immediately stop work for the remainder of that work day and design and implement a more effective dust control program prior to resuming work the following work day. During this

period, equipment maintenance, decontamination and other non dust-producing activities may be performed.

3.6.3 Visible Dust

If visible dust is present in the demolition work area, increased wetting of the area using water trucks and spray misters will be implemented. If visible dust is observed leaving the active demolition work area, work will stop until additional dust control measures are implemented.

These additional dust control measures may include:

- Increased wetting/misting of demolition work areas
- Adding surfactant to the water used for dust control
- Adjusting the rate/speed and/or quantity of equipment in the demolition work areas

4.0 PERIMETER AIR SAMPLES COLLECTED FOR LABORATORY ANALYSES

4.1 Metals Analyses

Air samples will be collected upwind and downwind at the property boundaries (at the same location as the E-BAM monitors) for laboratory analyses of both lead and cadmium during demolition activities using a low volume particulate air sampler. This analytical data will be correlated with the real-time particulate concentration data collected by the E-BAM monitors on a weekly basis, provided validated sampling results are timely received, and at a minimum every two weeks. Two weeks of analytical data will be correlated with the corresponding real-time particulate concentration data collected by the E-BAM monitors to establish a two-week rolling average. The lowest correlated particulate “Take Action” level for cadmium or lead will be implemented as the TAL^{PM-30} and the SWL^{PM-60} until the next correlation is performed.

Air samples for these metals analysis will be collected by RSI at least three times per week (every other day) during active demolition activities. Samples will not be collected on days when demolition activities are not occurring.

Air samples for metals analysis will be collected over a full working shift (typically eight – ten hours) using a Gilian Model GilAir5 air sampling pump or equivalent. The intakes of the mixed

cellulose ester filter cassettes are positioned adjacent to the inlet of the colocated E-Bam air inlet. The inlet port of the filter is in a downward position. The air sampling interval may be less than eight hours in the event of inclement weather during the air sampling period (such as severe thunderstorms). Air samples will be collected by attaching laboratory-provided air sample filter cartridges (0.8- micrometer mixed cellulose ester membrane filter cartridge) to the pump, and setting the air sample filter cartridges approximately five feet above ground level at the E-BAM monitor locations, which are at or near the property lines both upwind and downwind. When the downwind air samplers are relocated with the E-BAM monitors due to a 90 degree change in the prevailing wind direction, averaged over a 30-minute period, the air samplers will be shut off during the relocation and started in the new location without a filter change. The air sample pumps will be set at a flow rate of approximately three to four liters per minute, thereby resulting in an air sample volume of approximately 1800 - 2400 liters per air sample.

Following air sample collection, the air sample cartridges/tubes will be securely capped, labeled, and delivered with chain of custody documentation to ALS Laboratory Group, in Salt Lake City, Utah for analysis of lead and cadmium. ALS is accredited by the TCEQ for analysis of environmental samples and is accredited by the American Industrial Hygiene Association (AIHA) for analysis of air samples and lead in soil, dust, paint and air. Laboratory analyses will be performed on an expedited 24-hour turnaround if possible. Metals will be analyzed using NIOSH Method 7303 (see Appendix 2). This method is specifically accredited by the AIHA.

Laboratory data will be validated by Exide's consultants and provided to the TCEQ within two business days of receipt of validated analytical results, excluding the day that the results are received. If data are received that cannot be validated, an e-mail notification will be provided to the TCEQ within two business days with a brief description of the issue(s). Upon receipt of the corrected data from the laboratory, Exide's consultant will validate and provide to TCEQ as described above.

4.2 Metals Concentrations "Take Action" Levels

Following receipt of the lead and cadmium analytical laboratory reports, the analytical data from the downwind air samplers will be compared to the site-specific lead and cadmium "Take Action" levels provided on Table 1 (revised as appropriate based on sample results). If either concentration in the downwind samples exceeds the applicable "Take Action" level, the

Contractor will immediately implement increased dust suppression activities. These increased dust suppression adjustment activities may include, but are not limited to the following:

- Increased wetting/misting of demolition work area(s)
- Adding surfactant to the water used for dust control
- Applying temporary cover (paper mulch with tackifier) to areas not actively being worked
- Adjusting the rate/speed and/or quantity of equipment in the work area(s)
- Covering active stockpiles with plastic sheeting or tarps during high wind
- Mobilizing additional dust suppression equipment and initiating its use

4.3 Metals Concentrations Stop Work Levels

Following receipt of the lead and cadmium analytical laboratory reports, the analytical data will be compared to the “Stop Work” levels shown on Table 1. The “Stop Work” limit for lead has been derived from the current (2008) NAAQS for Pb, adjusted as appropriate to address the differences in averaging periods. According to Appendix D “Averaging Period Concentration Estimates” in EPA-454/R-92-024 “Workbook of Screening Techniques for Assessing Impacts of Toxic Air Pollutants (Revised)” December 1992, the appropriate multiplying factor in converting eight-hour averaged concentrations to three-month averages is 0.14. Accordingly, the NAAQS value of $0.15 \mu\text{g}/\text{m}^3$ is divided by 0.14, yielding $1.05 \mu\text{g}/\text{m}^3$ average concentration as the lead “Stop Work” level. For cadmium, the TCEQ short term ESL of $0.1 \mu\text{g}/\text{m}^3$ average concentration is the “Stop Work” level. The “Take Action” levels for the lead and cadmium sample results are set at 75% of the “Stop Work” levels.

