7.0 SITE MONITORING

7.1 General

Site monitoring shall be performed as necessary for site remediation and clean construction work. This section covers general site monitoring for employee exposure to physical and chemical hazards including air contaminants (dust, metals, volatile organic compounds, and other specific compounds), heat stress, cold stress, and noise. Monitoring for potential CWM hazards will be performed in accordance with the project RCWM Safety Plan.

Minimum site monitoring requirements are determined by the PMC during the project design stage, and are specified in the design package Health and Safety Requirements section for implementation by the PMC Subcontractor. Site monitoring shall be performed by, or under the direction of, the assigned PMC Subcontractor HSS. The PMC may perform additional monitoring at field worksites if necessary. Collecting and submitting industrial hygiene samples to the RMA Environmental Analytical Laboratory shall be conducted in accordance with PMC Procedure HS-006-RMA (FWENC 2003d).

7.2 Required Site Monitoring

Site monitoring is required under the following conditions:

- When required by the subcontract or task-specific HASP
- When required by specific OSHA standards (e.g., 29 CFR 1910.120, hearing conservation, asbestos, benzene, cadmium, inorganic arsenic, lead, formaldehyde, vinyl chloride, etc.)
- When worker exposure is reasonably anticipated to be greater than 50 percent of the OSHA Permissible Exposure Limit (PEL), ACGIH TLV, or other recognized occupational exposure limit
- When necessary to verify the adequacy of hazard control measures and/or PPE, including respiratory protection
- When necessary to assess and evaluate worker exposure, or to resolve worker complaints or concerns

With the concurrence of the PMC Health and Safety Manager, site monitoring may be discontinued after representative initial monitoring is conducted and worker exposures are shown to be adequately controlled through the use of engineering, work practice, or PPE control measures. If work activities change so that the initial monitoring is no longer representative of worker exposure, monitoring must be reinitiated.

7.3 Monitoring Strategy

The anticipated site monitoring strategy for remedial implementation projects is shown in Figure 7-1. Where site monitoring is required, the PMC Subcontractor shall develop and implement a site monitoring program that considers the factors that may affect worker exposure and the following elements:

- Monitoring requirements, contaminants, and monitoring equipment limitations
- Subcontractor-specific work locations, work activities, work practices, personnel, and equipment to be used on-site
- Any additional site-specific hazard information gathered by the Subcontractor during development of the task-specific HASP
- Subcontractor health and safety program requirements for site monitoring

The monitoring strategy and approach shall be documented in the task-specific HASP. Documentation shall include a discussion of rationale used to determine the site monitoring requirements that sufficiently justifies the approach. Background information, such as exposure modeling calculations and previous (or similar) exposure monitoring data, shall be included as necessary. The approach shall include the type of monitoring (direct reading, personal, perimeter or area monitoring), activities or locations to be monitored, contaminants, monitoring instrumentation, monitoring methods, and frequency of monitoring as appropriate.

7.4 Typical Site Monitoring

7.4.1 Direct Reading Exposure Monitoring

Direct reading instruments for exposure monitoring are extremely useful on construction and hazardous waste sites. The primary advantages include ease of use, ability to monitor constantly changing conditions, and the rapid detection of flammable atmospheres, oxygen deficiency, certain gases and vapors, and physical hazards including noise and radiation.

The following are some of the instruments that may be used by the PMC or PMC Subcontractors for exposure monitoring at RMA:

- Photoionization detector
- Flame-ionization detector
- Combustible gas indicator
- Specific gas monitors (e.g., oxygen, carbon monoxide, hydrogen sulfide)
- Real-time aerosol monitor
- Radiation detection instruments
- Colorimetric indicating tubes (e.g., Draeger tubes)
- Mercury vapor analyzer
- Specialized air monitors
- Noise dosimeter
- Sound level meter (SLM)

Routine direct reading monitoring results (date/time, calibration information, results, and activities monitored) shall be recorded on the Daily Site Monitoring Report Form shown in Figure 7-2 or an equivalent form if approved by the PMC Health and Safety Manager. Monitoring results shall be recorded initially and periodically throughout the monitoring period (e.g., every 15 minutes, when results are above background levels, when site operations or locations change, or when unexpected site conditions arise). Direct reading instrumentation with datalogging and printing capabilities is preferred over manually recording monitoring results. When direct reading air monitoring results at the work location equal or exceed the action levels specified in the task-specific HASP for the project, the PMC Subcontractor shall conduct exclusion zone perimeter air monitoring. If the air concentrations at the perimeter of the exclusion zone equal or exceed the action level(s), the boundaries of the exclusion zone shall be expanded as necessary to maintain exclusion zone air contaminant concentrations below the action level(s). The Subcontractor shall notify the PMC Health and Safety representative and/or PMC Project Engineer who will then notify the Air Quality Group to determine whether additional perimeter air monitoring is necessary. Results of routine direct reading monitoring shall be summarized and documented on the Weekly Site Monitoring Summary Report shown in Figure 7-3. Weekly Site Monitoring Summary Reports shall be turned in to the assigned PMC Health and Safety Representative as part of the weekly health and safety report (Refer to Section 18).

