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WORKPLAN
FOR
VARIOUS FIELDWORK EFFORTS
INSTALLATION RESTORATION PROGRAM SITES 10 AND 11
NAVAL AIR STATION JOINT RESERVE BASE
WILLOW GROVE, PENNSYLVANIA

Contract No. N2472-92-1296
Contract Task Order No. 0074

Prepared for:

Department of the Navy
Northern Division
Naval Facilities Engineering Command
10 Industrial Highway
Mail Stop No. 82
Lester, Pennsylvania 19113-2090

Prepared by:

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March 2003
FINAL
EA Project No. 2960074.5200

Sampling and Analysis Plan
Installation Restoration Program Sites 10 and 11
Naval Air Station Joint Reserve Base
Willow Grove, Pennsylvania

Contract No. N62472-92-D-1296
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LIST OF ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
COD	Chemical Oxygen Demand
COPC	Constituent(s) of Potential Concern
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
DOT	Department of Transportation
EM	Electromagnetic
EPA	Environmental Protection Agency
ft	Foot/Feet
gal	Gallon(s)
hr	Hour(s)
ID	Inside Diameter
in.	Inch(es)
IDW	Investigation Derived Waste
IR	Installation Restoration
L	Liter(s)
LNAPL	Light Non-Aqueous Phase Liquid
min	Minute(s)
mL	Milliliter(s)
mph	Miles Per Hour
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSL	Mean Sea Level
MW	monitoring well
NASJRB	Naval Air Station Joint Reserve Base
OD	Outside Diameter
ORP	Oxidation/Reduction Potential

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

PADEP	Pennsylvania Department of Environmental Protection
PAH	Polycyclic Aromatic Hydrocarbons
PID	Photo Ionization Detector
ppb	Parts Per Billion
PPE	Personal Protective Equipment
ppm	Parts Per Million
psi	Pounds Per Square Inch
PVC	Polyvinyl chloride
RBC	Risk-Based Concentration
RME	Reasonable Maximum Exposure
SCS	Soil Conservation Service
SHERP	Safety, Health, and Emergency Response Plan
SVOC	Semivolatile Organic Compound(s)
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
µg	Microgram(s)
USEPA	United States Environmental Protection Agency
USGA	United States Geological Survey
UST	Underground Storage Tank
VOA	Volatile Organic Analyte
VOC	Volatile Organic Compound(s)

1. PROJECT DESCRIPTION

This Work Plan has been prepared by EA Engineering, Science, and Technology, Inc. (EA) under Contract No. N62472-92-D-1296, as authorized by Engineering Field Activity Northeast, EFA Northeast, Naval Facilities Engineering Command.

EA has been tasked with the investigation of Installation Restoration (IR) Program Sites 10 and 11 at the Naval Air Station Joint Reserve Base (NASJRB), Willow Grove, Pennsylvania. IR Site 10 consists of a former fuel farm where Light Non-Aqueous Phase Liquid (LNAPL) had been detected in the past. EA installed a LNAPL Recovery system in 1998, which, due to a variety of mechanical failures, is no longer operational. Subsequent to recent communications with the Pennsylvania Department of Environmental Protection (PADEP) it was agreed that site contamination may have decreased to a low enough level to warrant a possible path to site closure. However, PADEP requested that additional soil and ground-water samples be collected and evaluated to determine if the site can be closed out.

IR Site 11 consists of a former construction area along the Navy's Aircraft Parking Area. During past construction activities, petroleum contaminated soil was detected and removed. However, no confirmation sampling was undertaken and EA has been tasked to collect both soil and ground-water samples to determine if an unacceptable environmental impact exists.

NASJRB's mission is to provide support for operations involving aviation. Therefore, please note that it is necessary to call 215-443-6220 prior to each field day at NASJRB Willow Grove to make sure access to the site is open. If NASJRB is in a Charlie or Delta Threat Condition, access to NASJRB may be denied. In addition, access may be withdrawn during the day.

1.1 OBJECTIVE

As described in this Work Plan, EA will conduct one round of ground-water sampling at IR Site 10. The objective of this investigation is to collect sufficient analytical data to determine the next steps in closing IR Site 10 ground water under Act II of PADEP's Land Recycling Program. Once the results are received, a "Petition to Reduce the Number of Sampling Events to Demonstrate Attainment" will be completed and submitted to PADEP for review and comment. This process will be used to determine potential reductions to the number of required sampling rounds and/or locations. The petition report will include historic data as well as the current sample results screened against the appropriate Statewide Health Standard as discussed in Section 4 of this document. Please note that for demonstration of attainment of the Statewide Health Standard in ground water, a minimum of eight consecutive quarterly sampling events is suggested by PADEP. However, based on site conditions, only four rounds of sampling that demonstrate statistical independence is estimated to be needed by PADEP in order to achieve closure since this allows for an evaluation of seasonal variation of dissolved-phase constituents in ground water. These site conditions in which PADEP accepts 4 rounds of sampling are detailed in 25 Pa. Code Section 250.704(d)(1)-(4). Please note that for site characterization PADEP requires a minimum of two independent rounds of ground-water sampling. The two

characterization sampling events may be applied toward the attainment demonstration. In the case of Site 10 the historic data may be sufficient to allow site characterization based on the one additional sampling round.

In addition, EA will collect one round of ground-water sampling at IR Site 11. The objective of the investigation at IR Site 11 is to determine if residual contamination exists and if so, whether it is impacting the environment. Once the results are received, a "Petition to Reduce the Number of Sampling Events to Demonstrate Attainment" will be completed and submitted to PADEP for review and comment. This report will be used to determine what, if any, additional sampling will be required. The petition report will include the sample results screened against the Statewide Health Standard as discussed in Section 4 of this document.

An additional objective of the investigation described in this Work Plan is to collect sufficient analytical data to determine, if IR Site 10 and IR Site 11 can be closed out for soil medium under Act II of PADEP's Land Recycling Program. A PADEP Act II "Final Report" for each IR Site 10 and one for IR Site 11 will be submitted for soil assuming the soil analytical results will be below the calculated Medium Specific Calculations (MSCs) of the Statewide Health Standards.

The appropriate method for seeking closure for releases occurring prior to 5 August 1989 is under 25 Pa. Code Chapter 250 and Act 2. Both the administrative and technical requirements under 25 Pa. Code Chapter 250 and Act 2 must be satisfied to receive liability protection and site closure. In addition, the point of compliance for attainment of ground-water standards in 25 Pa. Code Chapter 250 is the property boundary at the time the release was discovered.

1.2 SCOPE

The investigation will include the installation of seven monitoring wells, five intermediate, and two shallow. Three of the intermediate wells will be completed to a depth of 120 feet below the ground surface (bgs), two intermediate wells will be completed to a depth of 70 feet bgs and the shallow wells will be completed to a depth of 40 feet bgs. Four intermediate wells and one shallow well will be installed in the IR Site 10 area and the remaining intermediate and shallow wells will be installed in the IR Site 11 area. Soil samples will be collected during well installations. Ground-water samples from the newly installed wells will be collected after the installation of wells. In addition, ground-water samples will be collected from nineteen existing wells at IR Site 10.

Analytical data from soil samples collected during past construction activities at IR Site 11 showed petroleum contamination. As a result the site soil was excavated and removed. However, no confirmation soil samples were ever collected. Therefore, soil samples will be collected at IR Site 11 via Geoprobe ®.

1.3 ORGANIZATION OF THE WORK PLAN

This Work Plan is divided into separate discussions of the basis for investigation, objective, and scope (Chapter 1); site description and background (Chapter 2); sampling procedures,

decontamination procedures, investigation derived waste procedures, and analytical methodology (Chapter 3); data interpretation (Chapter 4); project management roles and responsibilities and schedule (Chapter 5). A site-specific Safety, Health, and Emergency Response Plan (SHERP) is included in Appendix A. The Quality Assurance Project Plan (QAPP) for Installation Restoration Program Sites 10 and 11 NASJRB, Willow Grove, Pennsylvania is provided under separate cover.

2. SITE DESCRIPTION AND BACKGROUND

2.1 ACTIVITY DESCRIPTION

The NASJRB, Willow Grove, Pennsylvania (PA) is located in Horsham Township, Montgomery County in southeastern Pennsylvania, approximately 15 miles northwest of Philadelphia, PA (Figure 2-1). NASJRB occupies approximately 1,000 acres and can be characterized as slightly rolling terrain. NASJRB is bordered on the east boundary by PA Route 611, on the southwest by PA Route 463 and on the north by Keith Valley Road.

NASJRB's mission is to provide support for operations involving aviation and to train Navy reservists. Other tenants which utilize the installation include the U.S. Marines, the U. S. Air Force and the U. S. Army. The installation provides facilities, services, materials, and training to directly support assigned military units. Units include an antisubmarine warfare squadron, a helicopter squadron, a fleet logistics squadron and other Marine and Navy units.

IR Site 10 consist of the former Navy Fuel Farm which contained both above and underground storage tanks (Figure 2-2). Since 1950 this site has contained storage tanks that at times have experienced spills and some tanks have leaked. During construction and investigations at the site, LNAPL was discovered, and in 1998 EA installed an LNAPL recovery system. The system has not been operational since 21 September 2001. EA continued to check the recovery wells and monitoring wells for LNAPL using a hand bailer (for visual check) and an Oil/Water Interface probe. From December 2001 to July 2002 LNAPL was not detected either in the bailer or with the Oil/Water Interface probe during these events. Petroleum odors were occasionally noted. In August, 2002 the Oil/Water Interface probe indicated the presence of LNAPL in RW-2R but the thickness was too small to measure. At RW-16 the probe showed LNAPL thickness of 0.10 foot. No data have been collected since August 2002.

IR Site 11 is adjacent to the Navy's Aircraft Apron and south of the U. S. Air Force Area, where petroleum contaminated soil were detected during a construction project in the early 1990's (Figure 2-3). Although soil samples were analyzed and the soil was excavated, confirmation sampling was not conducted.

2.2 PHYSICAL FEATURES

2.2.1 Climate

The prevailing wind direction at the NASJRB is southwesterly in the summer and northwesterly in the winter. The mean annual wind speed and direction are from the northwest at approximately 9 miles per hour. Minimum daily temperatures range from 24° F in February to 86° F in July.

The average annual precipitation is approximately 44.5 inches with an average annual snowfall 21.5 inches. Precipitation is evenly distributed throughout the year, with an increase in rainfall during the summer months. Annual frost penetration is between 20 and 30 inches.

2.2.2 Topography

The NASJRB lies in the Triassic Lowlands Section of the Piedmont Physiographic Province. This section is characterized by rolling topography. Broad northeast-southwest trending ridges in the area reflect resistant sandstone beds or diabase dikes. The NASJRB occupies a relative topographic high, which precludes surface water from flowing onto the base. Surface elevations range from 370 feet above mean sea level (MSL) to approximately 240 feet MSL. Natural slopes are less than three percent, however, where re-grading has occurred they may be steeper.

The topography of IR Site 10 is gently sloping to the north while the topography of IR Site 11 is flat adjacent to the Aircraft Parking Area, with a steep gradient between the parking area and the U. S. Air Force Area.

2.2.3 Soil

Previous drilling activities at the NASJRB indicate that overburden soil thickness varies from 4 to 15 feet thick. Generally, the soil includes brown, yellowish-brown, reddish-brown, and orange mixtures of silt, clay, and sand with some finer-grained materials.

The Soil Survey of Montgomery County (United States Department of Agriculture, 1967) indicates that five major soil series are found within the boundaries of the NASJRB. These series include the Landsdale, Lawrenceville, Chalfont, and Readington silt loams and the Landsdale loam. Generally, the soil exhibits moderate to slow permeability that encourages rapid runoff during normal precipitation events.

2.2.4 Geology

The geology of the NASJRB has been characterized based on geologic logs of past soil borings and monitoring wells. Depth to bedrock varies from 4 to 15 feet bgs depending on whether the area has undergone construction activities. Competent sandstone overlies shale or siltstone units. Regional bedrock formation dip ranges from 5 to 15 degrees with strike to the north-northwest. Rock beds vary in thickness, often pinching out or grading into other facies, making stratigraphy correlation difficult.

The Middle Arkosic Member of the Late Triassic Stockton Formation underlies unconsolidated materials. This member consists of interbedded red shale, siltstone, and gray-tan, medium-grained, arkosic sandstone, which were deposited as part of a coalescing fluvial channel system. Red shale and siltstone are predominant along the southern edge of the site, whereas the arkosic sandstone underlies the remainder of the site.

2.2.5 Hydrology

The NASJRB lies within an upland area that forms a local drainage divide between the Little Neshaminy Creek drainage basin to the north and the Pennypack Creek drainage basin to the south. These local basins lie within the regional Delaware River drainage basin.
Runoff from base surface areas is primarily channeled through open drainage swales and enclosed storm sewers to five primary outfall areas. Three of these outfall to the Park Creek. The fourth outfall flows in an intermittent stream that flows into Pennypack Creek and the fifth is connected to the Northern Storm Sewer System.

2.2.6 Hydrogeology

Water levels in monitoring wells can fluctuate several feet annually due to seasonal influences. In most cases, ground water is observed within bedrock fractures or within the weathered zone immediately overlying competent bedrock. Static water levels not only reflect the regional potentiometric surface, but also the composite head resulting from the different water-yielding zones that the wells intercept. For this reason, water levels may show marked differences between nearby wells depending on the number, location, and size of fractures intercepted by each well.

A topographic ridge exists on NASJRB that acts as a ground and surface water divide (USGS, 2001). This divide trends southwest to northeast and is found in the southern portion of the installation in the vicinity of the Fire Training Area. Ground water north of this divide flows in a northwest direction and that to the south flows in a northeast direction.

Therefore, since IR Site 10 and 11 lie north of this divide, flow is predominantly to the northwest. However, because flow is primarily through rock fractures within bedrock or weathered bedrock, localized flow direction may vary. Ground-water flow through arkosic sandstone is more rapid than through shale/siltstone as evidenced by more rapid recharge rates during well development and purging prior to sampling. This may also be due to the greater size and density of fractures present within the sandstone.

The average hydraulic conductivity has been calculated to be approximately 4.05×10^{-5} centimeters per second (cm/sec). The average ground-water velocity has been calculated to be approximately 30 ft/year, assuming an effective porosity of 7 percent and a hydraulic gradient of 0.029ft.ft. EA has conducted aquifer tests during low and high water-table conditions and results of remedial system operations indicate that wells previously installed at IR Site 10 are low yielding. These wells typically yield 0 to 2 gallons per minute (gpm) during low water-table conditions and 5 to 10 gpm during high water table conditions.

2.3 BACKGROUND

2.3.1 IR Site 10 (Former Navy Fuel Farm)

From 1950 to 1991, two partially buried 210,000-gal JP/JP-5 aviation fuel tanks (Tank Nos. 115 and 116) were located at the Navy Fuel Farm, now called IR Site 10. A 500-gal underground waste oil tank and an underground diesel fuel tank were also located at the southwestern corner of the site.