If the lead or cadmium “Stop Work” levels are exceeded by results from a downwind air sampler, RSI will immediately stop all demolition activities and design and implement a more effective dust control program prior to resuming work. The additional dust suppression activities may include but are not limited to the following:

- Increased wetting/misting of demolition work area(s)
- Adding surfactant to the water used for dust control
- Applying temporary cover (paper mulch with tackifier) to areas not being actively worked
- Adjusting the rate/speed and/or quantity of equipment in the work area(s)
- Covering active stockpiles with plastic sheeting or tarps during high wind
- Stopping specific dust-generating activities until wind directions and/or wind speeds are more conducive to reduced dust levels
- Mobilizing additional dust control equipment

Table 1 provides the default action levels and responses for particulates, lead, and cadmium. When sufficient site data has been collected following the start of the demolition activities, the action and stop work levels for particulates will be updated based upon the relationship of particulate concentration and lead and cadmium concentrations utilizing the formulas in Section 3.3.1 and 3.3.2, respectively. Take Action and Stop Work levels will be updated weekly, provided timely sampling results are received, and at least every two weeks based upon the relationship between dust and measured metals concentrations.

Table 1. Action Levels and Response

Contaminant of Concern	Monitoring Method	Frequency of Monitoring	Take Action Level (Increase Dust Suppression)	Stop Work Level
Particulate Matter	Visual		Visible dust within the active Work Zone – Implement additional dust control measures.	Dust leaving the Work Zone perimeter – Stop Work. Implement additional dust control measures.
	PM ₁₀ Downwind Particulate Monitors	30-minute block average	PM ₁₀ > TAL ^{PM-30} Default TAL ^{PM-30} = 0.10 mg/m ³ average 30-minute concentration – Implement additional dust control measures.	PM ₁₀ > SWL ^{PM-30} Default SWL ^{PM-30} = 0.20 mg/m ³ (or, two times default TAL ^{PM-30}) average 30-minute concentration – Stop Work. Implement additional dust control measures.
	PM ₁₀ Downwind Particulate Monitors	60-minute block average		PM ₁₀ > SWL ^{PM-60} Default SWL ^{PM-60} = 0.10 mg/m ³ average hourly concentration – Stop Work. Implement additional dust control measures.
Lead	Low Volume Particulate Samplers	Three days per week, 8-10 hour sample event, max 2000 liter sample volume	Take action level = 0.78 µg/m ³ – Implement additional dust control measures.	Stop Work = 1.05 µg/m ³ average concentration.
Cadmium	Low Volume Particulate Samplers	Three days per week, 8-10 hour sample event, max 2000 liter sample volume	Take Action level = 0.075 µg/m ³ – Implement additional dust control measures.	Stop Work = 0.100 µg/m ³ average concentration (TCEQ short term Cd ESL).

5.0 REPORTS

5.1 Daily Dust Concentration and Wind Speed and Direction Summary Reports

Daily Dust Concentration (PM₁₀) and Wind Speed and Direction summary reports will be prepared by FDS. These summary reports will include the average 30-minute net block average PM₁₀ results for each downwind E-BAM instrument and the 30-minute block average wind speed and direction data. “Take Action” or “Stop Work” level exceedances and the dust suppression adjustment activities implemented in response will be documented in the summary reports.

Summary reports must be completed within two business days of the monitoring day being reported. The data will be validated by Exide’s consultants as described in Section 6.4.

Summary reports of the validated data will be provided to the TCEQ within two business days of receipt of verifiable results, excluding the day that the results are received. If data are received that are not able to be validated, an e-mail notification will be provided to the TCEQ with a brief description of the issue(s). The summary report with the corrected data will be resubmitted to Exide’s consultant followed by validation. The summary report with validated data will then be submitted to TCEQ as described above. Concurrent with submittal to the TCEQ, the summary reports will be posted to the publicly accessible website established for the Exide Frisco Facility at <http://exide.com/en/sustainability/recycling-centers-sustainability/frisco.aspx>.

Concerns regarding activities conducted at the Exide Technologies Frisco Recycling Center should be addressed to the following points of contact:

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6.0 QUALITY ASSURANCE / QUALITY CONTROL

Quality assurance (QA) refers to the planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy a given requirement for quality. QA is applied to location and equipment selection, equipment acquisition and installation, routine site operation, and data processing and reporting.

Quality control (QC) refers to the operational techniques and activities that are used to fulfill requirements for quality. QC procedures applied at each step provide checks for acceptable conditions with corrective procedures specified when necessary.

The purpose of QC procedures is to assess and document data quality and to define remedial corrective actions when operating conditions exceed pre-established limits. Routine QC procedures are designed to focus on areas most likely to have problems, based on experience and guideline documents. Table 2 shows the frequency of audits and routine QC measures for the air quality study. The following subsections describe the QC, calibration, and auditing procedures to be used during this project.

Table 2. Schedule of Audits, Calibrations, and Quality Control Checks

Frequency	Activity	Acceptable Limits
Prior to Delivery, Prior to Start of the Project	Calibration of E-BAM Monitors	
Prior to the Start of Work Each Week	Routine Checks of E-BAM Monitors (Tape Checks, Zero Checks, Leak Check, and clean size selective inlets), Verify Clock Settings, Housekeeping) and Air Samplers	Leak Check >1.0 lpm requires nozzle and vane cleaning Leak Check > 1.5 lpm invalidates data to previous leak check
Every Two Weeks		
Every Three Weeks	Flow Rate Calibration, Barometric Pressure Calibration, Temperature Calibration, Membrane Test and Pump Test of E-BAM Monitors	Flow rate +0.2 lpm Membrane Check Pass/Fail
Every tape change and At Least Monthly	Cleaning Nozzle and Vane of E-BAM Monitors (Leak Check required anytime tape is removed or installed)	Leak Check >1.0 lpm requires nozzle and vane cleaning Leak Check > 1.5 lpm invalidates data to previous leak check
Weekly	Field Blanks Collected for Air Samplers	
Monthly	Trip Blanks Collected for Air Samplers	