7.4.2 Integrated Personal Air Monitoring

Integrated personal air monitoring refers to the continuous collection of a sample over a period of time for subsequent analysis, usually by a laboratory. This monitoring typically involves the use of portable sampling pumps and an appropriate collection media such as filters, impingers, or adsorption tubes. Integrated monitoring can also be performed using organic vapor monitors and other passive sampling devices.

Personal sampling and analysis will be performed in accordance with the OSHA Industrial Hygiene Technical Manual, the National Institute for Occupational Safety and Health (NIOSH) Manual of Analytical Methods, or other acceptable industrial hygiene practices. Only analytical laboratories accredited by the American Industrial Hygiene Association shall perform sample analysis. The laboratory analysis will include field blanks, as required by the individual method or laboratory. The laboratory shall also be a successful participant in the NIOSH Proficiency Analytical Testing program for the appropriate analytical category. Prior to sampling, the specific sampling and analytical method should be discussed with the receiving laboratory to determine any special requirements or variations to established methods necessary to collect an acceptable sample.

Sampling and analytical information for personal sampling shall be recorded on the Air Monitoring Data Sheet shown in Figure 7-4. Data sheets and the corresponding laboratory analytical reports shall be submitted to the PMC Health and Safety Representative as part of the weekly safety report (Section 18.1). To ensure timely reporting of analytical results, personal air sampling media shall be sent to the laboratory within 5 working days of the date collected, analyzed with normal laboratory turnaround time (10 to 14 calendar days), and the results reported to the PMC on the Air Monitoring Data Sheet within 5 working days after receiving them from the laboratory.

7.4.3 Noise Monitoring

Noise monitoring shall be conducted for operations that may exceed an 8-hour TWA sound level of 85 dBA (Refer also to Section 5.3.3). Noise monitoring shall be performed in accordance with 29 CFR 1910.95 using a SLM or noise dosimeter as appropriate. Results shall be documented as described in Section 7.4.1 and 7.6.6.

7.4.4 Heat Stress Monitoring

Heat stress monitoring shall be conducted as necessary to assist in determining initial work/rest regimens, and to verify that these regimens are adequate as the work progresses (refer also to Section 5.3.1). The following heat stress monitoring guidance should not be used as an absolute dividing line between safe and dangerous thermal stress levels. Professional judgment, use of competent persons, and overall heat stress management is required to ensure adequate protection for each situation. Heat stress monitoring shall be performed in accordance with guidance given in the latest edition of the ACGIH Thermal Stress Criteria. Two primary monitoring methods are used depending on the type of protective clothing worn; 1) WBGT monitoring (when wearing permeable protective clothing) and 2) personal physiological monitoring (when wearing impermeable protective clothing).

7.4.5 WBGT Monitoring

When wearing permeable protective clothing (street clothes, cotton coveralls, and winter work uniform), WBGT monitoring is performed. A WBGT monitor integrates the ambient temperature, wet bulb temperature, and the globe temperature into an index that is predictive of potential heat stress conditions. The measured WBGT index is then compared to the ACGIH Screening Criteria for Heat Stress Exposure as shown below. Note: Higher heat exposures are permissible if workers have been undergoing medical surveillance and it has been established that they are more tolerant to work in heat than the average worker. Workers should never be permitted to continue work when their body temperature exceeds 38°C (100.4°F).

TABLE 7-1. Screening Criteria for Heat Stress Exposure (Acclimatized Workers)

[values listed in chart below are given in ºC and (ºF) WBGT]

Work/Rest Regimen	Light Work Load	Moderate Work Load	Heavy Work Load	Very Hard Work Load
Continuous work	29.5 (85)	27.5 (82)	26.0 (79)	NA
75% Work -25% Rest, each hour	30.5 (87)	28.5 (83)	27.5 (82)	NA
50% Work -50% Rest, each hour	31.45 (89)	29.45 (85)	28.5 (83)	27.5 (82)
25% Work -75% Rest, each hour	32.5 (91)	31 (88)	30 (86)	29.5 (85)

The TLVs listed above are adjusted based upon wearing the following clothing and conditions:

Summer work uniform = 0° C
Cloth (woven material) overalls = -3.5° C
Winter work uniform = -4° C
Double-cloth overalls = -5 ° C

7.4.6 Personal Physiologic Monitoring

Personal physiologic monitoring (heart rate and body temperature, and fluid loss, if possible) of workers shall be used to assist in determining work-rest regimens whenever impermeable protective clothing is worn. Remember that disposable clothing, such as Saranex or Poly-Coat, and raingear may be considered air or water vapor impermeable. The WBGT index is not used to determine work/rest regimens for impermeable protective clothing because the index takes into account the effects of evaporative cooling. Impermeable protective clothing impedes evaporative cooling.