In 1986, a release occurred when the Tank No. 115 was overfilled and fuel flowed from the vent pipe onto the ground. The event was attributed to faulty gauges that registered less fuel than was actually present. During this same year, a utility trench was excavated along the western boundary of the site, but work was discontinued when LNAPL was observed floating on the water within the trench. The area where the LNAPL was discovered is immediately adjacent to a former dry well. The dry well accepted water that was periodically siphoned from the bottom of the fuel tanks.

In March 1989, JP-5 jet fuel was detected emanating from two patches of dead grass to the west of Tank No. 115. As a result, it was decided to empty and remove both tanks. Removal occurred in 1991. During this time the waste oil diesel fuel underground storage tanks (USTs) were also removed. Inspection of the waste oil tank during removal revealed the tank was not intact as holes up to 1 inch in diameter were reported.

Following completion of removal activities, a new above ground storage tank (AST) system was installed to the east of the former tank field location. The new tank system at the Fuel Farm consists of above ground steel tanks set in a concrete berm. The Navy currently stores potassium acetate in the 40,000-gal AST. One of the 210,000 gal ASTs is connected to the boiler house, Building 6, with an underground pipeline and holds #2 fuel oil. The second 210,000 gal AST remains empty.

2.3.2 IR Site 10 Previous Investigations and Remediation

Previous investigations include the installation and sampling of monitoring wells, collection of LNAPL samples, and operation of a LNAPL removal system. The following was summarized from a *Sampling and Analysis Report for the Remedial Action at the Navy Fuel Farm* submitted on 11 June 1998.

Six ground-water sampling events were conducted at IR Site 10 between 1989 and 1997. The analytical data of samples collected during the 1997 sampling event indicated that six of the ten samples exceeded 19 May 1995 ACT II Statewide Health Standard (<= 2,500 TDS) for naphthalene and three samples exceed the 19 May 1995 Act II Statewide Health Standard (<=2,500 TDS) for benzene. However, please note that 1,3,5-Trimethylbenzene from the 1997 sampling event is above the current (2001) ACT II Statewide Health Standard (<=2,500 TDS).

In 1998 due to the presence of LNAPL, EA installed a LNAPL recovery system. In conjunction with the recovery system soil samples were collected in 1989 and 1991. None of the sample results exceeded the Cleanup Standard per Pennsylvania's Land Recycling Program, Technical Guidance, 18 July 1995, Soil to Ground Water Pathway. In 1993 a round of ground-water samples was collected. Benzene concentrations exceeded the 19 May 1995 Statewide Human Health Standard (< or = 2,500 TDS) for ground water in eight of the fourteen wells. No other constituent exceeded the standard. After becoming operational, the system recovered substantial LNAPL. However, by March 1999 the amount recovered leveled off and in 2001 it was recommended that the system be shut down and periodic hand bailing be undertaken. It was also recommended that samples should be collected from the site monitoring wells to document current conditions.

2.3.3 IR Site 11

In the early 1990's a construction project was undertaken adjacent to the Navy's Aircraft Parking Apron and just south of the U. S. Air Force Area. Figure No. 2-2 shows the location of IR Site 11. While grading of the site was being achieved, petroleum contaminated soil was encountered. Fifteen soil samples were collected in an effort to delineate the extent of soil contamination. Five of those samples showed analytical data above PADEP regulations and contaminated soil was removed as part of the construction project. Confirmation soil sampling of either remaining site soil or ground water was not conducted.

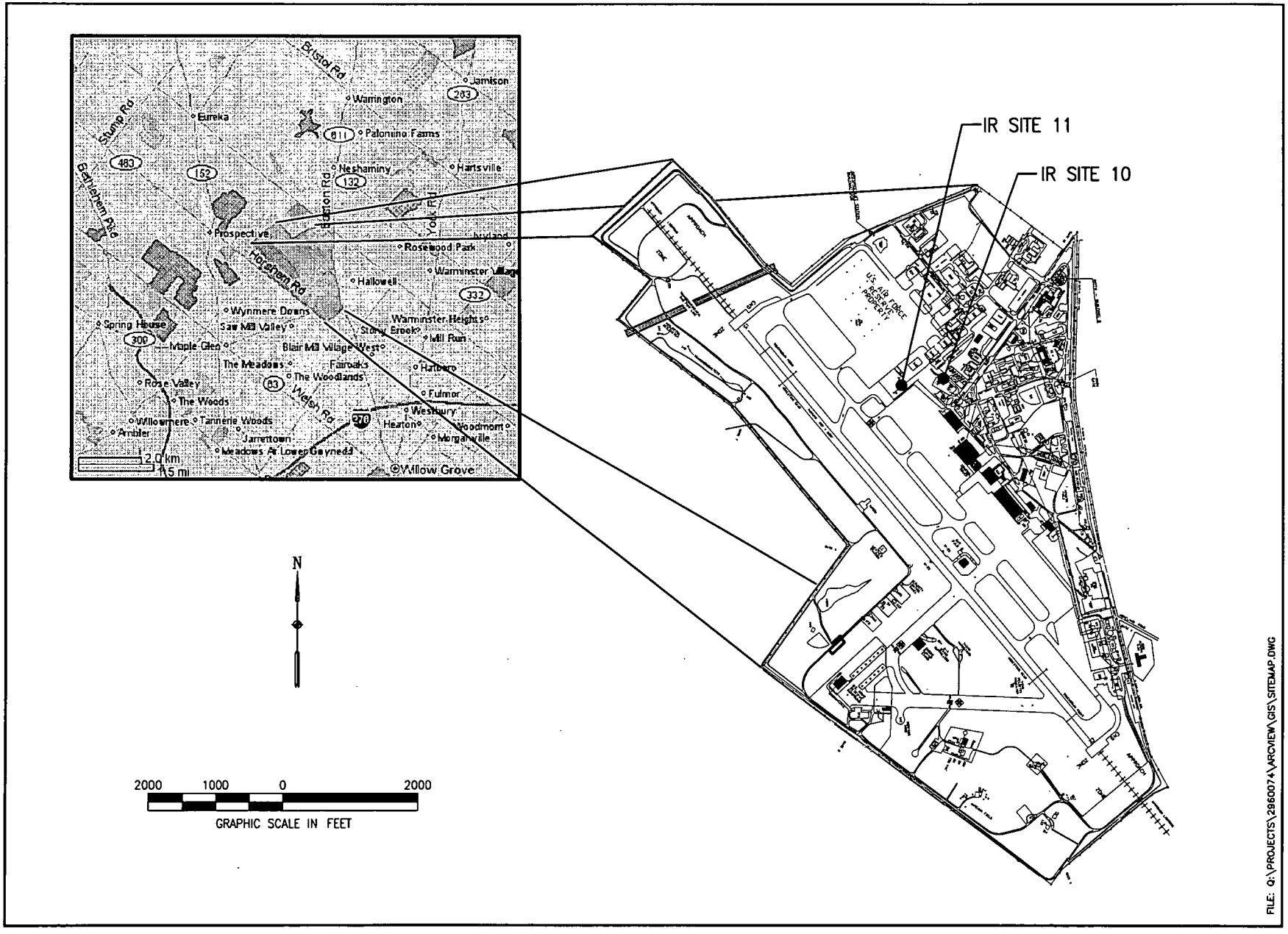

Figure 2-1. NASJRB INSTALLATION MAP

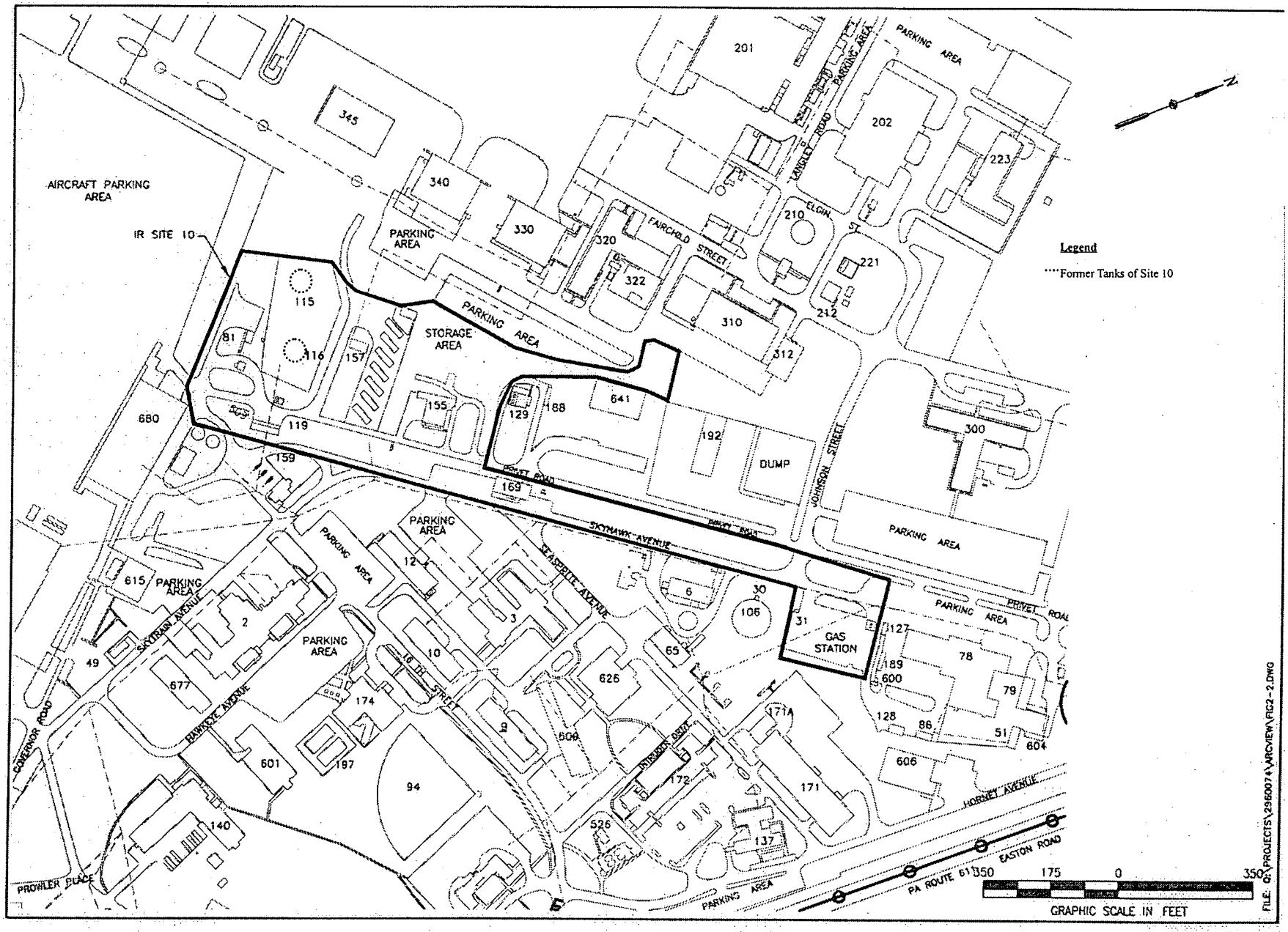

Figure 2-2. NASJRB IR SITE 10 – LOCATION MAP

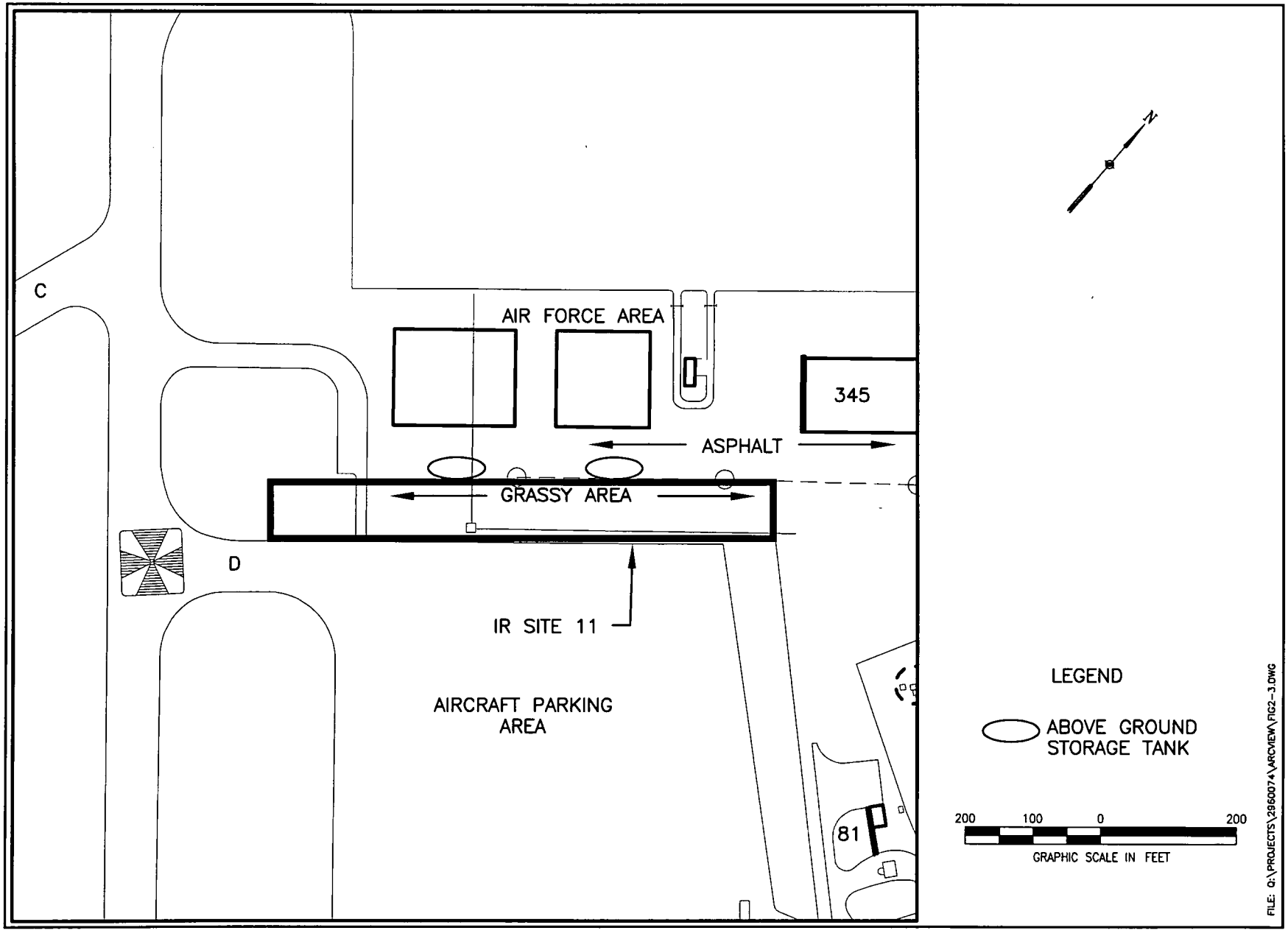

Figure 2-3. NASJRB IR SITE 11 – LOCATION MAP

3. SAMPLING PROCEDURES

3.1 SAFETY, HEALTH, and EMERGENCY RESPONSE PLAN

Field activities will follow requirements contained in the Safety, Health, and Emergency Response Plan for NASJRB, Willow Grove, Pennsylvania (EA 2003) which is contained in Appendix A.