6.1 Particulate Monitors

6.1.1 Quality Control

The E-BAM particulate monitor beta detectors are calibrated at the factory. The beta detector calibrations remain fixed for the life of the unit, and no user adjustments are required. Each unit has test membranes that are placed in the beta particle pathway to verify performance of the detector. The test membranes are thin sheets of material that absorb a fraction of beta particles equivalent to a known mass of particulate matter. Each instrument has an individually matched

membrane, and the factory-provided equivalent mass reading is stored in the instrument. The reference membrane tests are performed automatically every hour by the E-BAM and will be manually performed prior to the start of the project (the manufacturer recommends a frequency of one or two times per year for the E-BAM). The units are also equipped with zero-check inserts that are used in the same manner as the reference membranes. The zero check insert test will be performed prior to the start of the project and prior to the start of work each week.

QC flow checks (i.e. flow rate calibration, barometric pressure calibration, and temperature calibration) will be performed by RSI personnel every three weeks to ensure that the correct sample flow rate is being maintained to provide proper particle size separation. The E-BAM particle size selective inlets are designed to function at a flow rate of 16.7 L/min to maintain proper particle separation. The flow checks of the E-BAM instruments will use a volumetric flow calibration kit (BGI deltaCal™). This calibrator includes flow, temperature and barometric pressure. As part of the flow check for the E-BAM, the reference temperature and barometric pressure readings will be compared to the corresponding readings produced by the E-BAM's internal sensors.

Cleaning of the size selective inlets on the particulate monitors will be conducted prior to the start of work each week. The larger particles that are removed from the air flow are captured inside the PM₁₀ inlet heads. To maintain proper operation of the inlets, the particle deposits must be cleaned periodically. A leak check will be performed weekly and when the tape is removed or installed. The nozzle and vane beneath the filter tape will be cleaned each time the tape is changed but at a minimum of once per month.

6.2 Air Samplers

6.2.1 Quality Control

Field and trip blank quality control samples will be collected. Field blank samples assess the possible contamination introduced by field sampling procedures, sampling media, sampling equipment, or shipment of the samples. Trip blanks verify the cleanliness of the sampling media.

The field blank will be shipped to the field, prepared, and handled as the other samples, and returned to the laboratory, without drawing air through the air sampler, for analysis. One field blank will be collected each week for metals analysis. The trip blank will be shipped to the field, left sealed in its packaging, and then returned to the laboratory for analysis. One trip blank will be analyzed per month.

6.2.2 Quality Assurance

Precision and accuracy checks are both elements of QA. Precision checks are a measure of agreement among individual measurements of the same parameter, usually under prescribed similar conditions. Accuracy is the degree of agreement between an accepted reference measurement and the field measurement. Accuracy may be expressed as a total difference, or as a percentage of the reference value, or as a ratio. Precision checks are performed as collocated measurements.

Accuracy of ambient air sampling equipment is measured in terms of the accuracy of the flow rate measurement. Accurate determination of the air volume drawn through the air sampler is essential to the concentration calculation. Flow rates of the air samplers will be determined pre- and post-sampling using calibrated equipment appropriate to the sampling device and will be provided to the laboratory along with the sample.

Preventive maintenance will be part of the air samplers' QA program. Preventive maintenance is a combination of preventive and remedial actions taken to prevent or correct failure of the monitoring systems. Preventive maintenance for the air samplers includes inspection and cleaning of the inlets.

6.3 Laboratory Validation

Data validation is used to interpret the quality of the analytical data received from the laboratory. The quality of the data is determined through evaluation of both the field and laboratory quality control samples. Data validation procedures determine whether individual project data are useable, useable with qualification, or unusable. Data will be reviewed in accordance with guidelines presented in USEPA's *National Functional Guidelines for Inorganic Superfund Data*

Review (2010) and/or National Functional Guidelines for Organic Superfund Data Review (2008).

The Laboratory will submit the analytical data and supporting QA/QC data to Exide's consultant for validation. The validation review will consist of a Level II review which includes the following: blank samples (i.e., trip, method, equipment, field, etc.) are reviewed for detections which may indicate whether field or laboratory handling may have cross-contaminated samples causing false positive or high-biased data; spike recovery samples (i.e., laboratory control sample, surrogate, or matrix spike) are reviewed to evaluate accuracy in the laboratory's ability to recover known concentrations that were intentionally spiked into the quality control samples; and, duplicate samples (field and/or laboratory-prepared) are evaluated to determine precision, which is the level of agreement among individual measurements. In addition to the above quality control samples, verification of appropriate analytical methods, reporting limits, sample preservation, and holding times are also reviewed to determine data usability.

Any potential bias (high or low) or cross-contamination observed as a result of the data review is usually addressed by addition of data qualifiers. These typically include one of the following: a non-detect (U) flag for blank detections indicating the potential for cross-contamination; an estimated (J) flag for results that could be biased high or low due to accuracy or precision issues; rejection of data (R) due to results grossly outside their respective control limits or questionable data.

6.4 Dust Concentration, Wind Speed and Direction Report Validation

The Daily Dust Concentration and Wind Speed and Direction summary reports will be prepared by FDS and provided to Exide's consultant for validation. The review will include review of error reports, previous instrument flow and leak check information as well as review of the data received to insure the data being reported is from the instruments being used at the Site.

6.5 Sample Information Management

The sample information management system for the study will be based on a uniform sample identification system. Each sample will receive a unique ID that is based on the unique

combination of project, sampling date, sampling location and the Serial Number of the E-BAM Monitor that the sample is associated with.