The most important environmental conditions related to heat stress for workers wearing impermeable protective clothing are the ambient temperature and radiant (solar) heat. These factors are combined into an index called the "adjusted temperature" using the formula shown below. In this formula, ambient temperature is measured with a dry bulb thermometer shielded from the sun, and the % sunshine is the percent time the sun is not covered by clouds that are thick enough to produce a shadow.

Adjusted Temperature (ºF) = ambient temperature (ºF) + (13 x % sunshine)
The adjusted temperature values are then used to determine the initial work/rest regimen and physiological monitoring frequency. Table 7-2 gives the physiological monitoring frequency. The length of the work cycle is governed by the frequency of the required physiological monitoring. Initially, after physiological monitoring, rest periods are at least 15 minutes.

Table 7-2. Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers

Adjusted Temperature (ºF)	Physiologic Monitoring Frequency
90 or above	15 minutes
87.5 - 90	30 minutes
82.5 - 87.5	60 minutes
77.5 - 82.5	90 minutes
70 - 77.5	120 minutes

A person competent to accurately measure pulse and body temperature shall perform physiological monitoring. Monitoring results shall be recorded on the Heat Stress Physiological Monitoring form shown in Figure 7-5 or an equivalent Subcontractor form approved by the PMC Health and Safety Manager. The form is organized so that an individual worker's measurements for a full work week can be recorded on one form. General guidelines for physiological monitoring are shown in Table 7-3.

Table 7-3. Physiological Measurements and Actions

Physiological Measurement	Actions
Heart Rate: Count the radial pulse during a 30-second period as early as possible in the rest period.	If the heart rate exceeds 110 beats per minute (bpm) at the beginning of the rest period, shorten the next work cycle by one third and keep the rest period the same. If the heart rate still exceeds 110 bpm at the next rest period, shorten the following work cycle by one third.
Body Temperature: Use a clinical thermometer (3 minutes under the tongue) or a tympanic (ear) thermometer at the end of the work cycle (before drinking).	If core body temperature exceeds 101.3ºF for medically selected and acclimatized personnel or 100.4ºF in unselected, unacclimatized workers, shorten the next work cycle by one third without changing the rest period. If the temperature still exceeds 101.3ºF for acclimatized workers or 100.4 ºF for unacclimatized workers at the beginning of the next rest period, shorten the following work cycle by one third.
Fluid Loss, if possible: Measure weight on a scale accurate to 0.25 lb. at the beginning and end of each workday. Worker should wear similar weight (dry) clothing at each weighing.	The body fluid loss should not exceed 1.5 percent of the total body weight in one workday. If so, not enough fluids are being taken to prevent dehydration.

7.5 Other Site Monitoring

Other site monitoring may be necessary depending on the job task or site location of the work. The organization performing work under the PMC is responsible for identifying and implementing any additional site monitoring necessary to adequately assess and control worker exposure.

7.6 Data Quality Assurance

7.6.1 Training

Persons conducting site monitoring shall have adequate training and/or experience commensurate with the type and complexity of the monitoring program. They should be able to understand the limitations of the equipment they use, proper methods of calibration, proper methods of sealing and shipping samples and the importance of chain of custody.

7.6.2 Calibration

All instruments shall be calibrated (or checked for proper function if appropriate) before use for each shift. Instrument calibration shall be documented on sample data sheets or in logbooks. Calibration checks may be necessary during the day and at the end of use to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response. Air sampling pumps will be calibrated with primary standards (e.g., dry calibrator or bubble-tube method). Refer to FWENC procedure SCI-003 Equipment Calibration and Maintenance Requirements (FWENC 2003c) for additional information.

7.6.3 Operation and Maintenance

All instruments shall be operated and maintained in accordance with the manufacturer's specifications. The manufacturer's operation and maintenance manual will be kept at the site work location for each type of instrument that is being used.

The PMC Health and Safety department maintains the following written guidelines for operation and maintenance of monitoring equipment. These guidelines or similar PMC Subcontractor guidelines should be followed, to the extent feasible, when operating monitoring equipment.

HSG1-1	Air sampling pumps
HSG1-2	Detector tubes
HSG1-3	HNU
HSG1-4	Miniram Dust Monitor

HSG1-6	Organic Vapor Monitors
HSG1-7	Organic Vapor Analyzer
HSG1-8	Photovac Micro Tip
HSG1-11	Combustible Gas Indicator
HSG1-12	Oxygen Indicator

7.6.4 Sample Shipment

Samples sent to a laboratory for analysis shall be packaged to prevent damage, spillage, or leaks. An air or bulk sample data sheet with chain-of-custody information must accompany any sample shipped.