3.2 QUALITY ASSURANCE PROJECT PLAN

The field work, sample collection, and sample analysis will follow requirements contained in the Quality Assurance Project Plan for IR Sites 10 and 11 NASJRB Willow Grove, Pennsylvania (EA 2003) provided under a separate cover to this document.

3.3 FIELD METHODOLOGY

3.3.1 Confirmatory Soil Sampling

IR Site 11, a steep gradient grassy area, lies between the Aircraft Parking Area to the south and the U. S. Air Force Area to the north. Analytical data from soil samples collected during past construction activities showed petroleum contamination. As a result some of the site soil was excavated and removed.

EA has been tasked to complete confirmatory soil sampling in this area. This confirmatory soil sampling will be accomplished using a Geoprobe®. Both surface soil samples (0 –2 ft below the ground surface (bgs)) and subsurface soil samples at the interface of the soil and bedrock (20 ft bgs) will be collected at each of the nine locations. The subsurface soil sample will be collected at the interface of the soil and bedrock, unless the soil from 2 ft bgs to bedrock yields a photoionization detector (PID) reading above background and/or a visual environmental concern is observed. If this situation occurs, the subsurface sample will be collected at that point. These nine locations will be sampled in the grassy area extending southwest to northeast (Figure 3-1).

The Geoprobe® will advance a stainless steel tube into the ground. Inside this tube is a PVC sampling tube into which the soil core is driven. At each location the sampling tube will be driven until bedrock is encountered. At four feet increments the sampling tube will then be withdrawn from the ground. The core will be described and a soil sample will be collected at the appropriate depths as described above.

3.3.2 Monitoring Well Installation

Five intermediate and two shallow monitoring wells will be installed as part of this investigation. Four of the intermediate wells will be installed in the IR Site 10 area and one in the IR Site 11 area. Also, one shallow well will be installed in the IR Site 10 area and one in the IR Site 11 area. The intermediate wells will be completed to a depth of 70 feet bgs and 120 feet bgs and the shallow wells will be completed to a depth of 40 feet bgs. Proposed and existing monitoring

well locations are shown on Figure 3-1 and 3-2. A summary of the proposed wells is shown below on Table 3-1:

Table 3-1
Proposed Wells

Site	Proposed Well Identification #	Proposed Depth (feet bgs)
Site 11	NFFW-22	40 ft
Site 11	NFFW-23	70 ft
Site 10	NFFW-24	70 ft
Site 10	NFFW-25	120 ft
Site 10	NFFW-26	120 ft
Site 10	NFFW-27	40 ft
Site 10	NFFW-28	120 ft

Monitoring well installation will be accomplished by advancing a 10-inch diameter borehole through the overburden 2 feet into the competent bedrock by a combination of a hollow stem auger and air rotary drill. The overburden will be continuously cored to allow for collection of soil samples.

Soil Samples will be collected during the installation of the monitoring wells at both IR Site 10 and 11. Two samples will be collected at each monitoring well location. The surface sample (0 to 2 ft bgs) will be collected via split spoon. The subsurface sample will be collected at the interface of the soil and bedrock, unless the soil from 2 ft bgs to bedrock yields a PID reading above background and/or a visual environmental concern is observed. If this situation occurs, the subsurface sample will be collected at that point.

Once the overburden has been penetrated, it will be cased with 6-3/8-inch inside diameter (ID) steel. The casing will be advanced into the bedrock and grouted in place with a slurry of cement and bentonite. Once the grout has been allowed to cure for 24 hours, the bedrock borehole will be drilled through the casing using a 5 5/8-inch outside diameter (OD) direct air rotary drilling bit with a down-hole hammer into the bedrock.

An EA geologist will oversee the drilling process, noting and documenting any abrupt changes or anomalies in the air pressure, depth(s) of low or lost circulation, drill-cutting description, and any other pertinent information. The geologist will be sure to observe water return and progress of the rods to assess the location of water-bearing fractures.

The shallow monitoring wells will be completed as open-hole monitoring wells. The intermediate monitoring wells will be screened in the highest yielding water bearing zone within the 100 to 120 or 50 to 70 foot interval. The intermediate wells will be constructed with 4-inch diameter, flush joint PVC well casing and 4-inch diameter, 0.20 slotted well screen with a

bottom cap. The annular space between the screen and the borehole walls will be filled with No.2 quartz sand to one foot above the top of the screen. A bentonite pellet seal, at least 2 feet thick, will be placed above the sand-pack. The seal will be allowed to hydrate before proceeding. The remaining annular space will be filled with cement-bentonite grout to within 1 foot of the ground surface. Materials placed in the annular space will be installed so as to insure that no bridging occurs.

The surface area around the well will be completed by continuously pouring concrete from below the frost line (approximately 3 feet below grade) to the surface. Additional 6-3/8-inch steel casing will be welded as needed to extend the casing 24 inches above grade. A 24-inch by 24-inch by 12 –inch concrete pad will then be formed around the casing. The pad will extend 6 inches into the ground and 6 inches above. A locking well lid and identification labels or tags will also be attached to the well. Wells will be keyed alike. The well will be painted with a highly visible safety yellow paint after the concrete has cured.

3.3.3 Monitoring Well Development

Well development will be performed throughout the full length of the well to remove particles of rock (from gravel to clay size) from the water-bearing fractures in the open-rock borehole.

Well development will be started immediately after completing the well to the specified depth. The drilling string that consists of the downhole hammer, rods, and rig with an air compressor will be used to airlift water and rock cuttings to the surface. The airlifting development will be done with the air hammer at various depths in the borehole with a constant air stream and also by airlifting, allowing a ground-water recharge period, and repeating the airlifting. This process will remove the bulk of rock cuttings and rock/soil grains from the fracture intersected by the borehole.

3.3.4 Soil and Ground-water Sampling

Once monitoring wells have been developed and the appropriate time has past, the ground-water samples will be collected from the seven newly installed monitoring wells and the nineteen existing wells. The monitoring wells to be sampled are shown in Table 3-2 and on Figure 3-1 and 3-2.

TABLE 3-2

EXISTING AND NEW WELLS TO BE SAMPLED		
NFFW-1	NFFW-10	NFFW-21
NFFW-2R	NFFW-12	NFFW-22
NFFW-3	NFFW-13	NFFW-23
NFFW-4	NFFW-15	NFFW-25
NFFW-5	NFFW-16	NFFW-26
NFFW-6	NFFW-17	NFFW-27
NFFW-7	NFFW-18	NFFW-28
NFFW-8	NFFW-19	
NFFW-9	NFFW-20	

Using a 2-inch submersible pump, ground water will be purged and sampled according to U.S. EPA low flow procedures. During the purging process water quality parameters will be monitored for stabilization. Parameters will include temperature, conductivity, pH, turbidity, oxidation/reduction potential (ORP), and dissolved oxygen (DO). Readings will be taken at 5-minute intervals. Stabilization is achieved when three successive readings are within ±0.1 for pH, ±3% for conductivity and temperature, ±10mv for redox (Eh), and ±10% for turbidity and DO.

If the water level is observed to drop and the pump is at its lowest setting, water quality parameters will be monitored for stabilization as described above. If stabilization does not occur after 2 hours, then the removal of one interval volume of water will be used as the criterion for sampling.

Ground-water samples will be collected in order of decreasing volatility as follows:

- VOC
- Methane
- SVOC
- TAL Metals

After the parameters have stabilized, the flow rate will be reduced to 0.1 L/min and samples for VOC and Methane analyses will be collected by trickling the water down the inside wall of the vial. Other samples can be collected at a rate not to exceed 1L/min. The sampling scheme complete with quality control samples is presented below in Table 3-3 as per PADEP direction. Table 3-4 is a summary of analysis that will be completed for parameters associated with natural attenuation.

TABLE 3-3
Sample Summary

*Samples	Sample Matrix	**VOC SW-846 8260B	***SVOC SW-846 8270C	TAL Metals SW-846 6010B/7000
Ground Water	Aqueous	26	26	26
Field Duplicate[a]	Aqueous	2	2	2
MS/MSD[b]	Aqueous	3	3	3
Field Blank[c]	Aqueous	2	2	2
Rinsate Blank[d]	Aqueous	2	2	2
Trip Blank[e]	Aqueous	7		
Soil	Solid	32	32	32
Field Duplicate	Solid	2	2	2
MS/MSD	Solid	2	2	2
Field Blank	Aqueous	2	2	2
Rinsate Blank[f]	Aqueous	4	4	4

MS/MSD – Matrix Spike/Matrix Spike Duplicate
a – one per event with a rate of 5 to 10% used

*Ground water samples will be collected from 19 existing wells and 7 newly installed wells. Surface and subsurface soil samples will be collected from the 19 existing wells, 7 newly installed wells, and the 9 Geoprobe® locations.
* *includes Cumene and EDB, EDB Method 504 is for aqueous samples
***Benzo(a)pyrene will be analyzed by Method 8310 for aqueous samples

b- one per site (PADEP) and 1 per every 20 samples (lab)
c- one per site
d- 1 before using equipment for dedicated equipment for each site
e- 1 per cooler of VOCs for aqueous samples for each site
f- 1 before using equipment and 1 after using equipment for non-dedicated equipment for each site.

TABLE 3-4
Sample Summary for Natural Attenuation Parameters in Ground Water

# Samples	QA/QCSamples	Analysis	Method
26		Temperature	YSI Water Quality Meter
26		pH	YSI Water Quality Meter
26		Dissolved Oxygen	YSI Water Quality Meter
26		Eh	YSI Water Quality Meter
26		Ferrous Iron (Fe^{2+})	Color Disc (Hach)
26		Sulfate	Colorimeter (Hach)
26		Hydrogen Sulfide	Color Chart(Hach)
26	2Duplicates; 2 MS/MSD; estimated 7 trip blanks; 2 Rinsate Blanks; 2 Field Blanks	Methane	RSK 175

The necessary entries on the chain-of-custody form will be completed. The labeled and filled sample containers will be placed into an iced cooler with bubble wrap to prevent breakage. VOC samples will be stored in the same cooler along with the trip blanks. In addition, methane samples will be stored in the same cooler along with the methane associated trip blanks. At the end of the sampling day, the chain-of-custody form will be placed in a waterproof plastic bag and taped to the inside lid of the cooler. The cooler will be sealed with chain-of-custody seals and shipped or hand-carried to the selected analytical laboratory.

3.3.5 Field and Sample Documentation

The sample team performing ground-water sampling will maintain a field logbook that will be completed throughout the sample collection process. Recorded information will include sample location and number, sample collection time, sample description, water-level measurements, water quality parameters, purging data, sampling methods, daily weather conditions, field measurements, instrument calibration, and other site-specific observations. Deviations from the sampling plans, visitor's names or other base contacts made during sampling, and other site-specific information, will also be recorded.

Each soil and ground-water sample will be identified using an eight-character nomenclature described as follows:

Example IR10 or 11-NFFW03-22

IR10 or 11-NASJRB Installation Restoration Program Site Number
NFFW– Monitoring Well Number
22 - Depth in Feet to the Top of the Sampled Interval (only used for soil samples)

The chain-of-custody form accompanies the samples as they are moved from the field to the laboratory. It contains required sample analysis information and the appropriate signatures indicating custody changes along the way.

Entries to the chain-of-custody form will be completed and checked prior to sample shipment. Field-related entries will be completed prior to sample shipment. The forms will include the following information at a minimum:

- Project name
- Sample number (includes location and type)
- Matrix of the sample
- Type of sample (grab, composite, etc.)
- Preservation applied (or "None" if no preservation)
- Name of the person collecting the sample
- Analyses requested for each sample with method number and ml purge

3.4 ANALYTICAL METHODOLOGY

Soil Samples from IR Site 10 and 11 locations will be analyzed for:

- TCL VOC by EPA SW-846 8260B (Preparation Method 5035)
- EDB and Cumene by 8260 B, 25 ml purge
- TCL SVOC by EPA SW-846 8270C
- TAL Metals by EPA Method Series 6010B/7000

Ground-water Samples from IR Site 10 and 11 locations will be analyzed for:

- TCL VOC by EPA SW-846 8260 B
  - However, Bromoform, Dibromochloromethane, and Cumene will include a 25 ml purge in order for the analytical method detection limit to be at or below the medium specific concentration (MSC) or Practical Quantitation Limit (PQL).
- EDB by Method 504

- Methane by Method RSK 175
- TCL SVOC by EPA SW-846 8270C, however Benzo(a)pyrene by Method 8310 in order for the analytical method detection limit to be at or below the MSC or the PQL.
- TAL Metals by EPA Method Series 6010B/7000

In addition, one composite sample per each set of four 55-gallon drums of investigation-derived waste (IDW) of soil cuttings from the well installations will be collected. These samples will be analyzed for Full TCLP (SVOC, VOC, Metals, Hebicides, and Pesticides) in order to dispose of cuttings properly offsite. There is also the potential that ground-water and decontamination water may need to sampled as stated in the IDW section. If this is the case, one aqueous sample per each set of two 55-gallon drums will be collected for FULL TCLP (SVOC, VOC, Metals, Herbicides, and Pesticides), reactivity, corrosivity, and ignitability.

Quantification limits for the TCL and TAL parameters are listed in the Quality Assurance Project Plan.

An independent third-party reviewer will perform data validation on the laboratory data excluding the Full TCLP, reactivity, corrosivity, and ignitability analysis. The procedure will follow U.S. EPA Region III's data validation procedures: "Region III Modifications to the Laboratory Data Validation Functional Guidelines for Organic Data Review, Multimedia, Multi-Concentration" (dated September 1994); and "Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses" (dated April 1993).

3.4.1 Quality Control Samples

The analytical scheme will also include the collection of field quality control samples and sufficient sample volume for matrix spike/matrix spike duplicate samples for laboratory quality control purposes.

Field duplicate is a duplicate sample of an investigative sample. The field duplicate is collected of the same matrix, to the extent possible, at the same time, from the same location, and using the same techniques as the investigative sample. These samples are used to assess the combined field and laboratory precision. As per the PADEP *Groundwater Monitoring Guidance Manual* dated 1 December 2001, 1 field duplicate is required per event with a rate of 5 to10% used.