The sample ID will be structured as follows:

EX-YYMMDD-LOC-XXX[-QQ], where

EX-DEMO = Project (Exide-Demolition)
YYMMDD = Sampling date (e.g., 11/01/2012 = 121101)
LOC = Sample Location (e.g. UW = Upwind, DW = Downwind)
XXX = E-BAM Monitor Sample Association – Last 3 digits of Serial Number,
QQ = Optional QA sample flag (TB = trip blank, FB = field blank, SC = duplicate)

For example, a sample collected at a downwind station on 1 November 2012 would be identified as EX DEMO 121101 DW 123.

APPENDICES

APPENDIX A

Descriptive Literature on E-BAM Particulate Monitors

E-BAM

E-BAM is a complete measurement system it comes with the following standard components:

- 8 Channel Datalogger
- Internal DC Vacuum Pump Standard
- Real-Time Concentration
- PM10 Inlet
- Aluminum Tripod
- Ambient Temperature Sensor
- Volumetric Flow Control
- Weatherproof Enclosure
- Filter Temperature Sensor
- Filter RH Sensor
- Filter Pressure Sensor
- Calibration Membrane

Specifications

Range	0 - 65 mg per cubic meter
Accuracy	2.5 µg or 10% in 24 hour period
Measurement Cycle	Hourly measurements with 1, 5, 10, 15, or 30 min real-time averages
Beta Source	C14, less than 75 microcurie, Half life of 5730 years
Detector:	Scintillation probe
Analog Output	0-1V, 0-2.5v, 0-5V, selectable hourly or real-time output
Filter Tape	Continuous glass fiber filter
Inlet	Compatible with EPA PM10 and PM2.5 inlets
Flow Rate:	16.7 liters per minute, adjustable
Flow accuracy	+/- 2% of reading, volumetric flow controlled
Sample Pump	Dual diaphragm type, DC powered, 4000 hr rating
Alarm Signals	Filter, flow, power and operation failure
Input Power	12 Volts DC @ 48 Watts max
Alarm Contact Closure	2 Amp @ 240 VAC max
Operating Temperature	-30 Deg C to 50 Deg C
Enclosure	41 cm x 36 cm x 20 cm, 13kg

Options and Accessories

- BX-302 Zero Calibration Kit
- BX-305 Leak check valve
- BX-307 Flow Calibrator
- BX-308 PM2.5 Sharp-Cut Cyclone
- BX-803 TSP Inlet
- EX-034 Wind speed and direction sensor
- EX-121 AC Power supply, 100-240 VAC, 12 VDC output
- EX-593 Ambient RH Sensor
- EX-996 Phone modem kit
- EX-911 Cell modem kit
- 460130 Filter tape, roll
- 9425 Wall mount bracket
- Airsis Satellite modem kit
- External AC Vacuum Pump
- MMP MicroMet Plus Software
- Solar Panel Array



The Met One E-BAM is a portable, real-time beta gauge which is comparable to U.S. EPA methods for PM_{2.5} and PM₁₀ particulate measurements.

The Met One E-BAM has been built to satisfy users, regulators and those from the health community by providing truly accurate, precise, real time measurement of fine particulate matter automatically. In addition, it is rugged, portable, battery operated, and deployable in 15 minutes.

The E-BAM offers the following advanced features:

1. Accuracy and precision consistent with U.S. EPA requirements for Class III PM_{2.5} and PM₁₀ measurement.
2. Real-time, accurate results without correction factors, regardless of season or geographic location.
3. True ambient sampling provides accurate measurement of semi-volatile nitrates and organic compounds.
4. Lightweight, rugged construction is easily mounted on a tripod in minutes.
5. All-weather construction allows for true ambient sampling.
6. Operates on AC or DC power. Battery and Solar options available upon request.



Met One Instruments, Inc.

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Regional Sales & Service: 3206 Main Street, Suite 106, Rowlett, Texas 75088 • Tel (972) 412-4747 • Fax (972) 412-4716
<http://www.metone.com> • metone@metone.com



Met One Instruments, Inc.

Continuous Monitoring

The E-BAM automates particulate measurement by continuously sampling and reporting concentration data. Data records are updated every minute. E-BAM eliminates the old process of filter collection and manual filter weighing, and eliminates the need for more expensive, high maintenance instruments. Today, with the adaptation of Beta Attenuation to ambient monitoring this process became simple, streamlined, and inexpensive.

About Accuracy

Real-time accurate, reliable, and repeatable measurement of ambient fine particulate matter has been the elusive goal of environmental regulators and health professionals for many years. Met One Instruments has developed advanced particulate monitoring instrumentation which is reliable, and is easy to operate. It will also automatically report results in near real time, eliminating the need for high levels of human intervention.

Because sampling occurs under true ambient conditions semi-volatile organic compounds and nitrates are easily detected thereby avoiding under measurement.

Continuous Sampling

E-BAM is a lightweight portable instrument that operates directly in hostile environments without an exterior enclosure. E-BAM is a very robust portable sampler system that is easily installed in less than 15 minutes. No other sampler matches the portability and flexibility of the E-BAM.

Set up

Quick setup of the E-BAM is assured with a series of prompts instructing the installer on the sequence to follow. Then the E-BAM performs a series of self test diagnostics and alerts the installer of any corrective action. Upon completion, the E-BAM automatically places itself in normal operate mode.

Particulate size selection

Size selective concentration measurements are made using a variety of sampling inlets. The E-BAM may be supplied with TSP (Total Suspended Particulate), PM-10, PM 2.5 or PM 1 inlets. Flow dependent cut points in the size selective inlets are maintained using integral flow meter, pressure sensor and ambient temperature sensor.

The PM-10 inlet removes particles larger than 10 microns, the inlet is not affected by wind speed and wind direction. For PM 2.5 or PM 1 secondary size selection is made using a second downstream inlet.

Construction etc.