Filter Cassettes – Filter cassettes should be mailed in a cardboard box and packed with paper. Do not use packaging peanuts or other static producing material because the static charge will draw material away and off the filter surface. This is especially true for asbestos fiber samples. Filter cassettes shall be taped over the top and bottom to keep the plugs on the end of the cassette and to prevent sample tampering prior to analysis.

Charcoal Tubes – Charcoal tubes should be mailed in a cardboard box and adequately packaged to prevent breakage during shipment. Charcoal tubes must never be shipped in the same package as bulk samples.

Bulk Samples – Bulk samples shall be packaged in labeled containers compatible with the sample and tightly sealed to prevent leaks and spills. Remember that some bulk samples may be considered hazardous materials by the Department of Transportation and have special requirements for packaging, labeling, and method of shipment. Bulk samples must never be shipped in the same package as charcoal tubes.

7.6.5 Data Review

The designated HSS or other qualified person will assess and interpret monitoring data and results based on standard industry practices and his/her professional judgment. All calculations performed on raw data (e.g., TWA calculations) shall be documented and reviewed by another qualified person. Commonly used air monitoring calculations are shown in Figure 7-4.

7.6.6 Recordkeeping and Posting

The PMC or PMC Subcontractor performing work is responsible for maintaining adequate records of site monitoring activities, communicating or posting exposure information, and informing employees of monitoring results as may be required. All integrated personal air sampling results shall be communicated in writing to affected employees within 5 days of receiving laboratory results. All exposure monitoring and sampling results shall be maintained at the site and made available for inspection and review by the PMC or RVO. Copies of records shall be submitted to the PMC in accordance with Section 18, Records and Reports. All employee exposure records are to be kept by the employer and made available in accordance with 29 CFR 1910.1020.

7.7 Additional Site Monitoring Considerations

7.7.1 Monitoring Frequency

Monitoring or sampling frequency will be influenced by a number of factors including the following:

- Frequency of contaminant release (i.e., continuously, intermittently, one-time release)
- Frequency of operation
- Number of samples required
- Number of different work groups requiring assessment
- Number of work shifts requiring monitoring

Each of these factors should be considered to determine the monitoring frequency.

7.7.2 Monitoring Duration

When monitoring a worker's exposure for comparison to a published exposure limit value such as the OSHA Permissible Exposure Limits (PELs) or ACGIH TLVs, monitoring may need to be conducted over a full eight-hour (or longer) work shift or a 10- to 15-minute period of time. In some cases, monitoring may need to be continuous if there is the potential for buildup of a dangerous atmosphere. Monitoring duration can also be affected by the duration of the operation being monitored (i.e., it may only operate one hour a day) or by the length of time a worker performs an operation. Duration can also be affected by the contaminant concentration in air. Oftentimes, higher concentrations of air contaminants will require the collection of shorter-term samples to avoid overloading the sample collection device..

7.7.3 Monitoring Location

The monitoring location will be influenced by the purpose for monitoring. When monitoring for compliance with employee exposure limit values such as PELs or TLVs, monitoring close to the person's breathing zone will normally be required. On the other hand, ambient or area monitoring is often used to determine air concentrations in a general area that may then be used to estimate worker exposures when they are working in the area.

The location of monitoring will also be influenced by where the contaminant or hazard source originates and/or the dispersion pattern, which may be influenced by atmospheric conditions.

7.7.4 Number of Samples

The number of samples that need to be collected and analyzed will be influenced by the purpose for the monitoring and the degree of confidence necessary. If the purpose of the monitoring is to collect subjective data to determine the magnitude of the airborne contamination, then only a few samples will be necessary. However, if the purpose is to determine and document compliance with a regulation, then a "statistically" significant number of samples will be necessary. In this case it may be necessary to consult with a statistician who can help develop a monitoring strategy to achieve sufficient statistical power. In many cases, three or more samples may be necessary to draw any preliminary conclusions.

When integrated personal sampling and analysis is required by the Subcontractor Health and Safety Requirements of the subcontract, unless otherwise specified, at least three full-shift samples representative of worst-case exposure conditions are required. Alternate sampling plans will be considered if proposed in the task-specific HASP and approved by the PMC Project Health and Safety Manager.

7.7.5 Observation of Monitoring

Observation of monitoring refers to two different aspects. First, all air monitoring needs to be checked throughout the day by the person performing the monitoring. All air-monitoring devices are subject to breakdown and tampering and thus they need to be checked periodically. Never set up a device and leave it unattended until the end of the monitoring period. If the monitoring period is only 10 to 30 minutes long, then it should be observed the entire time.

The other aspect to observation of monitoring is the right of employees or their representative to observe the monitoring. Employees have a right to observe monitoring (that affects them) and this right should be explained to them. Bargaining unit employees have a right to request that a union representative observe the monitoring.

7.8 Related Site Monitoring

Related site monitoring plans implemented at RMA include the Site-Wide Air Quality Monitoring Program Plan (FWENC 1999a) (covers site-wide air quality monitoring stations) and the Site-Wide Odor Monitoring Plan (FWENC 1999b) (covers site-wide odor monitoring and odor control efforts).