Additional sample volume will be collected for *matrix spike/matrix spike duplicate*. These are laboratory quality control samples consisting of a field sample that is spiked with the analyte(s) of interest and analyzed to monitor matrix effects associated with a particular batch of samples. Matrix spikes are analyzed with every sample batch of 20 or fewer samples. For organic analyses, matrix spike duplicate samples are performed for every batch of 20 or fewer samples. Additional aliquots will be collected at a frequency of 1 per 20 samples per matrix (one per analytical batch, or partial batch). In addition as per PADEP *Groundwater Monitoring Guidance Manual* dated 1 December 2001, 1 ms/msd is required per site. However, the lab may have different guidelines as discussed.

Trip blanks are used to assess sample contamination during storage or transportation to/from the laboratory. Trip blanks will be prepared by filling 40-mL volatile organic analyte (VOA) vials with reagent-grade de-ionized water at the laboratory. These samples will be shipped to the site with the empty containers and kept with the investigative samples throughout the sampling event. The trip blanks are then returned to the laboratory for analysis. They will remain sealed until they are analyzed with the field samples. These blanks will be preserved, handled, transported, and analyzed in an identical manner to the actual samples. One trip blank (2-40 mL glass vials) will be submitted for every discrete shipping container containing samples for VOC analyses for ground water. In addition, one trip blank (2-40 mL glass vials) will be submitted for every discrete shipping container containing samples for methane analyses for ground water.

Rinsate blanks are samples obtained by running contaminant-free water over/through sample collection equipment before and/or after it has been cleaned. These samples will be used to determine residual chemical concentrations on sampling equipment after decontamination. Rinsate blanks will be collected once before non-dedicated equipment is utilized for sampling and once after for each site as per the PADEP *Groundwater Monitoring Guidance Manual* dated 1 December 2001. If dedicated equipment is utilized for the sampling event, one rinsate blank is required prior to use as per the PADEP *Groundwater Monitoring Guidance Manual* dated 1 December 2001. They will be collected in empty laboratory-provided sample containers appropriate for the parameters being analyzed in the field samples.

Field blanks are samples of contaminant-free media prepared in the field. Typically, this is done by pouring contaminant-free water into laboratory-cleaned sampling containers during sampling activities. Field blanks are analyzed for the parameters sampled for during the field effort. The purpose of field blanks is to provide a check on contaminants that could be introduced to the samples during sample collection. One field blank is required per site as per the PADEP *Groundwater Monitoring Guidance Manual* dated 1 December 2001.

3.5 DECONTAMINATION

A decontamination pad will be established at a location to be specified by the NASJRB contact. The pad will consist of a rubber sheet overlain by two layers of heavy-gauge plastic and bounded by a wooden frame. The dimensions of the pad will be sufficient to accommodate the back of a drilling rig and will be deep enough to contain and store sediment and water from decontamination procedures. Potable water for decontamination will be drawn from a location on the NASJRB distribution system, if available. If water is not available onsite, water will be brought onsite for deconing purposes. Down-hole equipment (includes bit and rods) related to drilling will be steam-cleaned between each well location.

Other non-dedicated sampling equipment will be decontaminated as described below:

1. Clean thoroughly with potable water and detergent (alconox or liquinox), using a brush, if necessary, to remove particulate matter and surface films.

2. Rinse thoroughly with potable water from the designated decontamination water supply source.

3. Rinse with isopropyl alcohol followed by a nitric acid rinse.

4. Rinse equipment thoroughly with distilled or de-ionized water.

5. The equipment will be allowed to air dry before reuse.

3.6 INVESTIGATION DERIVED WASTE

Investigation derived is waste that is created during environmental investigation activities such as excess soil, rock cuttings, decontamination water, and purged water.

During ground-water sampling and soil sampling of the newly installed wells, decontamination water and purged water will be discharged to the ground surface and allowed to infiltrate the soil pending NASJRB approval of PID readings from soil cuttings produced from the well installations. Water will be contained while awaiting NASJRB approval. A copy of the PID readings will be provided to NASJRB in advance to make a decision on disposal. If there are high PID readings or visible contamination during soil sampling of a particular well or there is a nearby surface water body or storm drain nearby, than decontamination water and ground water will be contained in 55-gallon drums, sampled, and analyzed. Once the laboratory analysis is received, water will be disposed offsite or discharged directly to the ground surface pending on NASJRB decision.

Based on the results of previous ground-water analysis, decontamination water and purge water generated during sampling of the existing wells will be discharged directly to the ground surface or contained and sampled. Once the laboratory analysis is received, water will be disposed offsite or discharged directly to the ground surface pending on NASJRB decision.

Soil and rock cuttings produced during monitoring well construction and soil sampling during the monitoring well construction will be contained in 55-gallon drums, sampled, and analyzed. Once the analysis is received, soil will be disposed offsite.

Soil cuttings from the Geoprobe® during the soil sampling at Site 11 will be backfilled into the appropriate borehole which will then be filled to the surface with bentonite.

Used personal protective equipment (PPE) will be placed in plastic garbage bags and contained in 55-gallon drums. The drums of PPE will be disposed offsite.

If trucks and drill rigs need to be washed because of the presence of soil, trucks and drills rigs will be cleaned at a staging area as directed by NASJRB. In addition, if trucks and drill rigs are believed to be potentially contaminated, trucks and drill rigs will be decontaminated at a staging area directed by NASJRB. Decontamination water from the potentially contaminated vehicles

will be contained and sampled. Once the laboratory analysis is received, water will be disposed offsite or discharged directly to the ground surface pending on NASJRB's decision.

Waste-containing drums will be labeled on the side with weather-resistant paint or waterproof labeling with indelible marker. The drums will display the matrix, site number, well number (as appropriate), point-of-contact, date, and telephone number.

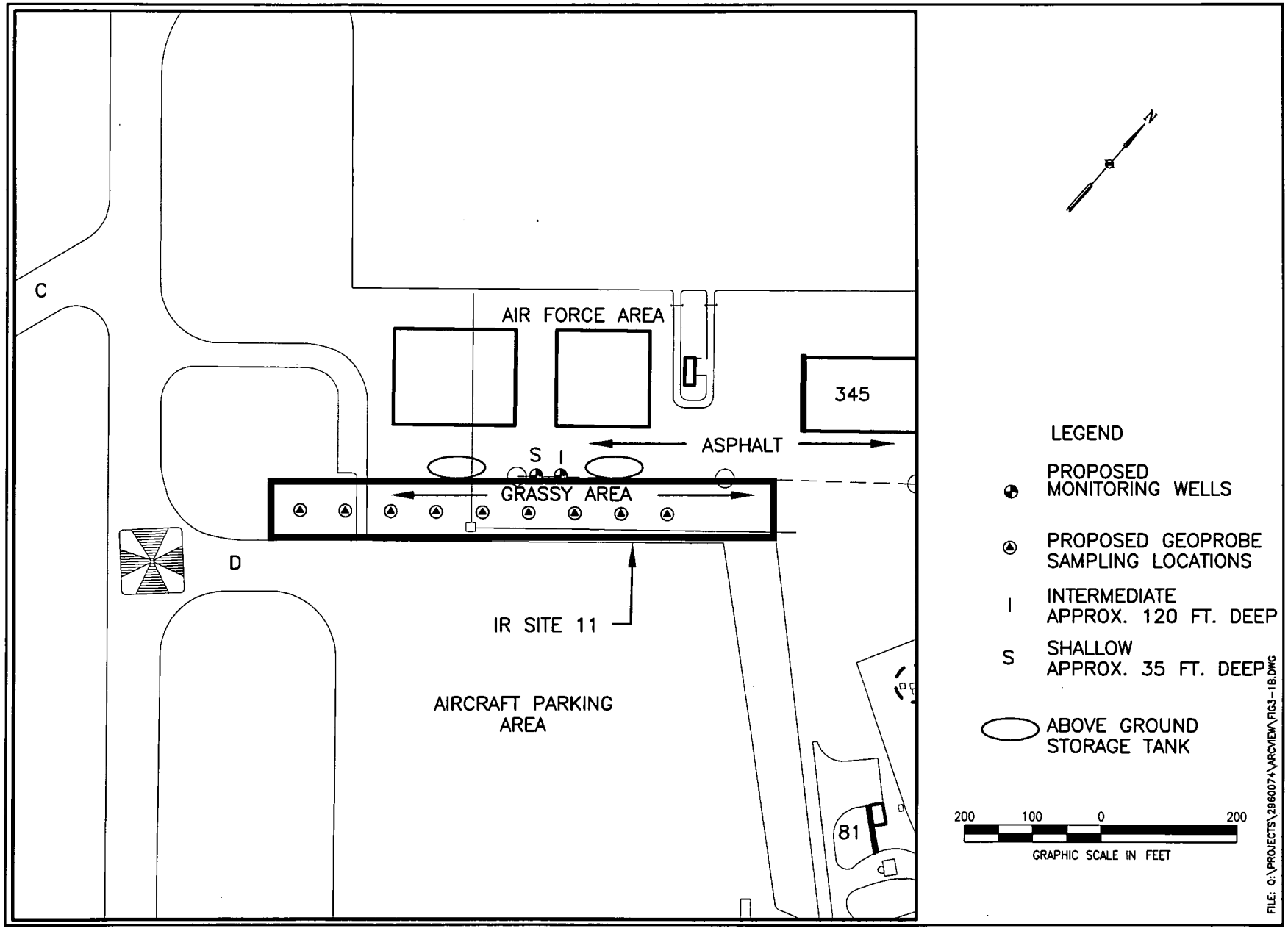

Figure 3-1. NASJRB IR SITE 11, PROPOSED SOIL BORING AND MONITORING WELL LOCATIONS

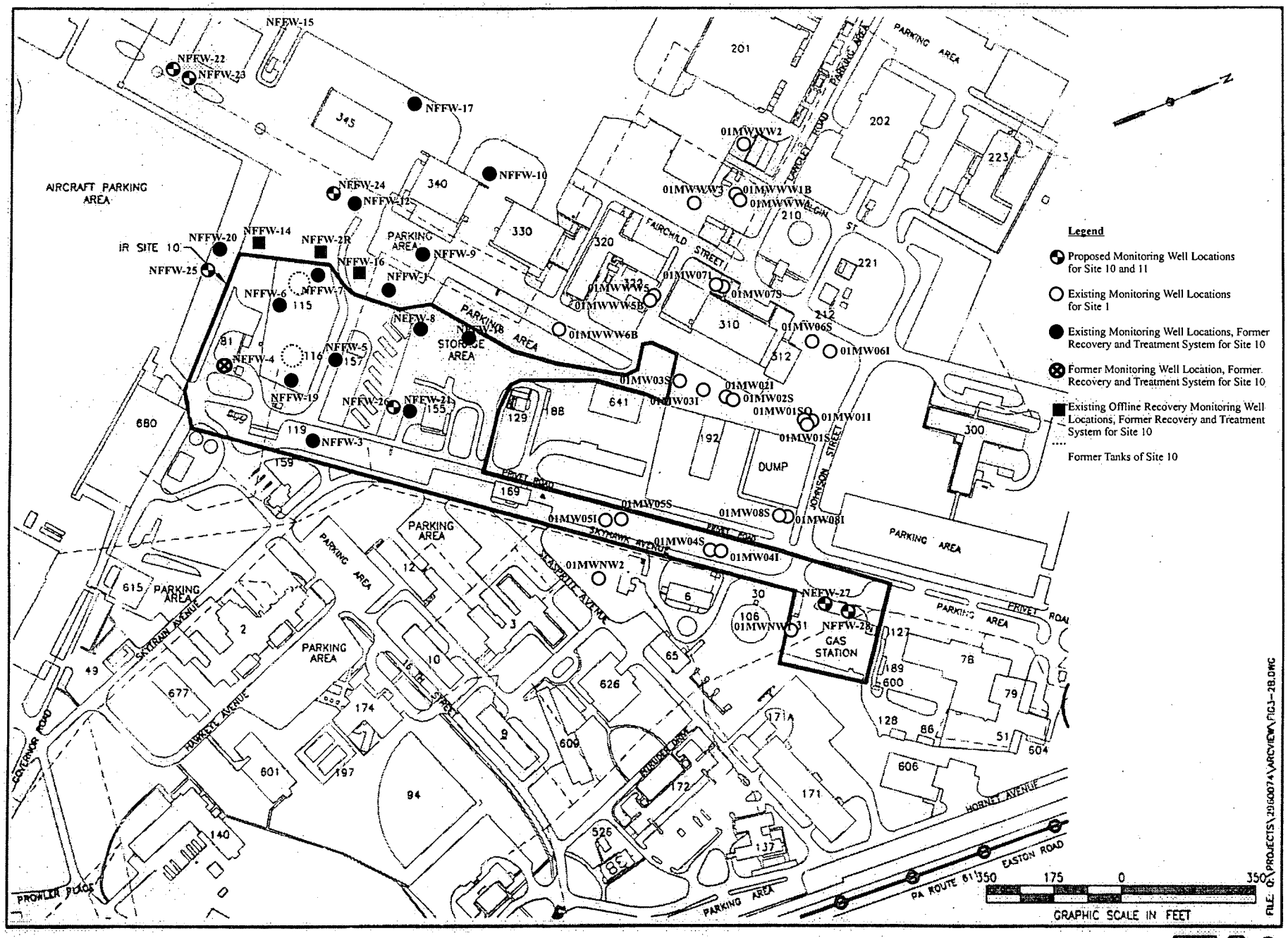

Figure 3-2. EXISTING, PROPOSED, AND/OR FORMER MONITORING WELL LOCATIONS FOR NASJRB IR SITES 10, 11, AND 1.

4. DATA INTERPRETATION

The remediation standard will be selected as per the guidance in the PADEP Act II Technical Guidance Manual, Section II Remediation Standard, Section B Statewide Health Standard, dated 4 May 2002 as directed by PADEP. Interpretation of both ground water and soil data will be conducted in accordance with the PADEP Act II guidelines.

4.1 GEOLOGIC DATA

Geologic data will be obtained from the following sources:

- Borehole logs from the drilling to be conducted as described in this Work Plan
- Available borehole logs from earlier drilling efforts
- Prior interpretation of geologic data relative to other investigations at Willow Grove NASJRB
- Available literature

The borehole logs for IR Sites 10 and 11 will be used to construct site cross section(s) showing the lithologies encountered. These data and data from the other sources described above will be used to develop a conceptual site model for the geologic setting of both sites. The geologic conceptual model will then be used to inform the interpretation of ground-water and soil quality data.