The standard configuration of the E-BAM is a self-contained environmentally sealed aluminum enclosure placed on a rugged tripod. This system can be permanently placed on rooftops, near roads, at industrial sites, or rapidly deployed to monitor emergency situations.

'E-' represents Environment Proof instrument, E-BAM has been specifically designed to work in hostile environments without additional protection.

Direct Field Reporting

Collecting real time or historical particulate data from a field site has never been easier. Advanced communication options include cellular phone, Line of Sight Radio, and for very remote sites, satellite communications are now available. E-BAM also supports the full line of standard MET ONE options, such as phone modem, and direct communications to a portable computer.

E-BAM data is recorded internally and may be retrieved using one of the communication options, or data may be forwarded to third party data acquisition system.

MicroMet Plus Software supports the E-BAM and provides a complete communication, data base and reporting modules with charting. Comet data retrieved software is included.

Digital, Analog and Alarm Outputs

The E-BAM provides both continuous digital and analog outputs. Analog output is selectable to several full-scale voltages. Digital output is supplied as RS-232.

Reporting modes

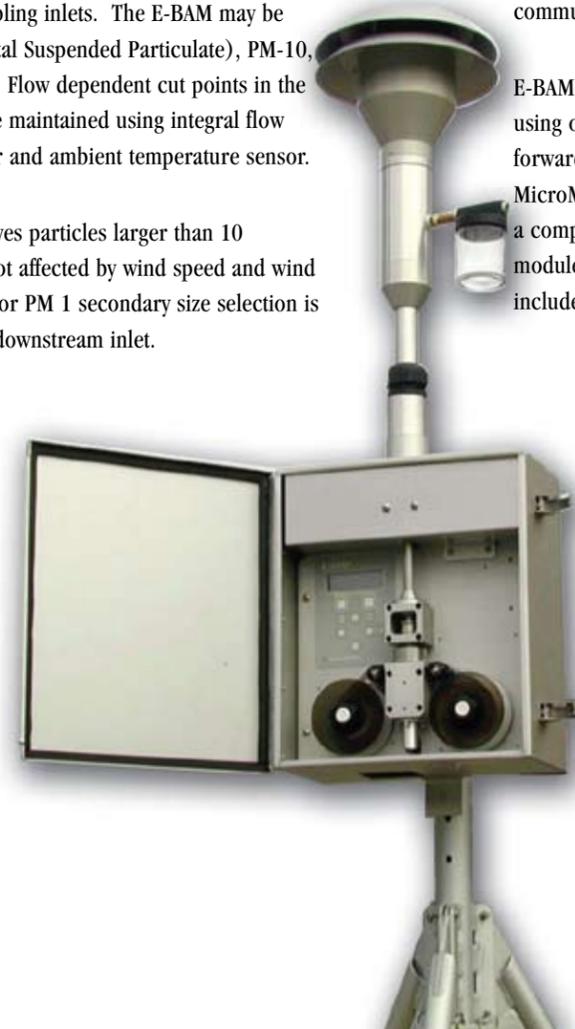
The internal data logger can store up over 182 days of concentration data at one hour sample times, and collect data from eight other measurements at the same time! Both digital and analog outputs are included to enable users to connect to other data recording systems.

Easy to Operate

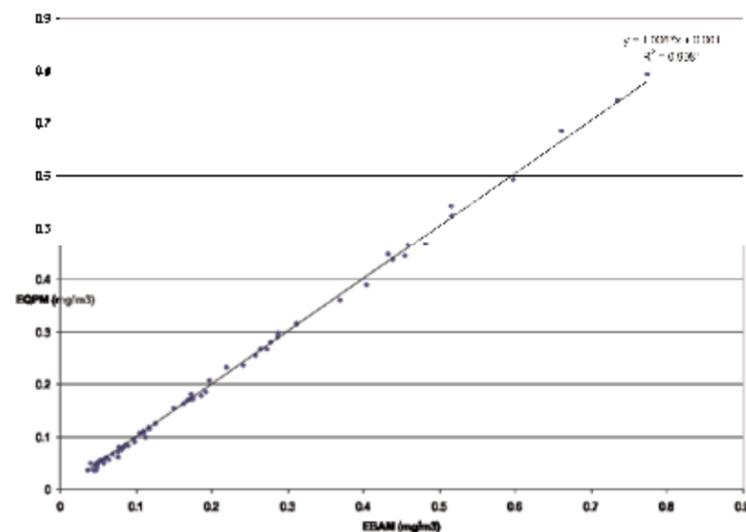
E-BAM has been programmed to operate at all times, except during calibration verification. Current data, historical data, and status information are available at all times without interrupting normal E-BAM operation.

Data Validation

The operator may select various criteria for data validation, including deviation from rolling average, high value excursions, power failure and others. If an error occurs it is entered into the error log with date, time and type of error.



EPA Designated Method EQPM-0798-122 VS EBAM



APPENDIX B
NIOSH Method 7303

**ELEMENTS by ICP
(Hot Block/HCl/HNO₃Digestion)**

7303

MW: Table 1

CAS: Table 2

RTECS: Table 2

METHOD: 7303, Issue 1

EVALUATION: PARTIAL

Issue I: 15 March 2003

OSHA Table 2

PROPERTIES: Table 1
NIOSH: Table 2
ACGIH: Table 2

ELEMENTS: aluminum	cadmium	indium	nickel	strontium	zinc
antimony*	calcium	iron	palladium	tellurium	
arsenic	chromium	lead*	phosphorus	thallium	
barium	cobalt	magnesium	platinum	tin*	
beryllium	copper	manganese	potassium	titanium	
bismuth*	gallium	molybdenum	selenium	vanadium	
boron	gold	neodymium	sodium	yttrium	