Figure 7-1. Anticipated Site Monitoring Requirements for Remedial Implementation Projects

Implementation Project	Direct Reading Exposure Monitoring (see notes)	Integrated Personal Monitoring
RCRA Cover	Temperature extremes	Respirable particulates not otherwise classified (PNOC) Silica (respirable)
Slurry Walls	Organic vapors Noise Temperature extremes	Dependent on direct reading exposure monitoring results
Hazardous Waste Landfill Construction	Total dust Noise Temperature extremes	Respirable PNOC Silica (respirable) Radiological (for users of nuclear density gauges)
Old Toxic Storage Yard	Total dust Noise Temperature extremes	Respirable PNOC Silica (respirable) Metals (arsenic, chromium)
Burial Trenches/Munitions Testing	Total dust Noise Temperature extremes	Respirable PNOC Silica (respirable) Metals (arsenic, chromium)
Sanitary Landfills	Organic vapors Hydrogen sulfide Total dust Noise Temperature extremes	Asbestos (during asbestos removal and packaging operations) Respirable PNOC Silica (respirable)
South Plants	Organic vapors Mercury Total dust Noise Temperature extremes	Pesticides (aldrin, dieldrin, endrin, isodrin, chlordane) Dicyclopentadiene (DCPD) Dibromochloropropane (DBCP) Hexachlorocyclopentadiene (HCCPD) Metals (arsenic, cadmium, chromium, lead) Asbestos (building demolition) Respirable PNOC Silica (respirable)
Basin A Construction	Total dust Noise	Respirable PNOC Silica (respirable)
Basin A Operations	Organic vapors (as necessary depending on materials received) Total dust Noise Temperature extremes	Respirable PNOC Silica (respirable)

Implementation Project	**Direct Reading Exposure Monitoring (see notes)**	**Integrated Personal Monitoring**
Hazardous Waste Landfill Operations	Organic vapors (as necessary depending on materials received) Total dust Noise Temperature extremes	Respirable PNOC Silica (respirable) Asbestos PCBs DBCP Pesticides (as necessary depending on materials received) Metals (as necessary depending on the materials received) Organic vapors (as necessary depending on materials received)
Haul Roads Construction	Total dust Noise Temperature extremes	Respirable PNOC Silica (respirable)
Haul Roads Operations	Total dust Noise Temperature extremes	Respirable PNOC Silica (respirable)
Basin F Treatability Studies	Organic vapors Mercury Total dust Noise Temperature extremes Ammonia	Pesticides (aldrin, dieldrin, endrin)
Hex Pit and Treatability Studies	Organic vapors Total dust Noise Temperature extremes	Pesticides (aldrin, dieldrin, endrin, isodrin) HCCPD
M-1 Pits and Treatability Studies	Organic vapors Mercury Total dust Noise Temperature extremes	Metals (arsenic, cadmium)
Revegetation	Total dust Noise Temperature extremes	Respirable PNOC Silica (respirable)
Lake Sediments, Miscellaneous Northern and Southern Tier Soils	Total dust Noise Temperature extremes	Pesticides (aldrin, dieldrin, isodrin) Metals (arsenic, chromium, lead) Asbestos (building demolition) Respirable PNOC Silica (respirable)

Implementation Project	Direct Reading Exposure Monitoring (see notes)	Integrated Personal Monitoring
Misc. Structures	Total dust Noise Temperature extremes	Respirable PNOC Silica (respirable) Asbestos, lead, and other building specific contaminants as necessary
North Plants	Total dust Noise Temperature extremes	Metals (arsenic, cadmium, chromium, lead) Asbestos (building demolition) Respirable PNOC Silica (respirable)
Lime Basins	Total dust Noise Temperature extremes	Pesticides (aldrin, dieldrin, endrin) Metals (arsenic) Mercury
Secondary Basins	Total dust Noise Temperature extremes	Pesticides (aldrin, dieldrin, endrin, isodrin) Metals (arsenic, chromium, lead) Respirable PNOC
Former Basin F	Total dust Noise Temperature extremes Organic Vapors Ammonia	Pesticides (aldrin, dieldrin, endrin, isodrin) Ammonia Chloroacetic acid Dicyclopentadiene Respirable PNOC Silica (respirable)
Basin F Exterior	Total dust Noise Temperature extremes	Pesticides (aldrin, dieldrin, endrin, isodrin) Metals (arsenic, chromium, lead) Respirable PNOC Silica (respirable)
Section 35 Soils	Total dust Noise Temperature extremes	Pesticides (aldrin, dieldrin, endrin, isodrin) Metals (arsenic, chromium, lead) Respirable PNOC Silica (respirable)
Enhanced Hazardous Waste Landfill (ELF) Construction	Total dust Noise Temperature extremes	Respirable NOC Silica (respirable) Radiological (for users of nuclear density gauges)