4.2 GROUND-WATER ELEVATION DATA

For both IR Site 11 and IR Site 10 ground-water elevation data from the network of newly installed wells, pre-existing wells, and other wells at NASJRB will be used to develop ground-water elevation contour maps for the shallow and intermediate zones. It is anticipated that a single ground-water elevation map will be prepared for each zone and both sites will be shown on the map. Because the sites are in close proximity to each other it is anticipated that combining the elevation data from both sites will result in a more complete picture for each site. Ground-water flow directions will be determined based on these maps. Vertical flow will be determined based on comparison of ground-water elevations in the shallow and intermediate zones. Combined with the geologic data this will allow development of the site(s) conceptual site model for hydrogeologic system (i.e., establishment of potentiometric surface, hydraulic gradients, and other hydraulic properties capable of influencing contaminant migration). However, if two statistically independent rounds of ground-water sampling at the wells installed at IR Site 11 reveal that constituents are below method detection limits, PADEP would tend to agree that more thorough definition of the hydrogeologic system is not necessary at the site, since liability protection should only be entertained for environmental media impacted by past site activities.

4.3 SOIL QUALITY DATA

Soil quality characterization will be based on the results of laboratory analysis of the samples collected during this effort. In addition soil quality characterization may be based on past available soil results from IR Site 10, if the past results were analyzed according to same method

numbers as proposed for this sampling event discussed in this document. In addition, PADEP approval of the use of past soil results for IR Site 10 is required. The results will be compared to the calculated remediation standard. The remediation standard will be selected as per the guidance in the PADEP Act II Technical Guidance Manual, Section II Remediation Standard, Section B Statewide Health Standard, dated 4 May 2002. The guidance states the following for soil samples collected between 0 to 15 ft bgs. The soil standard involves comparing two numerical standards: the direct contact number versus the greater of the two soil-to-groundwater numbers (the generic value versus the 100 X the ground-water MSC). The appropriate standard is the lowest value which is either the direct contact number or the greater of the two soil-to-groundwater numbers. The direct contact number for this site in determining the appropriate standard is the non-residential surface soil (0-2 feet bgs) and nonresidential subsurface soil (2 to 15 ft bgs). The soil-to-groundwater number for this site in determining the appropriate standard is the used aquifer with total dissolved solids less than or equal to 2500 mg/L for non-residential. A PADEP Act II "Final Report" for each IR Site 10 and one for IR Site 11 will be submitted for soil assuming the soil analytical results will be below the calculated MSCs. However, if the analytical results are above the calculated MSCs further discussion will occur with PADEP. The potential for a Remedial Investigation Report and a Cleanup Plan, if the soil results are above the MSCs and need to be removed may be required. However, if the soil have the potential to remain in place a Remedial Investigation Report along with a Risk Assessment may be required.

4.4 GROUND-WATER QUALITY DATA

The remediation standard will be selected as per the guidance in the PADEP Act II Technical Guidance Manual, Section II Remediation Standard, Section B Statewide Health Standard, dated 4 May 2002. Ground-water quality characterization will be based on the results of analysis of the ground-water samples collected during this effort. These data will be compared to the Medium-Specific Concentrations (MSCs) for ground water using the Non-Residential values for a used aquifer with TDS =<2,500 mg/l. These results will be presented in a report titled "Petition to Reduce the Number of Sampling Events to Demonstrate Attainment". One report will be submitted for IR Site 10 and one for IR Site 11. These reports will be submitted after each round of sampling to determine if the number of attainment sampling locations for ground water may be reduced based on the results of the characterization sampling.

5. PROJECT MANAGEMENT AND SCHEDULE

EFA Northeast's Remedial Project Manager, Mr. Jim Colter, will coordinate activities between NASJRB Willow Grove, regulatory agency personnel, and EA.

EA's project staff will include:

- CTO Manager: Katherine Sheedy
- Senior Technical Review: Paul Caprio, P.G.
- Site Safety and Health Officer: Maria Magilton or Kim Walters, P.G.
- Site Manager (Staff): Maria Magilton or Kim Walters, P.G.
- Quality Assurance Officer: Paul Caprio, P.G.

5.1 PROJECT SCHEDULE

Dates were revised to reflect the issue date of this Work Plan:

Final Work Plan	11 April 03
Field Work	to be determined
Draft Report	to be determined
Final Report	to be determined

REFERENCES

United States Geological Survey. 2002. *Hydrogeological Investigation at Site 5, Willow Grove Naval Air Station/Joint Reserve Base, Horsham Township, Montgomery County, Pennsylvania.*

United States Geological Survey. 2001. *Altitude and Configuration of the Regional Potentiometric Surface, Willow Grove Naval Air Station/Joint Reserve Base and Vicinity, Horsham Township, Montgomery County, Pennsylvania.*

EA Engineering, Science, and Technology, Inc. 2001. *Memorandum: Path Forward for Site 10, Navy Fuel Farm, NASJRB, Willow Grove.*

Pennsylvania Department of Environmental Protection 2001. *Letter Re: ECP – Storage Tanks, LRP ID. 1-46-26925, Site 10, Navy Fuel Farm, NASJRB Willow Grove.*

EA Engineering, Science, and Technology, Inc. 2001. *Final Report on System Performance of the Vacuum Enhanced LNAPL and Groundwater Recovery and Treatment System January 1999 to December 1999, Naval Air Station Joint Reserve Base, Willow Grove, Horsham Township, Pennsylvania.*

EA Engineering, Science and Technology, Inc. 1998. *Final Sampling and Analysis Report, Navy Fuel Farm Facility, NASJRB, Willow Grove, Pennsylvania.*

APPENDIX A

SAFTEY, HEALTH AND EMERGENCY RESPONSE PLAN

FINAL
SAFETY, HEALTH, AND EMERGENCY RESPONSE PLAN FOR IR SITE 10 AND 11 NAVAL AIR STATION JOINT RESERVE BASE WILLOW GROVE, PENNSYLVANIA

Prepared for:

Department of the Navy
Northern Division
Naval Facilities Engineering Command
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Prepared by:

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(302) 325-3560

Contract No. N62472-92-D-1296
Contract Task Order No. 0074

March 2003
FINAL
EA Project No. 29600.74 5200

SAFETY, HEALTH, AND EMERGENCY RESPONSE PLAN FOR IR SITE 10 AND 11 NAVAL AIR STATION JOINT RESERVE BASE WILLOW GROVE, PENNSYLVANIA

Contract No. N62472-92-D-1296
Contract Task Order No. 0074

Maria Magilton
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3/27/03
Date

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3/28/03
Date

Kris H. Hoiem, CIH
Program Safety & Health Officer

3/24/03
Date

March 2003
FINAL
EA Project No. 29600.74 5200

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LIST OF ACRONYMS AND ABBREVIATIONS

ANSI	American National Standards Institute
AOC	Area of Concern
BRAC	Base Realignment and Closure
Ca	Carcinogen
CFR	Code of Federal Regulations
CGI	Combustible Gas Indicator
CIH	Certified Industrial Hygienist
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Contaminants of Concern
COTR	Contracting Officers Technical Representative
CPR	Cardiopulmonary Resuscitation
CRZ	Contamination Reduction Zone
CTO	Contract Task Order
dBA	Decibels on the A-Weighted Scale
EPA	U.S. Environmental Protection Agency
EZ	Exclusion Zone
°F	Degrees Fahrenheit
F.A.R.	*Federal Acquisition Regulation*
GFCI	Ground Fault Circuit Interrupter
HR	Heart Rate
IDLH	Immediately Dangerous to Life and Health
IDW	Investigation-Derived Waste

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

IR Program	Installation Restoration Program
kV	Kilovolt(s)
LEL	Lower Explosive Limit
MSC	Medium-Specific Concentrations
MSDS	Material Safety Data Sheets
NASJRB	Naval Air Station Joint Reserve Base
NIOSH	National Institute for Occupational Safety and Health
NTR	Navy Technical Representative
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppm	Parts Per Million
RQ	Reportable Quantities
SAP	Sampling and Analysis Plan
SHERP	Safety, Health, and Emergency Response Plan
SSHO	Site Safety and Health Officer
SZ	Support Zone
TLV	Threshold Limit Value
USCG	U.S. Coast Guard
VOC	Volatile Organic Compounds
WBGT	Wet-Bulb Globe Temperature

1. INTRODUCTION

Site: Installation Restoration (IR) Site 10 and 11 NASJRB
Location: Willow Grove, Pennsylvania

This Safety, Health, and Emergency Response Plan (SHERP) is written to document the safety and health protocols and practices to be used for hazardous waste site field activities in support of the Sampling and Analysis Plan (SAP) compiled by EA Engineering, Science, and Technology, Inc. under Contract No. N62472-92-D-1296, Contract Task Order 0074 for IR Sites 10 and 11.

2. PURPOSE AND SCOPE

This SHERP addresses safety and health protocols associated with hazardous waste work throughout the base for Site 10 and 11 NASJRB Willow Grove. This SHERP addresses the following:

- drilling and installation of wells via hollow steam auger and air rotary drill,
- soil sampling during well installation,
- ground water sampling, and
- the potential for soil sampling via geoprobe®.

It has been prepared in accordance with the following regulations and guidance:

- Occupational Safety and Health Administration (OSHA) Standards for General Industry, 29 CFR 1910, including 29 CFR 1910.1030, *Occupational Exposure to Bloodborne Pathogens*.

- OSHA Standards for Construction Industry, 29 CFR 1926, including 29 CFR 1926.65, *Hazardous Waste Operations and Emergency Response* and 1926.59, *Hazard Communication*.

- National Institute for Occupational Safety and Health (NIOSH)/OSHA/U.S. Coast Guard (USCG)/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities,* October 1985.

- *Federal Acquisition Regulation* (F.A.R.), Clause 52.236-13: Accident Prevention.

- *Safety and Health Management Plan for BRAC CLEAN Contract No. N62472-92-D-1296*, September 1998 Rev. 1.

The health and safety of site personnel and the public are a primary concern during investigative activity at IR Sites 10 and 11. Thus, a comprehensive, carefully managed, and thoroughly documented SHERP is crucial for successful project completion. This SHERP presents the conditions and hazards known or anticipated at NASJRB Willow Grove for IR Sites 10 and 11. This SHERP will be used to identify and mitigate potential site and task-specific hazards, and

select appropriate health and safety protective measures to be instituted for the tasks and operations to be undertaken.

This plan has been developed for use by EA Engineering, Science, and Technology, Inc. and its subcontractors and is based on available information pertaining to IR Sites 10 and 11 and describes the field implementation of the SHERP, specific personnel responsibilities, training requirements, protective equipment, site operating procedures, emergency contingency procedures, and medical monitoring.

Prior to the commencement of field activities, the SHERP will be reviewed with site personnel and made available for review through the Site Manager to ensure sufficient awareness of potential hazardous conditions and safety procedures on IR Sites 10 and 11.

Site personnel, including contractors, subcontractors, and visitors, are required to read and attest to their knowledge of, and willingness to comply with, aspects and provisions of this SHERP by signing the agreement in Appendix A.

3. PERSONNEL

There are currently 2 Areas of Concern (AOCs) identified at NASJRB Willow Grove, Pennsylvania. The AOCs have been designated IR Program Sites 10 and 11.

Field and project activities will be performed by EA personnel and necessary subcontractors. EA's project team has been selected and organized to provide the technical expertise, field supervision, and management support needed to ensure that execution of the investigation is successful, efficient, and safe.

3.1 KEY PERSONNEL

CTO Manager:	Katherine Sheedy
Site Manager:	Maria Magilton or Kim Walters
Program Safety and Health Officer:	Kris H. Hoiem, CIH
Site Safety and Health Officer (SSHO):	Maria Magilton or Kim Walters

3.2 RESPONSIBILITIES

3.2.1 Contract Task Order (CTO) Manager

The responsibilities of the CTO Manager include:

- Preparing and ensuring compliance with the SHERP.
- Coordinating with the designated Navy Technical Representative (NTR) for review and approval of SHERP.
- Providing overall supervisory control for safety and health protocols in effect for the project.
- Assigning the SSHO/Site Manager and assuring that the assigned onsite staff will enforce SHERP provisions.
- Assuring adequate resources are available for safety and health.

3.2.2 Program Safety and Health Officer

The responsibilities of the Program Safety and Health Officer include:

- Interfacing with the Site Safety and Health Officer.
- Providing senior review and approval of the SHERP.
- Developing and reviewing safety and health procedures.
- Providing technical support to the SSHO/Site Manager, particularly in the modification of site health and safety requirements.
- Approving change from initial Level D PPE fieldwork, if such changes are necessary.
- Reviewing injury and occupational illness records to ensure appropriate corrective action has been taken.

3.2.3 Site Safety and Health Officer/Site Manager

The SSHO/Site Manager will be onsite throughout the field work to ensure daily compliance with site safety and health requirements and will be responsible for handling emergency responses. The SSHO/Site Manager's responsibilities include:

- Conducting daily inspections of the site.
- Be responsible for initiating the evacuation of the work site when needed, communicating with offsite emergency responders, and coordinating activities of onsite and offsite emergency responders.
- Determine when work can continue after an emergency.
- Implementing usage of forms in Appendices.

- Implementing the SHERP.
- Conducting regularly scheduled safety and health meetings. Meetings are conducted daily during intrusive investigations, but may be less frequent during non-intrusive investigations.
- Providing an initial safety and health briefing to site workers and visitors.
- Review training and medical records prior to site work.
- Evaluating reported hazardous conditions and recommending corrective action.
- Conducting necessary monitoring.
- Establishing and ensuring compliance with site control areas and procedures.
- Supervising decontamination procedures of personnel, tools, and equipment.
- Supervising the distribution, use, maintenance, and disposal of personal protective clothing and equipment.
- Investigating and preparing incident reports as necessary.

3.2.4 Employees

Employees (including subcontractors) will be responsible for:

- Following the SHERP and applicable safety and health rules, regulations, and procedures.
- Using required controls and safety devices, including PPE.
- Notifying supervisor of suspected safety and health hazards.

- Complying with training and medical requirements.

3.3 SUBCONTRACTORS

EA's subcontractors will be required to follow this SHERP, as well as their own company's safety and health program and applicable regulations.

3.4 VISITORS

Visitors will remain in an observation area and will not be permitted to enter an exclusion zone unless they have current and appropriate OSHA training and medical monitoring, and permission of the SSHO/Site Manager.

4. SITE DESCRIPTIONS AND OPERATIONS

NASJRB is located in Horsham Township Montgomery County in southeastern Pennsylvania, approximately 15 miles northwest of Philadelphia, PA. NASJRB occupies approximately 1,000 acres that is characterized as slightly rolling terrain. NASJRB is bordered on the east boundary by PA Route 611, on the southwest by PA Route 463 and on the north by Keith Valley Road.

NASJRB's mission is to provide support for operations involving aviation and to train Navy reservists. Other tenants which utilize the installation include the U.S. Marines, the U. S. Air Force and the U. S. Army. The installation provides facilities, services, materials, and training to directly support assigned military units. Units include an antisubmarine warfare squadron, a helicopter squadron, a fleet logistics squadron and other Marine and Navy units.