• With certain restrictions (see Table 3)

SAMPLING		MEASUREMENT	
SAMPLER:	FILTER (0.8-µm, cellulose ester membrane)	TECHNIQUE:	INDUCTIVELY COUPLED ARGON PLASMA, ATOMIC EMISSION SPECTROSCOPY
FLOW RATE:	1 to 4 L/min	ANALYTE:	See element list above
VOL-MIN:	Table 1	REAGENTS:	Conc. HCl, 1.25 mL; and conc. HNO ₃ , 1.25 mL
-MAX:	Table 1	FINAL SOLUTION:	5% HCl and 5% HNO ₃ , 25 mL
SHIPMENT:	Routine	WAVELENGTH:	Spectral wavelength shift
SAMPLE STABILITY:	Stable	BACKGROUND CORRECTION:	Elements in 5% HCl, 5% HNO ₃
BLANKS:	2 to 10 field blanks per set	CALIBRATION:	LOQ to 50,000 pg/sample [1]
ACCURACY		RANGE:	Varies with element; Table 1
RANGE STUDIED:	5,000 to 50,000 pg/sample	ESTIMATED LCD:	Not evaluated
BIAS:	Not determined	PRECISION (s):	
OVERALL PRECISION:	Not determined		
ACCURACY:	Not determined		

APPLICABILITY: The working range of this method is up to 100 mg/m³ for each element in a 500-L sample (the minimum range depends on the LCD for each sample; see Table 1). The analysis is not compound specific. Certain elemental compounds are known to be acceptable or unacceptable by this method (see Table 3). For unverified compounds, a test run should be conducted using a known amount of the compound in question to determine acceptability.

INTERFERENCES: Interferences are spectral in nature and are accounted for by choosing appropriate wavelengths, applying interelement correction factors, and background correction.

OTHER METHODS: Alternative, more sensitive methods exist for some elements by graphite furnace atomic absorption spectroscopy. This method is similar to NIOSH Method 7301, differing only in the use of the hot block for digestion of the sampler.

REAGENTS:

1. Hydrochloric acid,* conc., ultra pure.
2. Nitric acid,* conc., ultra pure.
3. Calibration stock solutions, 50-1000 pg/mL. Commercially available single element solutions or multielement solutions prepared as instructed by the instrument manufacturer.
4. Argon, prepurified.
5. Distilled, deionized, Type II water.
6. Diluting solution: 5% HCl : 5% HNO₃. To about 600 mL of deionized water in a 1-L volumetric flask, slowly add 50 mL conc. HCl and 50 mL conc. HNO₃. Dilute to the mark with deionized water.

EQUIPMENT:

1. Sampler: cellulose ester membrane filter, 0.8-µm pore size, 37-mm diameter; In cassette filter holder.
2. Personal sampling pump, Ito 4 L/min, with flexible connecting tubing.
3. Inductively coupled argon plasma-atomic emission spectrometer, equipped as specified by the manufacturer for analysis of elements of interest.
4. Hot block apparatus at 95 °C.
5. Digestion vessels and caps, 50-mL.
6. Watchglasses.
7. Pipettes, electronic and mechanical.
8. Regulator, two-stage, for argon.
9. Forceps.

" See SPECIAL PRECAUTIONS

SPECIAL PRECAUTIONS: Concentrated acids are powerful oxidizers, toxic, and corrosive liquids. Wear protective clothing and work in a fume hood.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Sample at an accurately known flow rate between and 4 L/m in for a total sample size of 200 to 2000 L for TWA measurements. Do not exceed a filter loading of approximately 2 mg total dust.

SAMPLE PREPARATION:

3. Open the cassette filter holder and with forceps remove the sample filter. Fold the filter into quarters taking care not to lose any sample, and transfer to a clean, 50-mL hot block digestion tube.
4. Add 1.25 mL HCl. Cover with a plastic watchglass. Place in the hot block and heat at an internal temperature of 95 °C for 15 minutes.
NOTE: The internal temperature may vary from the digital readout. Calibrate the hot block prior to digestion.
5. Remove the sample from the hot block and cool for 5 minutes. Remove watchglass and add 1.25 mL HNO₃. Replace watchglass and return to hot block at 95°C for 15 minutes.
6. Remove the sample from the hot block and cool for at least 5 minutes. Rinse watchglass into the sample container and discard watchglass.
7. Dilute to 25-mL final volume with distilled, deionized Type II water.

CALIBRATION AND QUALITY CONTROL:

8. Calibrate the spectrometer according to the manufacturer's recommendations. Use standards consisting of the same 5% HCl :5% HNO₃ matrix as the samples.
9. Analyze a standard every 10 samples.
10. Analyze a media blank every 20 samples, and a reagent blank every 10 samples.
11. Analyze a set of two laboratory control samples every 40 samples of a given matrix for a given analyte.
12. Check recoveries with at least two spiked media blanks per ten samples.
NOTE: In the determination of lead, there may be a measurement interference (for example, samples with high aluminum levels). More recent instruments have a correction for this.

MEASUREMENT:

13. Set spectrometer to conditions specified by manufacturer.

14. Analyze standards, samples and quality control checks.

NOTE: If the elemental value for a sample is above the linear range of the element(s) in question, dilute the sample solution with 5% HCl :5% HNO₃ diluting solution, reanalyze and apply the appropriate dilution factor in the calculations.

CALCULATIONS:

15. Obtain the solution concentrations for the sample, C, (pg/mL), and the average media blank, C_b (pg/mL), from the instrument.