Implementation Project	Direct Reading Exposure Monitoring (see notes)	Integrated Personal Monitoring
ELF Operations	Organic vapors (as necessary depending on materials received) Total dust Noise Temperature extremes	Respirable PNOC Silica (respirable) DBCP Pesticides (as necessary depending on materials received) Metals (as necessary depending on the materials received) Organic vapors (as necessary depending on materials received)
Section 36 Balance of Areas	Total dust Noise Temperature extremes	Pesticides (aldrin, dieldrin, endrin, isodrin) Metals (arsenic, chromium, lead, mercury) Respirable PNOC Silica (respirable)

Notes

- Organic vapor monitoring will be conducted using a direct reading monitor equipped with a photoionization detector or flame ionization detector. Monitoring will be conducted for operations where unknown drums or containers could be encountered, or where soils potentially contaminated with significant levels of organics are handled.
- Total dust sampling will be conducted using a Miniram or equivalent. Monitoring will be conducted for operations that could produce elevated total dust or airborne silica concentrations.
- Noise monitoring shall be conducted in accordance with Section 7.4.3.
- Heat stress monitoring shall be conducted in accordance with Section 7.4.4.
- Respirable PNOC sampling and analysis shall be conducted according to NIOSH method 0600 or equivalent.
- Silica (respirable) sampling and analysis shall be conducted according to NIOSH method 7500 or equivalent.

Figure 7-2. Daily Site Monitoring Report Form

TETRA TECH FW, INC.	PROGRAM MANAGEMENT CONTRACTOR **ROCKY MOUNTAIN ARSENAL**	**DAILY SITE MONITORING REPORT** **Page 1 of ___**
Implementation Project:		Date:
Task Name:		Subcontractor(s):
Description of Activities:		Description of Potential Contaminant(s) and Source:

Monitoring Instrumentation

Instrumentation Description: Instrument ID Number:	Calibration Method & Equipment: Time & Date Calibrated: Calibration Results:

Site Monitoring Results

Time(s)	Monitoring Location (note distance from source, upwind/downwind, etc.)	Sample Type (source, breathing zone, area, etc.)	Instrument Reading (Units)	Comments

Review

Sampler:	Signature:	Date:
PMC Reviewer:	Signature:	Date:

TETRA TECH FW, INC.

PROGRAM MANAGEMENT CONTRACTOR
ROCKY MOUNTAIN ARSENAL

DAILY SITE MONITORING REPORT
(Continuation Page) Page ___ of ___

Site Monitoring Results

Time(s)	Monitoring Location (note distance from source, upwind/downwind, etc.)	Sample Type (source, breathing zone, area, etc.)	Instrument Reading (Units)	Comments

Review

Sampler:	Signature:	Date:
PMC Reviewer:	Signature:	Date:

Figure 7-3. Weekly Site Monitoring Summary Report

TETRA TECH FW, INC.	PROGRAM MANAGEMENT CONTRACTOR ROCKY MOUNTAIN ARSENAL	WEEKLY SITE MONITORING SUMMARY REPORT	
Implementation Project:	Task Name and Location:	Subcontractor(s):	Week of:

Sampling/ Monitoring Parameter(s)	Type of Sampling	Date(s)	Description of Work Activities and Locations	Summary of Results

Review

Subcontractor H&S Supervisor:	Signature:	Date:
PMC Reviewer:	Signature:	Date:

PROGRAM MANAGEMENT CONTRACTOR ROCKY MOUNTAIN ARSENAL			**WEEKLY SITE MONITORING SUMMARY REPORT**
Implementation Project:	Task Name and Location:	Subcontractor(s):	Week of:

Sampling/ Monitoring Parameter(s)	Date(s)	Type of Sampling	Description of Work Activities and Locations	Summary of Results
Total dust	11/15/99	RT/A	Demolition of Bldg. 384 and cleanup activities	ND to 0.020 mg/M^3 Results are below established action levels.
Pesticides (aldrin, dieldrin, endrin) One sample	11/16/99	I/BZ	Excavation of CSA 1b HHE soils using excavator. Operation lasted six hours.	Pesticides (aldrin, dieldrin, endrin) – ND (excavator operator sampled)
Lead One sample	11/19/99	I/BZ	Torch cutting on steel tank in laydown area. Operation lasted two hours.	Torch cutter 8-hour TWA for lead was 0.01 mg/m^3
Total Dust Three samples	11/19/99	I/BZ	General laborer activities including sweeping and removal of stormwater controls outside Buildings 535 and 537. Activities performed for 6 hours.	Three samples – 0.01 to 3 mg/m^3 8-hour TWA. High sample (3 mg/m^3) occurred on laborer lifting hay bales used for stormwater control..