4.1 INTRUSIVE TASKS

Intrusive tasks involve penetrating environmental media and include those tasks which involve direct contact with contaminated media.

- drilling and installation of wells via hollow steam auger and air rotary drill,
- soil sampling during well installation,
- ground water sampling, and
- the potential for soil sampling via geoprobe®.

The potential for exposure to hazardous materials is increased under these situations.

4.2 NONINTRUSIVE TASKS

Nonintrusive tasks do not involve penetrating environmental media and include those tasks where there is no, or a low, potential for worker exposure to chemical hazards because those activities involve minimal or no contact with contaminated media. These types of tasks include, but are not limited to, daily inspections, surveying and site touring.

5. HAZARD COMMUNICATION PROGRAM

5.1 HAZARD COMMUNICATION

The SSHO/Site Manager will conduct regularly scheduled safety meetings with site workers to review the planned activities, since these activities and workers may change over the duration of the project. The objective of instituting a Hazard Communication Program is to ensure that hazards associated with the site and with chemicals brought onsite by EA or subcontractors are evaluated, and that information concerning these hazards is transmitted to site employees. Site personnel include EA and subcontractor employees, manufacturer's representatives, government employees (i.e., Navy, EPA, State, or local agency employees), and other workers who observe or perform services in the work area. Employee awareness of chemical identities, health and physical hazards, properties, and characteristics is essential to safely handle chemicals and to minimize potential hazards. The Hazard Communication Program must follow OSHA requirements listed in 29 CFR 1910.1200.

5.2 HAZARDOUS SUBSTANCE LIST

The SSHO/Site Manager will maintain a current alphabetical list of "Hazardous Substances" present onsite. The list will be updated as necessary to accurately reflect the chemicals present at the site. Examples of hazardous substances that might be present at the site include irritants, corrosives, and compressed gases.

5.3 HAZARD COMMUNICATION LABELING

The SSHO/Site Manager will ensure that containers are properly labeled and that workers know the contents of containers. Container labels will contain at least information on name of product on container, chemical(s) in product, manufacturer's name and address, protective equipment required for the safe handling of the product, and first-aid procedures in case of overexposure to product contents.

5.4 MATERIAL SAFETY DATA SHEETS (MSDS)

The SSHO/Site Manager will maintain a current alphabetical file of complete MSDS for each hazardous substance stored or used at the work sites. The file must be easily accessible to employees. Subcontractors and visitors to the workplace will be informed of the existence and location of this file. Workers and visitors will be instructed in how to read and understand the information shown on the MSDS. Subcontractors must inform the SSHO/Site Manager about hazardous substances which they bring onsite and provide MSDS.

5.5 HAZARD COMMUNICATION TRAINING

Site workers and visitors will be informed of the location of the chemical inventory and the location of the MSDS file. Prior to site work or potential exposure to hazardous substances, the employee's supervisor and SSHO/Site Manager will describe hazardous substances routinely used and provide information about:

- Nature of potential chemical hazards;
- Appropriate work practices;
- Appropriate control programs;
- Appropriate protective measures;
- Methods to detect presence or release of hazardous substances; and
- Emergency procedures.

5.6 CHEMICAL HAZARDS

Table 1 presents the exposure limits, routes of exposure, and symptoms of exposure for potential chemicals of concern.

The potential contaminants of concern for IR Site 10 were derived from the "Final Sampling and Analysis Report for the Remedial Action at the Navy Fuel Farm, NASJRB, Willow Grove, Horsham Township, PA" by EA Engineering, Science, and Technology dated 11 June 1998. This report contained the analytical results for the soil samples collected on 2-16 March 1989, 1989, April 1991, 4 September 1997, and 8 September 1997; ground-water samples collected on 10-21 June 1993 and 8 September 1997. These results along with the recent sampling results (2000 January-December) of influent samples of the remediation system at the Fuel Farm were

compared to the current (11/24/2001) conservative Medium-Specific Concentrations (MSCs) for the appropriate media. The MSCs are referred to as the statewide health standards established under Act II. The constituents that are above the current MSCs are shown in Table 1 and are considered the potential contaminants of concern. Please note no soil samples were found above the current MSCs. The potential contaminants of concern for Site 10, the fuel farm area are shown in Table 1. In addition, benzene, ethylbenzene, toluene, and xylene are potential contaminants of concern for Site 11.

Dermal irritation from contaminants within the soil will not occur on a normal basis. Gloves will be worn when needed to prevent skin contact and decontamination procedures such as washing with water and soap will be implemented. A skin irritation must be reported to your supervisor and monitored. If skin irritations are common within an area, work will stop and reevaluation of the work area will be performed by the SSHO/Site Manager.

Accidental ingestion of soil may occur within the work area. In order to prevent contamination by ingestion the following will be enforced: no smoking will be allowed and employees will wash their hands before eating and before pursuing other activities.

Dust will be controlled through normal practices such as wetting exposed dry surfaces. If dust cannot be controlled, there will be a stoppage of work to modify the SHERP.

5.7 PHYSICAL HAZARDS

Many physical hazards will potentially be present during field activities. These physical hazards may include, but may not be limited to:

- General safety hazards
- Airfield hazards
- Fire/explosion hazards
- Heavy equipment hazards
- Vehicle and pedestrian hazards
- Noise hazards
- Electrical hazards
- Utility hazards
- Weather hazards

- Drilling/Geoprobe® hazards
- Heat stress
- Cold stress
- Material Handling/Moving/Lifting

5.7.1 General Safety Hazards

This SHERP includes a hazard analysis for the hazards most likely to be present at IR Sites 10 and 11. The sites will be visually inspected for the presence of general safety hazards (e.g., trip/slip hazards, unstable surfaces or steep grades, sharp objects) prior to beginning work. If hazards are present, these hazards will be recorded and precautionary measures will be taken to prevent injury.

5.7.2 Airfield Hazards

Prior to the commencement of work, EA will contact the NASJRB Airfield Division number at 215-443-6193 to schedule a 1-hour airfield safety briefing. NASJRB will provide radios to field personnel while performing field activities in the airfield area.

5.7.3 Fire/Explosion Hazards

The potential for fire and/or explosion emergencies might be present. Workers must continuously monitor the work area for combustible or explosive gases when operations have the potential to generate sparks. Employees should always be alert for unexpected events, such as ignition of chemicals or sudden release of materials under pressure, and be prepared to act in these emergencies.

Field vehicles will be equipped with a fire extinguisher. Employees must be trained in the proper use of fire suppression equipment. However, large fires that cannot be controlled with fire extinguishers should be handled by professionals. The proper authorities should be notified in these instances.

5.7.4 Heavy Equipment Hazards

The use of heavy equipment (e.g., drill rigs, generators, etc.) may pose safety hazards to site workers. Heavy equipment work must be conducted only by trained, experienced personnel. If possible, personnel must remain outside the turning radius of large, moving equipment. At a minimum, personnel must maintain visual contact with the equipment operator. Heavy equipment will be equipped with backup alarms. No guards, safety appliances, or other devices may be removed or made ineffective unless repairs or maintenance are required, and then only after power has been shut off and locked out. Personnel must be aware of rotating equipment and will not wear loose clothing or jewelry that could be entangled in equipment. Long hair will be covered or tied back when working around rotating equipment. Safety devices must be replaced once repair or maintenance is complete. Exhaust from equipment must be directed so that it does not endanger workers or obstruct the view of the operator. When not operational, equipment must be set and locked so that it cannot be activated, released, dropped, etc.

5.7.5 Vehicle and Pedestrian Hazards

Vehicle traffic or pedestrians, particularly in busy areas, may be susceptible to site hazards or may present a hazard to site workers. Equipment must be located in an area that does not present a hazard to bystanders. Barriers must be used to separate the work areas from both vehicular and pedestrian traffic areas and to prevent inadvertent entry into the work area. When possible, work in high traffic areas will be performed when traffic is minimal. Safety cones (with a minimum height of 28 in.) will be placed around the work area to create a buffer zone. Workers should wear safety vests or reflective material to enhance visibility in these areas. The buffer zone will be maintained even when work is not being performed in the area to prevent unauthorized access and to make the work site visible.

5.7.6 Noise Hazards

Work around heavy equipment often creates excessive noise. Noise can cause workers to be startled, annoyed, or distracted; can cause physical damage to the ear, pain, and temporary and/or permanent hearing loss; and can interfere with communication. If workers are subjected to noise exceeding an 8-hour time-weighted average sound level of 85 dBA (decibels on the A-weighted

scale), hearing protection will be selected with an appropriate noise reduction rating to comply with 29 CFR 1910.95 and reduce noise levels to or below the permissible values.

5.7.7 Electrical Hazards

Although interference from overhead power lines, electrical wiring, electrical equipment, and buried cables are not anticipated, employees should be aware of the risk of electric shock, burns, muscle twitches, heart fibrillation, and other physical injuries, as well as fire and explosion hazards. Workers will take appropriate protective measures when working near live electrical parts, including inspection of work area to identify potential spark sources, maintenance of a safe distance, proper illumination of work areas, provision of barriers to prevent inadvertent contact, and use of nonconductive equipment. If overhead lines are encountered and cannot be de-energized prior to the start of work, a 10-ft distance must be maintained between overhead energized power lines with a voltage of 50 kV and elevated equipment parts. This distance will be increased 4 in. for every 10 kV greater than 50 kV. For example, workers must maintain a distance of 11.7 ft from energized power lines with a voltage of 100 kV. Field electrical equipment must be used with a ground fault circuit interrupter (GFCI) system, or an assured grounding program must be implemented as required in 29 CFR 1926.405.

5.7.8 Utility Hazards

Underground utilities pose hazards to workers involved in intrusive operations. These hazards include electrical hazards, explosion, and asphyxiation, as well as costly and annoying hazards associated with damaging communication, sewer, and water lines. Prior to commencement of intrusive operations, underground utilities, including buried wires, pipes, tanks, etc., must be visibly marked by NASJRB with flags or marking paint to alert workers of areas unsafe for digging/excavating. Document contacts with utility personnel. Personnel should be aware that although an area may be cleared, it does not mean that unanticipated hazards will not appear.

Workers should be alert for unanticipated events such as snapping cables, drilling into unmarked underground utilities, drilling into a heavily contaminated zone, etc. Such occurrences should prompt involved individuals to halt work immediately and take appropriate corrective measures to gain control of the situation.

5.7.9 Weather Hazards

Weather conditions should always be taken into consideration. Heavy rains, electrical storms, high winds, and extreme temperatures, for example, may create extremely dangerous situations for employees. Equipment performance may also be impaired because of inclement weather. Whenever unfavorable conditions arise, the SSHO/Site Manager will evaluate both the safety hazards and ability of the employees to effectively perform given tasks under such conditions. Activities will be halted at their discretion.

Wind direction should be accounted for when positioning equipment at sampling locations. If exposure to organic vapors is anticipated, workers should locate upwind of sampling point. Wind direction often changes abruptly and without warning, so personnel should always be prepared to reposition, if necessary.

5.7.10 Drilling/Geoprobe® Hazards

The geoprobe® hazards mentioned in this section are based on contingency that additional sampling may occur at Site 11. The selection of locations for each drilling/geoprobe® activity will take into account buried utility pipes, wires, conduits, and tanks, or other potentially dangerous structures. Overhead power lines and obstructions will also be surveyed. Prior to raising the mast, the area overhead and surrounding the rig will be checked by the drilling foreman and the SSHO/Site Manager. When positioning near electric lines, refer to the section on Electrical Hazards.

When rotary drilling/sampling, drill rods will not be racked more than 1.5 times the height of the mast. During drilling operations and rig setup and takedown, persons who enter the Exclusion Zone will wear hard hats, safety shoes/boots, and safety glasses to protect personnel from the physical hazards.

If during drilling/ geoprobing® there is an indication that underground tanks, drums, or other containers are being encountered, the drill rig/geoprobe® will be halted immediately and the SSHO/Site Manager shall notify the CTO Manager and Program Safety and Health Officer. Indications that a waste container may have been encountered during drilling include (1) change in the speed or momentum of the auger, (2) visual examination of auger cuttings, (3) odor noted

in the cuttings, and/or (4) the presence of airborne total volatile organics as measured with a direct-reading instrument.

Work around drilling equipment also involves basic safety hazards (e.g., snapping cables, slings, ropes, moving heavy equipment, slip and trip hazards, etc.). Accidents may include head injuries from falling tools and equipment, hand and feet injuries due to moving equipment, and crushing injuries from unstable equipment or careless moving of equipment. If possible, personnel must remain outside the turning radius of large moving equipment. If this is not feasible then, at a minimum, personnel must maintain visual contact with the equipment operator at times when equipment is active.

5.7.11 Heat Stress

Personnel, especially those in impermeable clothing, should be familiar with the signs and symptoms of heat stress, including:

- Heat exhaustion—dizziness, light-headedness, slurred speech, rapid pulse, confusion, fainting, fatigue, copious perspiration, cool skin that is sometimes pale and clammy, and nausea.

- Heat stroke—hot, dry, flushed skin, delirium, and coma (in some cases). Heat stroke is a life-threatening event and requires immediate medical attention.

Some preventive measures to avoid heat stress include:

- Frequent resting in cool or shaded areas.
- Consumption of large quantities of fresh potable water or dilute electrolyte beverages.

Heat stress monitoring will be conducted in a manner that anticipates and prevents the onset of heat stress symptoms [i.e., wet-bulb globe temperature monitoring (WBGT) coupled with work-rest regimens]. If the WBGT Index is used and semi-impermeable or impermeable clothing is worn, the WBGT Index will be lowered, as appropriate. Unacclimatized workers should be closely observed, and workers wearing full-body chemical protective clothing will be monitored when the work area temperature is greater than 70°F; the worker's heart rate will be measured at the start of a rest break, and the work period length will be decreased, if required. When

required, the work period should be decreased so that after 1 minute of rest, a worker's heart rate (HR) does not exceed 110 beats per minute. A suggested work-rest regimen is:

Ambient Temperature	Work	Rest
70°F	3 hours	15 min.
75°F	2½ hours	15 min.
80°F	2 hours	15 min.
85°F	1½ hours	15 min.
90°F	1 hour	15 min.
95°F	½ hour	15 min.

If a worker's HR is greater than 110 beats per minute, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the HR is 110 beats per minute at the beginning of the next rest period, the following work cycle should be shortened by 33 percent. When ambient temperatures are expected to exceed 85°F, resting HRs of each worker should be measured prior to start of onsite activities.

Other factors, such as a worker's acclimatization, level of physical fitness, and age, may increase or decrease his/her susceptibility to heat stress. Before assigning a task to an individual worker, these factors should be taken into account to ensure that the task will not endanger the worker's health.

If heat stress is suspected or observed, the affected person must be moved to a cool or shaded area and given plenty of liquids to consume. If symptoms of heat stroke are observed, the victim will be transported to the hospital immediately.