16. Using the solution volumes of sample, V, (mL), and media blank, V_b (mL), calculate the concentration, C (mg/m³), of each element in the air volume sampled, V (L):

$$C = \frac{C_s V_s - C_b V_b}{V \text{ m}^3}$$

NOTE: pg/L mg/m³

EVALUATION OF METHOD:

The method was evaluated for all elements and compounds listed in Table 1 and Table 2 between 1999 and 2001 using known amounts of bulk material [4]. Evaluation is ongoing for additional elements and compounds. The limits of detection and quantitation were also determined for each element. Two ICP instruments were used in the evaluation, a Thermal Jarrell Ash Model 61E [5] and a TJA IRIS [6], operated according to the manufacturer's instructions.

REFERENCES:

- [1] WOHL [2001]. Metals validation using hot block digestion, Unpublished data. Wisconsin Occupational Health Laboratory, Madison, WI.
- [2] NIOSH [1994]. Method 7300: Elements by ICP, NIOSH Manual of Analytical Methods, Fourth Edition, Issue 2, Aug. 15, 1994.
- [3] WOHL [2001]. Metals Manual 2001, WOHL Internal Document, Updated Apr. 1, 2001. Wisconsin Occupational Health Laboratory, Madison, WI.
- [4] WOHL [2001]. WOHL General Operations Procedures Manual, WOHL Internal Document, Updated 2001. Wisconsin Occupational Health Laboratory, Madison, WI.
- [5] Thermal Jarrell Ash [1991]. ICAP 61E Plasma Spectrometer Operator's Manual, Thermal Jarrell Ash Corp., Part No. 128832-01, Feb., 1991.
- [6] Thermal Jarrell Ash [1997]. IRIS Plasma Spectrometer User's Guide, Thermal Jarrell Ash Corp., Part No. 135811-0, Feb. 4, 1997.

METHOD WRITTEN BY:

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TABLE 1: ANALYTE INFORMATION FOR VALID ELEMENTS AND COMPOUNDS

Analyte	Properties		LOD (ug/mL)	LOQ (ug/mL)	Estimated LOQ (ug/sample)*	Minimum** air vol. (L)	Maximum*** air vol. (L)
	MW	MP (*C)					
Al	26.98	660	0.111	0.37	9.25	2	10,000
As	74.92	817	0.009	0.03	0.075	8	5,000,000
Au	196.97	10.63	0.015	0.05	1.25	1	3,300
B	10.81	2177	0.0094	0.0283	0.71	1	3,300
Ba	137.34	3.51	0.0018	0.006	0.15	1	100,000
Be	9.01	2178	0.00075	0.0025	0.062	35	25,000,00
Bi	208.98	271	0.025	0.085	2.12	1	10,000
Ca	40.08	842	0.099	0.33	8.25	2	10,000
CaO	56.08	2927	0.139	0.462	11.6	3	10,000
Cd	112.4	321	0.0037	0.012	0.30	3	500,000
Co	58.93	1495	0.003	0.011	0.27	3	500,000
Cr	52.00	1890	0.009	0.03	0.75	8	500,000
Cu	63.54	1083	0.020	0.060	1.50	15	500,000
Fe	55.85	1535	0.070	0.20	5.00	1	5,000
Fe ₂ O ₃ (as Fe)	159.69	1462	0.070	0.20	5.00	1	5,000
Ga	69.72	29.75	0.03	0.09	2.25	1	3,300
In	114.82	156.3	0.015	0.05	1.25	15	500,000
Mg	24.31	651	0.047	0.14	3.50	1	10,000
MgO	40.32	2825	0.078	0.23	5.75	5	33,000
Mn	54.94	1244	0.0012	0.004	0.10	0.05	10,000
Mo	95.94	651	0.0072	0.024	0.60	0.5	10,000
Nd	92.906	2477	0.01	0.03	0.75	0.1	3,300
Ni	58.71	1453	0.012	0.039	0.98	1	50,000
P	30.97	44	0.3	1.0	25	250	500,000
Pb	207.19	328	0.023	0.07	1.75	35	100,000
Pd	106.4	1550	0.009	0.03	0.75	0.1	3,300
Pt	195.09	1769	0.0045	0.015	0.38	200	25,000,000
Sb	121.75	630.5	0.018	0.06	1.50	3	100,000
Se	78.96	217	0.021	0.064	1.60	8	250,000
Sn	118.69	232	0.015	0.05	1.25	1	25,000
Sr	87.62	769	0.002	0.006	0.15	300	100,000,000
Te	127.60	450	0.15	0.5	12.5	125	500,000
Ti	47.90	1675	0.005	0.016	0.40	0.1	10,000
Tl	204.37	304	0.044	0.133	3.32	35	500,000
V	50.94	1890	0.003	0.01	0.25	2.5	500,000
Y	88.91	1495	0.001	0.003	0.075	0.1	50,000
Zn	65.37	419	0.022	0.066	1.65	0.5	10,000
ZnO	81.37	1970	0.027	0.082	2.05	0.5	10,000

Value based on a 25-mL sample volume.

The minimum sampling volume needed to obtain the OSHA PEL at the LOQ for the element/compound at a sample digestion volume of 25 mL.

*** The maximum sampling volume for a given sample, calculated by taking 50,000 pg as the limit for the element/compound per sample.

NOTE: The LOD and LOQ values are dependent on the particular analytical instrument used. Also, LOD and LOQ values may vary for a particular element due to certain interelement interferences.