Review

Subcontractor H&S Supervisor:	Signature:	Date:
PMC Reviewer:	Signature:	Date:

Legend: RT = Real Time A = Area I = Integrated BZ = Breathing Zone

Instructions:

The purpose is to compile a summary of real-time and integrated air monitoring for the week completed at the project.

Column 1 – List the type of real-time and integrated air monitoring conducted for the week, include the number of monitoring days or events or number of integrated air samplings

Column 2 – List the dates that real-time and integrated air monitoring was conducted.

Column 3 – Using the abbreviations in the legend, describe what type of air monitoring was conducted.

Column 4 – Describe the type of work that was conducted, duration, and where it was conducted.

Column 5 – List the summary of results; include the range (low to high), average of the real-time, time-weighted average (TWA) for integrated sampling, and number of results over established action levels for real-time monitoring and established PELs or TLVs for integrated monitoring. Provide comments for any unusual results

Figure 7-4. Air Monitoring Data Sheet

TETRA TECH FW, INC.	**PROGRAM MANAGEMENT CONTRACTOR** ROCKY MOUNTAIN ARSENAL	**AIR MONITORING DATA SHEET (Personal Sampling) Page 1 of 2**

Employee		Date	
SSN	PMC Dbase #	Project	
Company		Task	
Job Title		Site	

Sample No.							Blank
Pump No.							
Media							
Time On							
Time Off							
Total Time							
Flow Rate							
Volume							
STP Volume (Used for gas or vapor samples)							

Laboratory Analysis	Laboratory Used:			Report Nos. (attach copies)			
Contaminant	Results	Results	Results	Results	Results	Results	Results

Description of Job Duties and Activities Conducted:

Continue on separate sheet if necessary

Control Measures:

Continue on separate sheet if necessary

PPE Utilized:

Continue on separate sheet if necessary

Calibration Data

Pre-Calibration					Post-Calibration				
Pump No.	1st	2nd	3rd	Average	Pump No.	1st	2nd	3rd	Average

Chain of Custody

Relinquished by	Received by	Date & Time
Relinquished by	Received by	Date & Time
Relinquished by	Received by	Date & Time
Relinquished by	Received by	Date & Time

Additional Information (Diagrams, calculations, other employees represented by the sample)

Sampler*****:	Signature:	Date:
PMC Reviewer:	Signature:	Date:

**Form and calculations completed by sampler unless otherwise indicated.*

Figure 7-5. Heat Stress Physiological Monitoring Form

TETRA TECH FW, INC.	ROCKY MOUNTAIN ARSENAL PROGRAM MANAGEMENT CONTRACTOR	**PERSONAL PHYSIOLOGICAL MONITORING DATA SHEET**
Project		Company

1. Take and record measurement of temperature and pulse at the following times:
   a. before beginning shift
   b. at each break
   c. at the end of the day
2. Shorten the work cycle if measurements exceed:
   Pulse – 110 beats per minute
   Temperature – 99.6° F
3. Never continue work if your body temperature is more than 100.4° F, or if you are experiencing sudden and severe fatigue, nausea, dizziness, or lightheadedness.

Employee: ____________ Body Weight: prework ____________
Date: ____________ postwork ____________

Time							
Temp							
Pulse							

Employee: ____________ Body Weight: prework ____________
Date: ____________ postwork ____________

Time							
Temp							
Pulse							

Employee: ____________ Body Weight: prework ____________
Date: ____________ postwork ____________

Time							
Temp							
Pulse							

Employee: ____________ Body Weight: prework ____________
Date: ____________ postwork ____________

Time							
Temp							
Pulse							

Employee: ____________ Body Weight: prework ____________
Date: ____________ postwork ____________

Time							
Temp							
Pulse							

Figure 7-6 Air Monitoring Calculations

TETRA TECH FW,INC	**Program Management Contractor** **Rocky Mountain Arsenal**	**AIR MONITORING CALCULATIONS**

1. DUST/CHEMICAL OF CONCERN (COC) SAMPLING CALCULATIONS

a. Calculating Sample Air Volume in m^3 = sample time in minutes x sampler flow rate in lpm, divided by 1,000 liters/m^3.

Example: $\text{Air Volume} = \dfrac{600 \text{ minutes} \times 1.7 \text{ lpm}}{1000 \text{ l/m}^3} = 1.02 \text{ m}^3$

b. Calculating % COC = COC filter weight from lab divided by dust filter weight from lab x 100.

Example: $\% \text{ COC} = \dfrac{.0142 \text{ mg COC}}{.056 \text{ mg Dust}} \times 100 = 25.4\% \text{ COC}$

c. Calculating dust concentration in mg/m^3 = Dust filter weight from lab in mg divided by the sample air volume in m^3.

Example: $\text{Dust Concentration} = \dfrac{.056 \text{ mg Dust}}{1.02 \text{ m}^3} = .055 \text{ mg/m}^3$

d. Calculating COC Concentration = COC filter weight from lab in mg divided by the sample air volume in m^3.