5.7.12 Cold Stress

Cold stress hazards are most likely to occur at low temperatures or low wind chill factors, with wet, windy conditions also contributing to risks. Cold exposure and hypothermia are possible during field activities. Workers should be familiar with the signs and symptoms of cold stress. Hypothermia is a cold-induced decreasing of the core body temperature that produces shivering, numbness, drowsiness, and muscular weakness. Frostbite is a constriction of blood vessels in the extremities, which limits the supply of warming blood. Symptoms of frostbite are white or grayish skin, blisters, numbness, mental confusion, failing eyesight, fainting, shock, and cessation of breathing. As a precautionary measure, employees should wear insulated coveralls,

head covering, and boots when temperatures fall below 40°F, including wind chill. Bare skin contact with cold surfaces (below 20°F) must be avoided. Table 2 presents the cooling power of wind on exposed flesh expressed as equivalent temperatures.

A temperature-dependent work regimen limiting lengthy periods of outdoor activity may be necessary. Table 3 gives the threshold limit values work/warm-up schedule for a 4-hour shift. Workers entering heated shelters should remove the outer layer of clothing and loosen remaining clothing to permit sweat evaporation. Dehydration must be avoided by drinking water, warm drinks, or soups.

5.7.13 Material Handling/Moving/Lifting

Materials handling at hazardous waste sites can vary from heavy equipment handling to manually moving/lifting items. Hazards associated with materials handling include physical injury, detonation, fire, explosion, and vapor generation among others.

Injuries to back and abdominal muscles from improperly lifting of loads are the most common occupational injuries reported. Such injuries can range from relatively mild strains to major, permanently disabling injuries. Before lifting a load, personnel will consider the overall weight, distribution of weight, awkwardness of the load, distance to be carried, obstacles to be negotiated, site conditions, and visibility.

When using equipment to move materials, proper work practices will be followed. Equipment used will be designed for the task to be performed. Equipment will be inspected regularly by the SSHO/Site Manager, and damaged or defective equipment will be removed from service. Planning is critical when handling materials. The SSHO/Site Manager will plan where the materials are to be moved, taking into consideration the current location of such materials and hazards associated with moving them. Routes for moving materials will be clearly outlined, with paths cleaned of obstructions so materials may be transported.

Loads will be lifted using the power of the leg muscles rather than the back, stomach, or arm muscles. The item will be approached to balance the load evenly. Backs will be kept straight and the arms nearly parallel with the body. The knees will be bent to grasp the load. Lifting will be done by straightening the legs without bending the body, holding the load as close to the body as possible and the back remaining as straight as possible.

Bulky, heavy loads will be handled by at least two people, ensuring that the load is level and evenly distributed between personnel helping to carry it. Carriers will know the destination and path for the load.

5.8 BIOLOGICAL HAZARDS

Poisonous Plants

Poisonous plants, such as poison ivy, might be present at NASJRB Willow Grove. Personnel should know how to recognize these plants and avoid them. If contact occurs, the affected areas must be washed with soap and water immediately.

Insect Bites/Stings

Protective outer clothing such as gloves, hard hats, and coveralls can reduce the potential for insect bites and stings. Insect bite symptoms may include redness, rash, swelling, chills, fever, diarrhea, and vomiting. A worker who has been bitten or stung and shows symptoms of a severe reaction should seek medical assistance immediately. Workers who know of their allergies to insects should advise their employer prior to field activities and should carry an antidote kit, if necessary.

To prevent contact with disease-carrying ticks, workers should wear long-sleeved shirts, long pants, and boots that extend above the ankle with pants cuffs taped to boots. Workers should thoroughly check clothing, skin, and hair for the presence of ticks at the end of each work day. If a tick attaches to the body, it should be removed by gently tugging with tweezers where the mouth parts enter the skin. The tick should not be killed prior to removal.

6. EMPLOYEE TRAINING AND MEDICAL SURVEILLANCE

6.1 EMPLOYEE TRAINING

A record of current training for site workers will be available onsite. Personnel who do not meet the following training requirements are prohibited from engaging in hazardous waste site operations within the exclusion and contamination-reduction zones:

Site Workers:

- Forty (40) hours of Initial Offsite Hazardous Waste Operations Training and 3 days onsite training under the direct supervision of a more experienced site worker.
- If more than 12 months have passed since initial training, an 8-hour Annual Refresher Training must be completed.

Site Manager: Above requirements for site workers, plus a one-time 8-hour Supervisor's Hazardous Waste Operations Training.

First Aid/CPR: At least one onsite worker must be currently certified in both first aid and Cardiopulmonary Resuscitation (CPR) by the American Red Cross or equivalent organization. First aid training must be updated every 3 years and must include the bloodborne pathogen training; CPR training must be updated annually.

Subcontractors: Prior to mobilization onsite, the CTO Manager must obtain a written list of subcontractor personnel to be present onsite and written certification that the workers meet the training requirements summarized above. A record of their training will be available onsite.

Visitors: Authorized visitors will not be permitted to enter areas where they may be exposed to hazardous substances if they do not meet the training requirements summarized above.

Pre-Entry Briefing: The SSHO/Site Manager must brief workers and visitors on the potential hazards of the site and the protective measures to be implemented.

6.2 MEDICAL SURVEILLANCE

A record of current medical examination records for site workers will be available onsite.

The medical surveillance program is under the direction of a physician who is Board Certified in Occupational Medicine. Medical examinations and consultations will comply with the protocols of 29 CFR 1926.65 and will be provided according to the following schedule:

- Prior to field work assignment.
- At least annually (or biennially with the occupational physician's approval) for employees covered by the program.
- At termination of employment or reassignment to an area where the employee had not been examined within the past 6 months.
- As soon as possible after the development of signs or symptoms that may indicate an overexposure to hazardous substances or health hazards.
- More frequently if the physician deems such examination necessary to maintain employee health.

The records will be complete and accurate and be kept on file for at least 30 years after termination of employment. A minimum of the following information will be kept:

- Name and social security number.
- Physician's written opinions, recommendations, limitations, and test results.
- Employee medical complaints related to hazardous waste operations.
- Information provided to the physician by the employee concerning possible exposures, accidents, etc.

Subcontractors must provide medical surveillance information in writing to the CTO Manager for their workers prior to mobilization onsite.

7. PERSONAL PROTECTIVE EQUIPMENT

7.1 GENERAL PPE REQUIREMENTS

Personnel will be equipped with proper PPE for the tasks they are asked to perform. The SSHO/Site Manager will distribute PPE to EA employees and will also train employees in proper use and disposal. Subcontractors are responsible for providing proper PPE for their own employees.

Should PPE fail during use, the affected person must leave the exclusion zone immediately and replace or repair failed PPE. This person is not permitted to re-enter the exclusion zone until the problem has been rectified.

7.2 LEVELS OF PPE

The level of PPE for the work performed on the sites will be level D. If an upgrade of PPE is needed, work will stop and this SHERP will be revised to include the changes in PPE. Engineering controls and work practices will be used where feasible to minimize potential hazards. The components of level D PPE are listed below.

7.2.1 Level D PPE

Level D protection will be the minimum protection used for field operations. The following are the minimum requirements for Level D:

- Steel-toe, steel-shank safety shoes/boots.
- Boot covers (optional).
- Hard hat (when overhead hazards are present) that meets ANSI Standard Z89.1-1986.
- Chemical-resistant gloves when contact with potentially contaminated soil or water is expected.
- Leather work gloves (as needed).

- Safety glasses (when flying particles or splash hazards are present).
- Hearing protectors (when noise hazards are present).
- Face shield (when operating steam cleaner).
- Coveralls (as appropriate).
- Poly-coated coveralls (when splash hazards are present or contact with heavily contaminated soil/water is expected).

8. ENVIRONMENTAL MONITORING

8.1 ENVIRONMENTAL MONITORING AND ACTION LEVELS

Task-specific environmental monitoring requirements are summarized below, including the type of monitoring to be performed, the frequency and location of monitoring, action levels, and required responses if action levels are detected. Nonintrusive tasks generally do not require monitoring. Only personnel trained in proper use and calibration of the instruments may use the instruments.

This section summarizes minimum requirements, which may be upgraded on a site-specific basis.

Work Task	Monitoring Instrument	Frequency and Locations
Boring	Combustible Gas Indicator (CGI)	Initially and every 10 minutes during soil disturbance. Measure at the surface of the hole.
	Photoionization Detector (PID)	Initially and every 10 minutes during soil disturbance. Measure breathing zone.
Soil sampling	PID	Initially and every 10 minutes during sampling. Measure breathing zone.

Action Levels

CGI 0-10 percent Lower Explosive Limit (LEL)—continue
10-20 percent LEL—continuous monitoring. Prepare to shut down.
>20 percent LEL—shutdown and evacuate. Contact the NASJRB Willow Grove Fire Department immediately at 215-443-6198 and contact the CTO Manager.

PID Level D—background levels
Stop Work and Revise SHERP-above background.

Action Level for Dust

Sustained (exceeding 5 minutes) visible dust in the breathing zone shall require dust suppression or work cessation.

Initial and detectable measurements must be logged on the Environmental Monitoring Report in Appendix B. If no detectable levels are measured, this must be documented on the form at least once every 30 minutes. Each exceedance of an action level must be documented on the Environmental Monitoring Report, along with the corrective action taken.

Depending upon direct reading instrument results, the SSHO/Site Manager will follow the CTO requirements and will determine whether further evaluation of employee and offsite (perimeter) exposures are required.

8.2 CALIBRATION OF MONITORING INSTRUMENTS

The calibration of each instrument must be checked according to the manufacturer's recommendations. Calibration procedures will be available in the field.

9. SITE CONTROL

9.1 WORK ZONES

Work zones will be established in the field in accordance with the following:

- **Exclusion Zone (EZ)**—This area has either known or potential contamination and has the highest potential for exposure to chemicals onsite. Persons who enter the EZ must wear the appropriate level D of PPE for the degree and types of hazards present at the site. The EZ zone will extend to approximately 25 ft surrounding the boring.

- **Contamination Reduction Zone (CRZ)**
  The purpose of the CRZ is to reduce the possibility that the Support Zone (SZ) will become contaminated or affected by the site hazards. Because of both distance and decontamination procedures, the degree of contamination in the CRZ generally will decrease as one moves from the hotline to the SZ. The CRZ will be established by the SSHO.

  The CRZ should be established outside the areas of known or potential contamination.

- **Support Zone**—Uncontaminated area and may include site vehicles.

  The SZ is the uncontaminated area where workers are unlikely to be exposed to hazardous substances or dangerous conditions.

  Potentially contaminated clothing, equipment, and samples must remain outside the SZ until decontaminated. The SZ should be upwind and as far from the EZ as practicable.

Level D will be the minimum protection in the EZ. The CRZ will require a minimum Level D. No specific PPE requirements are needed in the support zone, as contaminated materials are prohibited from being stored in this area.

Only authorized personnel will be permitted in the EZ and the CRZ. Entering these zones will require donning the required PPE prior to entry.

Exiting the EZ will require going through decontamination in the CRZ.

Safe work practices to be followed by site workers include:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited in the Exclusion and Contamination Reduction Zones.
- Hands and face must be thoroughly washed upon leaving the work area.
- Prescription drugs must not be taken by personnel unless specifically approved by a licensed physician who is familiar with the issues of worker exposure to hazardous materials.
- Personnel onsite must use the buddy system; visual contact must be maintained between team members.
- Work is allowed during daylight hours only.
- If dust is being visually generated in the Exclusion Zone, the SSHO/Site Manger will advise on procedures for misting or wetting the soil to prevent possible exposure from inhalation of soil contaminants.
- Possessing, using, purchasing, distributing, selling, or having controlled substances in your system during the work day, including meal or break periods onsite, is strictly prohibited.
- The use or possession of alcoholic beverages onsite is prohibited. Similarly, reporting to work or performing one's job assignments with excessive levels of alcohol in one's system will not be permitted.

9.2 DECONTAMINATION PROCEDURES

9.2.1 Personnel Decontamination

Remove and discard boot covers, if worn. Scrape soil from boots and wipe off dust with moist cloth or paper towel. Remove outer gloves and coveralls. Remove and discard inner gloves, if worn. Wash hands, face, and other exposed skin with soap and water. Soap and water for decontamination must be on site during activities. Shower and shampoo as soon as possible at the end of the work day, before dining or social activities. Place nondisposable coveralls in plastic bags prior to leaving the site and prior to entering a vehicle. Launder non-disposable clothing worn in the exclusion zone prior to reuse, separately from other laundry items.

9.2.2 Equipment Decontamination

Wet-wipe equipment used onsite with clean water prior to leaving the site.

9.2.3 Waste Disposal Procedures

The disposal of investigation-derived waste (IDW) will be in accordance with EPA, State, and Navy requirements. IDW includes soil cuttings, drilling muds, purged ground water, decontamination fluids, and disposable PPE.

12. EMERGENCY RESPONSE PLAN

12.1 EMERGENCY RECOGNITION

Prior to work startup, personnel will become familiar with this emergency response plan. The SSHO/Site Manager will make this plan available for review and photocopying. Employees should also become familiar with the location of telephones, emergency medical facilities, and water supplies near work areas. Regular rehearsals of emergency response procedures are highly recommended.

In emergency situations, involved personnel will stop work immediately, evacuate the exclusion zone, and report to the SSHO/Site Manger for further assistance and instructions. Emergency situations will be handled by offsite support personnel; however, initial response and first aid will be available by qualified onsite personnel.

The following should be considered emergency situations:

- Medical emergency
- Heavy equipment accident
- Overexposure of personnel to onsite contaminants
- Cold-related injury/hypothermia
- Heat-related illness
- Discovery of unanticipated hazard (e.g., drums, underground utilities, heavily contaminated materials)

In case of a hazardous materials emergency, the SSHO/Site Manager will assume full control of the situation until the arrival of emergency responders. The SSHO/Site Manager will work with emergency response teams to identify and evaluate hazards. Emergency responses and communications will be coordinated and controlled through the onsite Incident Commander, who will be designated by the emergency responders.

12.2 PROCEDURES FOR HANDLING EMERGENCIES

In the event of an emergency, the information available at the time will be properly evaluated and the appropriate steps taken to implement the emergency response plan. The Site Manager will assume command of the situation and will call the appropriate emergency services, evacuate personnel as needed, and take other steps needed to gain control of the emergency.

The following information will be given when reporting an emergency:

1. Name and location of person reporting.
2. Location of accident/incident.
3. Name and affiliation of injured party.
4. Description of injuries, fire, spill, or explosion.
5. Status of medical aid and/or other emergency control efforts.
6. Details of chemicals involved.
7. Summary of accident, including suspected cause and time it occurred.
8. Temporary control measures taken to minimize further risk.

This information should only be disclosed to the SSHO/Site Manager, and proper authorities. Once emergency response agencies have been notified, the CTO Manager, Program Manager, and Contracting Officers Technical Representative (COTR) will be notified immediately.