TABLE 2. EXPOSURE LIMITS, CAS #, RTECS

Element (Symbol)	CAS #	RTECS	Exposure Limits, mg/m ³ (Ca = carcinogen)		
			OSHA	NIOSH	ACGIH
Silver (Ag)	7440-22-4	VW3500000	0.01 (dust, fume, metal)	0.01 (metal, soluble)	0.1 (metal)
Aluminum (Al)	7429-90-5	BD0330000	15 (total dust) 5 (respirable)	10 (total dust) 5 (respirable fume) 2 (salts, alkyls)	10 (dust) 5 (powders, fume) 2 (salts, alkyls)
Arsenic (As)	7440-38-2	CG0525000	varies	C 0.002, Ca	0.01, Ca
Barium (Ba)	7440-39-3	CQ8370000	0.5	0.5	0.5
Beryllium (Be)	7440-41-7	DS1750000	0.002, C 0.005	0.0005, Ca	0.002, Ca
Calcium (Ca)	7440-70-2		varies	varies	varies
Cadmium (Cd)	7440-43-9	EU9800000	0.005	lowest feasible, Ca	0.01 (total), Ca 0.002 (respir.), Ca
Cobalt (Co)	7440-464	GF8750000	0.1	0.05 (dust, fume)	0.02 (dust, fume)
Chromium (Cr)	7440-47-3	G64200000	0.5	0.5	0.5
Copper (Cu)	7440-50-8	GL5325000	1 (dust, mists) 0.1 (fume)	1 (dust) 0.1 (fume)	1 (dust, mists) 0.2 (fume)
Iron (Fe)	7439-89-6	N04565500	10 (dust, fume)	5 (dust, fume)	5 (fume)
Potassium (K)	7440-09-7	TS6460000	-	-	-
Lanthanum	7439-91-0		-	-	-
Lithium (Li)	7439-93-2	-	-	-	-
Magnesium (Mg)	7439-95-4	0M2100000	15 (dust) as oxide 5 (respirable)	10 (fume) as oxide	10 (fume) as oxide
Manganese (Mn)	7439-96-5	009275000	CS	1; STEL 3	5 (dust) 1; STEL 3 (fume)
Molybdenum (Mo)	7439-98-7	QA4680000	5 (soluble) 15 (total insoluble)	5 (soluble) 10 (insoluble)	5 (soluble) 10 (insoluble)
Nickel (Ni)	7440-02-0	QR5950000	1	0.015, Ca	0.1 (soluble) 1 (insoluble, metal)
Phosphorus (P)	7723-14-0	TH3500000	0.1	0.1	0.1
Lead (Pb)	7439-92-1	0F7525000	0.05	0.05	0.05
Antimony (Sb)	7440-36-0	CC4025000	0.5	0.5	0.5
Selenium (Se)	7782-49-2	VS7700000	0.2	0.2	0.2
Tin (Sn)	7440-31-5	XP7320000	2	2	2
Strontium (Sr)	7440-24-6		-	-	-
Tellurium (Te)	13494-80-9	WY2625000	0.1	0.1	0.1
Titanium (Ti)	7440-32-6	XR1700000			
Thallium (Tl)	7440-28-0	XG3425000	0.1 (skin) (soluble)	0.1 (skin) (soluble)	0.1 (skin)
Vanadium (V)	7440-62-2	YW2400000	-	C 0.05	
Tungsten	7440-33-7	-	5	5 10 (STEL)	5 10 (STEL)
Yttrium (Y)	7440-65-5	ZG2980000	1	N/A	1
Zinc (Zn)	7440-66-6	ZG8600000	-		
Zirconium (Zr)	7440-67-7	ZH7070000	5	5, STEL 10	5, STEL 10

TABLE 3: VALIDATION SUMMARY

Analyte	Status ¹	Analyte	Status	Analyte	Status
Aq	Not Valid	CuO	Valid	S	Not Valid
Al	Valid	Fe	Valid	Sb	Partially Valid'
Al ₂ O ₃	Not Valid	Fe ₂ O ₃	Valid	Sb ₂ O ₃	Partially Valid'
As	Valid	Ga	Valid	Se	Valid
Au	Valid	In	Valid	Si	Not Valid
B	Valid	KCl	Pending	Sn	Partially Valid'
Ba	Pending	Mg	Valid	SnO	Pending
BaO	Pending	MgO	Valid	SnO ₂	Pending
BaO ₃	Pending	Mn	Valid	Sr	Valid
BaCl ₂	Valid	MnO	Valid	SrCrO ₄	Valid (by Cr)
BaSO ₄	Pending	Mo	Valid	Te	Valid
Be	Valid	NaCl	<u>P e n d i n g</u>	<u>T i</u>	<u>V a l i d</u>
Bi	Partially Valid'	Nd	Valid	TI	Valid
Ca	Valid	Ni	Valid	V	Valid
CaCO ₃	Valid	P	Valid	VA	Valid
CaO	Valid	Pb	Partially Valid'	Y	Valid
Cd	Valid	PbCrO ₄	Valid (by Cr)	Zn	Valid
Co	Valid	PbO	Valid	ZnO	Valid
Cr	Valid	Pd	Valid	Zr	Not Valid
Cu	Valid	Pt	Valid	ZrO ₂	Not Valid

Status definitions

Valid: The method is suitable for samples up to at least 0.0500 g bulk material with recoveries of between 90 and 110 percent. This weight exceeds most expected levels encountered in work environments.

Partially Valid: The method is suitable with bulk-material recoveries of between 90 and 110 percent under certain conditions (as footnoted above)

Not Valid: The method procedure is not suitable for samples at any weight with recoveries of between 90 and 110 percent. An alternative method should be used.

- 2 Valid up to 10,000 pg/sample and within 7 days of sample digestion.
- 3 Valid up to 50,000 pg/sample and at least 24 hours after sample digestion; Valid up to 15,000 pg/sample within 24 hours of sample digestion.
- 4 Valid up to 25,000 pg/sample and within 7 days of sample digestion.
- 5 Valid up to 25,000 pg/sample and within 7 days of sample digestion.
- 6 Valid up to 30,000 pg/sample and within 7 days of sample digestion.

NOTE: The upper limits of the method can be extended by serial dilution of the samples at the time of analyses