Example: $\text{COC Concentration} = \dfrac{.014 \text{ mg COC}}{1.02 \text{ m}^3 \text{ Air Volume}} = 0.014 \text{ mg/m}^3$

e. Calculating Shift Time Weighted Average (TWA) = Concentration for Dust or COC x exposure time in hours, divided by 8 hours.

Example #1:

$\text{Shift TWA} = .025 \text{ mg/m}^3 \text{ Dust Conc.} \times \dfrac{6 \text{ Hours Exposure}}{8 \text{ hours}} = .0188 \text{ mg/m}^3 \text{ Dust}$

Example #2:

$\text{Shift TWA} = .055 \text{ mg/m}^3 \text{ Dust Conc.} \times \dfrac{10 \text{ Hours Exposure}}{8 \text{ hours}} = .069 \text{ mg/m}^3$

f. Calculating Percent PEL for Dust or COC = Dust or COC Shift TWA Concentration in mg/m^3 divided by the PEL x 100.

Calculate the silica PEL using the OSHA PEL Equation:

$$\text{PEL} = \frac{10}{\%\text{Quartz} + 2(\%\text{Cristobalite}) + 2(\%\text{Tridymite}) + 2}$$

Figure 7-6: Air Monitoring Calculations (continued)

This PEL equation incorporates the respirable fraction of the dust sample as well as the types of silica that may be found in the respirable dust sample.

Example:

Total respirable Shift-TWA = .069 mg/m^3
Total respirable dust Conc. = .055 mg/m^3
Silica - Quartz Conc. = .014 mg/m^3 — % Silica - Quartz = 25.45%
Cristobalite Conc. = .008 mg/m^3 — % Cristobalite = 14.55%
Tridymite Conc. = 0.0 mg/m^3 — % Tridymite = 0.0%

$$\text{PEL} = \frac{10}{25.45 + 2(14.55) + 2(0) + 2} = .177\ mg/m^3$$

$$\%\ \text{PEL for silica} = \frac{\text{Shift-TWA}}{\text{PEL}} \times 100 = \frac{.069\ mg/m^3\ \text{TWA}}{.177\ mg/m^3\ \text{PEL}} \times 100 = 39.0\%\ \text{PEL}$$

Since the %PEL equals .390 or 39.0%, which is less than 1 or 100%, then compliance is maintained.
If the formula calculates to > 1 or 100% then there is a possible overexposure. If the value is $\leq$ 1 or 100% then there is compliance.

2. GAS/VAPOR/MIST/FUME CONCENTRATION CALCULATIONS

a. Calculating Sample Air Volume in m^3 (see Dust Sampling Calculations)

b. Calculating Concentration = Sample results from lab in mg divided by the Sample Air Volume in m^3. Be sure to correct the air volume to STP if sampling for gases or vapors, see 2e.

Example:

$$\text{Vapor Conc.} = \frac{200\ mg}{.665\ m^3} = 300.8\ mg/m^3$$

c. Calculating Shift TWA =

$$\text{Sample Conc. in ppm or } mg/m^3 \times \frac{\text{Exposure Time in Hours}}{\text{8 Hours}}$$

d. Calculating % PEL or TLV = $\dfrac{\text{shift TWA}}{\text{PEL / TLV}} \times 100$

Figure 7-6: Air Monitoring Calculations (continued)

e. Standard temperature, pressure correction for gases and vapors:
Where:

$$V_s = V \times \frac{T_{STP}\, P_a}{T_a\, P_{STP}}$$

V_S	=	Air volume at STP
V	=	Air volume sampled
P_a	=	barometric pressure in mm Hg.
P_{STP}	=	760 mm Hg
T_a	=	Temperature of sample air in Kelvin, ? C + 273
T_{STP}	=	298 K
STP	=	Standard temperature and pressure

3. ASBESTOS FIBER CONCENTRATION CALCULATION

a. Asbestos Fibers per cubic centimeter of air

$$f/cc = \frac{(\text{Fiber/Fields})\ (385\ mm^2/\text{Filter})}{(7854\ um^2/\text{Field})\ (\text{Liters of Air})} \times 1000$$

4. CONVERSION CALCULATIONS

a. Converting ppm to mg/m^3

$$\text{Example: } ppm = \frac{mg/m^3 \times (24.45)}{MW}$$

(MW = molecular weight of the air contaminant)

b. Converting mg/m^3 to ppm

$$\text{Example: } mg/m^3 = \frac{ppm \times (MW)}{24.45}$$

(MW = molecular weight of the air contaminant)

c. Measurement conversions for common units

1 milliliter of air (ml) = 1 cubic centimeter of air (cc)
1000 ml = 1 liter
1000 l = 1 cubic meter (m^3)
1000 milligrams (mg) = 1 gram (g)
1 mg/l = 1 ppm
10,000 ppm = 1.0%