12.3 MEDICAL EMERGENCIES

Personnel should always be alert for signs and symptoms of illnesses related to chemical, physical, and disease factors onsite. Severe injuries resulting from accidents and chemical overexposures will be recognized as emergencies and treated as such. One person currently trained in first aid (including bloodborne pathogen training) and CPR will be present onsite.

If a medical emergency occurs, the SSHO/Site Manager will announce the emergency, upon which work will stop and personnel will move to the decontamination area. Personnel with current first aid training will evaluate the injury or illness and determine its severity. Victims will be decontaminated prior to administering first aid (as long as this can be done without further injuring the victim). First aid should only be performed to limit further injury or stabilize

the victim. Personnel are not to move or transport victims unless doing so does not pose an immediate threat to their life, or if timely response of emergency medical services is impossible due to the remoteness of the site.

First aid equipment will be available at the following locations:

- First aid kit: field vehicle
- Fire extinguisher: field vehicle
- Eye wash: field vehicle meeting the requirements of ANSI Z358.1-1990

The SSHO/Site Manager will complete an Accident Investigation Report and submit it to the CTO Manager and Program Manager. See Appendix C for accident report forms. The Program Manager will submit the report to the COTR within 24 hours of the following types of incidents:

- Job-related injuries and illnesses.
- Accidents resulting in significant property damage.
- Accidents involving vehicles and/or vessels.
- Accidents in which there may have been no reportable injury or property damage, but which have a high probability of recurring with at least a moderate risk to personnel or property.

An accident that results in a fatality or in the hospitalization of three or more employees will be reported within 8 hours to the U.S. Department of Labor through the EA human resources representative. Subcontractors are responsible for notification of accidents involving their employees.

12.4 FIRE/EXPLOSION EMERGENCIES

Fire and explosion will be immediately recognized as an emergency. Although vehicles will be equipped with fire extinguishers, only small fires should be suppressed in this manner. In cases of larger fires, personnel should be evacuated to a secure location and authorities should be notified as soon as possible. Only persons trained in fire suppression/fire control should attempt to handle large fires. The necessary steps should then be taken to prevent or limit injury. The CTO Manager will be notified as soon as possible and, once control of the situation has been regained, will specify proper cleanup activities. Personnel will remain outside of the incident area until the area is deemed safe by the SSHO/Site Manager.

12.5 EMERGENCY TELEPHONE NUMBERS

The following list of emergency telephone numbers will be verified prior to starting work and placed in the glove compartment of field vehicles. In the event of a life threatening emergency, contact the NASJRB Clinic at 215-443-1911 and the 911 emergency service.

NASJRB Security:	(215) 443-6067
	(215) 443-6071
NASJRB Fire:	(215) 443-6198
NASJRB Emergency:	(215) 443-1911
NASJRB Airfield (call prior to working in airfield)	(215) 443-6193
Hospital (hospital location is shown in Appendix D):	
Abington Hospital	(215) 659-4513
2510 Maryland Road	
Willow Grove, PA 19090	
Northern Division Activity Coordinator:	
Jim Colter	(610) 595-0567, ext. 163
NASJRB On-Scene Coordinator:	
Jim Edmond	(215) 443-6939

CTO Manager:	
Katherine Sheedy	(302) 325-3560 ext. 109 (work)
	(302) 368-0438 (home)
Program Safety and Health Officer:	
Kris Hoiem, CIH	(410) 771-4950 ext. 5149 (work)
	(410) 357-5485 (home)
Program Manager:	
Ken Kilmer	(410) 584-7000 ext.2471
EA Medical Services:	
Health Resources	(800) 350-4511
EA Corporate Medical Director:	
Dr. Jerry Berke(Health Resources)	(781) 935-8581
In case of spill:	
NASJRB Fire	(215) 443-6198
Katherine Sheedy	(302) 325-3560
In case of accident or exposure:	
NASJRB Fire	(215) 443-6198
Kris Hoiem, Program	(410) 771-4950 ext. 5149 (work)
Safety and Health Officer	(410) 357-5485 (home)
Poison Control Center:	(800) 822-9761
National Response Center:	(800) 424-8802

TABLE 1 SUMMARY OF POTENTIAL CHEMICALS OF CONCERN

Compound	PEL or TLV	IDLH	Physical Description	Route of Exposure	Symptoms
Toluene	50 ppm	500 ppm	Colorless liquid with a sweet, pungent, benzene-like odor	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; lassitude(weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomia; paresthesia; dermatitis; liver, kidney damage
Benzene	1 ppm	Ca 500 ppm	Colorless to light-yellow liquid with an aromatic odor (Note: a solid below 42 degrees F)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; (potential occupational carcinogen)
Naphthalene	10 ppm	250 ppm	Colorless to brown solid with an odor of mothballs. (Note: Shipped as a molten solid)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatits, optical neuritis, corneal damage
Total Xylenes	100 ppm	900 ppm	Colorless liquid with an aromatic odor.	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis
Ethylbenzene	100 ppm	800 ppm	Colorless liquid with an aromatic odor.	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma

TABLE 1 (continued)

Compound	PEL or TLV	IDLH	Physical Description	Route of Exposure	Symptoms
1,3,5-Trimethylbenzene	25 ppm	–	Clear, colorless liquid with a distinctive, aromatic odor	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)

IDLH Immediately Dangerous to Life and Health
PEL Permissible Exposure Limit
TLV Threshold Limit Value
Ca Carcinogen

TABLE 2 COOLING POWER OF WIND ON EXPOSED FLESH AS EXPRESSED AS EQUIVALENT TEMPERATURE (UNDER CALM CONDITIONS)*

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	***LITTLE DANGER*** In < hr with dry skin. Maximum danger of false sense of security				***INCREASING DANGER*** Danger from freezing of exposed flesh within one minute.				***GREAT DANGER*** Flesh may freeze within 30 seconds.			
	Trenchfoot and immersion foot may occur at any point on this chart.											

* Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Highlighted areas show equivalent chill temperature requiring dry clothing to maintain core body temperature above 36 °C (96.8 °F) per cold stress TLV.

TABLE 3 THRESHOLD LIMIT VALUES WORK/WARM-UP SCHEDULE FOR FOUR-HOUR SHIFT*

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph wind		20 mph Wind	
° C (approx.)	° F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26 to -28	-15 to -19	(Norm. Breaks)	1	(Norm. Breaks)	1	75 min	2	55 min	3	40 min	4
-29 to -31	-20 to -24	(Norm. Breaks)	1	75 min	2	55 min	3	40 min	4	30 min	5
-32 to -34	-25 to -29	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35 to -37	-30 to -34	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38 to -39	-35 to -39	40 min	4	30 min	5	Non-emergency work should cease					
-40 to -42	-40 to -44	30 min	5	Non-emergency work should cease							
-43 & below	-45 & below	Non-emergency work should cease									

Notes:

1. Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-periods in a warm location and with extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For Light-to- Moderate Work (limited physical movement): apply the schedule one step lower. For example, at -35 C (-30 F) with no noticeable with 4 breaks in a 4-hour period (Step 5).
2. The following is suggested as a guide for estimating wind velocity if accurate information is not available:
   5 mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises newspaper sheet; 20 mph: blowing and drifting snow.
3. If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be: 1) special warm-up breaks should be initiated at a wind chill cooling rate of about 1750 W/m^2; 2) all non-emergency work should have ceased at or before a wind chill of 2250 W/m^2. In general, the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges, since windy conditions rarely prevail at extremely low temperatures.
4. TLVs apply only for workers in dry clothing.

* Adapted from Occupational Health & Safety Division, Saskatchewan Department of Labour.

APPENDIX A

SHERP REVIEW RECORD

I have read this Safety, Health, and Emergency Response Plan for this site and have been briefed on the nature, level, and degree of exposure anticipated as a result of participation in this project. I agree to conform to the requirements of this Plan.

Name	Signature	Affiliation	Date

APPENDIX B

ENVIRONMENTAL MONITORING REPORT

ENVIRONMENTAL MONITORING REPORT

INSTRUMENT:
Calibration Gas _____ Conc: _____ Span: _____

Time	Monitoring Location	Reading	Corrective Action Taken(a)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Changes in PPE Level	Work Operation	Reason For Change
_____	_____	_____
_____	_____	_____
_____	_____	_____

Comments: _____
_____
_____

(a) Corrective actions taken must be documented whenever readings at or above action levels are reached.

Recorded By: _____ Date: _____
Site Safety & Health Officer

APPENDIX C

ACCIDENT REPORT FORMS

ACCIDENT/LOSS REPORT

THIS REPORT MUST BE COMPLETED BY THE INJURED EMPLOYEE OR SUPERVISOR AND FAXED TO EA CORPORATE HUMAN RESOURCES WITHIN 24 HOURS OF ANY ACCIDENT. THE FAX NUMBER IS **(410) 771-1780**.

NOTE WHENEVER AN EMPLOYEE IS SENT FOR MEDICAL TREATMENT FOR A WORK RELATED INJURY OR ILLNESS, PAGE 4 OF THIS REPORT MUST ACCOMPANY THAT INDIVIDUAL TO ENSURE THAT ALL INVOICES/BILLS/CORRESPONDENCE ARE SENT TO HUMAN RESOURCES FOR TIMELY RESPONSE.

A. DEMOGRAPHIC INFORMATION:

NAME OF INJURED EMPLOYEE:_____
HOME ADDRESS:_____
HOME PHONE:_____ DATE OF BIRTH:_____
AGE:_____ SEX: M F
MARITAL STATUS:_____ NAME OF SPOUSE (if applicable)_____
SOCIAL SECURITY NUMBER:_____ DATE OF HIRE:_____
NUMBER OF DEPENDENTS:_____
EMPLOYEES JOB TITLE:_____
DEPT. REGULARLY EMPLOYED:_____
WAS THE EMPLOYEE INJURED ON THE JOB: Y N
PRIMARY LANGUAGE OF THE EMPLOYEE: _____

B. ACCIDENT/INCIDENT INFORMATION:

DATE OF ACCIDENT:_____ TIME OF ACCIDENT:_____
REPORTED TO WHOM: _____ NAME OF SUPERVISOR_____
EXACT LOCATION WHERE ACCIDENT OCCURRED (**including street, city, state and County**):
_____
_____

EXPLAIN WHAT HAPPENED (include what the employee was doing at the time of the accident and how the accident occurred): _____
_____
_____
_____

DESCRIBE THE INJURY AND THE SPECIFIC PART OF THE BODY AFFECTED (i.e. laceration, right hand, third finger):_____
_____
_____

OBJECT OR SUBSTANCE THAT DIRECTLY INJURED EMPLOYEE:_____

_____

NUMBER OF DAYS AND HOURS EMPLOYEE USUALLY WORKS PER WEEK:_____
IS THE EMPLOYEE EXPECTED TO LOSE AT LEAST ONE FULL DAY OF WORK?_____
DOES THE EMPLOYEE HAVE A PREVIOUS CLAIM? Y N if yes, STATUS Open Closed
WAS THE EMPLOYEE ASSIGNED TO RESTRICTED DUTY? _____

C. ACCIDENT INVESTIGATION INFORMATION

WAS SAFETY EQUIPMENT PROVIDED? Y N If yes, was it used? Y N
WAS AN UNSAFE ACT BEING FORMED ? Y N If yes, describe_____
WAS A MACHINE PART INVOLVED? Y N If yes, describe _____
WAS THE MACHINE PART DEFECTIVE? Y N If yes, in what way _____
WAS A 3RD PARTY RESPONSIBLE FOR THE ACCIDENT/INCIDENT? Y N
If yes, list Name, address and phone number_____

_____

WAS THE ACCIDENT/INCIDENT WITNESSED? Y N
If yes, list Name, address and phone number: _____

_____

D. PROVIDER INFORMATION

WAS FIRST AID GIVEN ON SITE? Y N
If yes, what type of medical treatment was given _____
PHYSICIAN INFORMATION (if medical attention was administered)
NAME:_____
ADDRESS (incl. City, state and zip):_____
PHONE:_____

HOSPITAL ADDRESS (incl. Name, address, city, state, zip code & phone)

_____

_____

WAS THE EMPLOYEE HOSPITALIZED? Y N If yes, on what date_____
WAS THE EMPLOYEE TREATED AS AN OUTPATIENT, RECEIVE EMERGENCY TREATMENT OR AMBULANCE SERVICE? _____

PLEASE ATTACH THE PHYSICIANS WRITTEN RETURN TO WORK SLIP

***NOTE* A PHYSICIANS RETURN TO WORK SLIP IS REQUIRED PRIOR TO ALLOWING THE WORKER TO RETURN TO WORK**

E. AUTOMOBILE ACCIDENT INFORMATION (complete if applicable)

AUTHORITY CONTACTED AND REPORT #_____
EA EMPLOYEE VEHICLE YEAR, MAKE AND MODEL_____
V.I.N._____ PLATE/TAG #_____
OWNER'S NAME AND ADDRESS:_____
_____
DRIVER'S NAME AND ADDRESS: _____
_____
RELATION TO INSURED:_____DRIVER'S LICENSE #_____
DESCRIBE DAMAGE TO YOUR PROPERTY:_____
_____
_____
DESCRIBE DAMAGE TO OTHER VEHICLE OR PROPERTY:_____
_____
_____
OTHER DRIVER'S NAME AND ADDRESS: _____
_____
OTHER DRIVER'S PHONE:_____
OTHER DRIVER'S INSURANCE COMPANY AND PHONE:_____
_____
LOCATION OF OTHER VEHICLE:_____
NAME, ADDRESS AND PHONE OF OTHER INJURED PARTIES:_____
_____
_____
WITNESSES

NAME:_____ PHONE:_____
ADDRESS:_____
STATEMENT:_____
_____
SIGNATURE: _____

NAME:_____ PHONE:_____
ADDRESS:_____
STATEMENT:_____
_____
SIGNATURE: _____

F. ACKNOWLEDGEMENT

NAME OF SUPERVISOR:_____
DATE OF THIS REPORT: _____ REPORT PREPARED BY:_____

I have read this report and the contents as to how the accident/loss occurred is accurate to the best of my knowledge.

Signature: _____ Date: _____
Injured Employee

I am seeking medical treatment for a work related injury/illness.

Please forward all bills/invoices/correspondence to:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

11019 McCORMICK ROAD

HUNT VALLEY, MD 21031

ATTENTION: Pat Noppenberger
HUMAN RESOURCES

(410) 584-7000

INCIDENT REPORT

THIS REPORT IS TO BE COMPLETED WHEN A NEAR MISS OCCURS THAT COULD HAVE POTENTIALLY RESULTED IN SERIOUS PHYSICAL HARM. PLEASE FAX THIS FORM TO EA HUMAN RESOURCES DEPARTMENT AT **(410) 771-1780**.

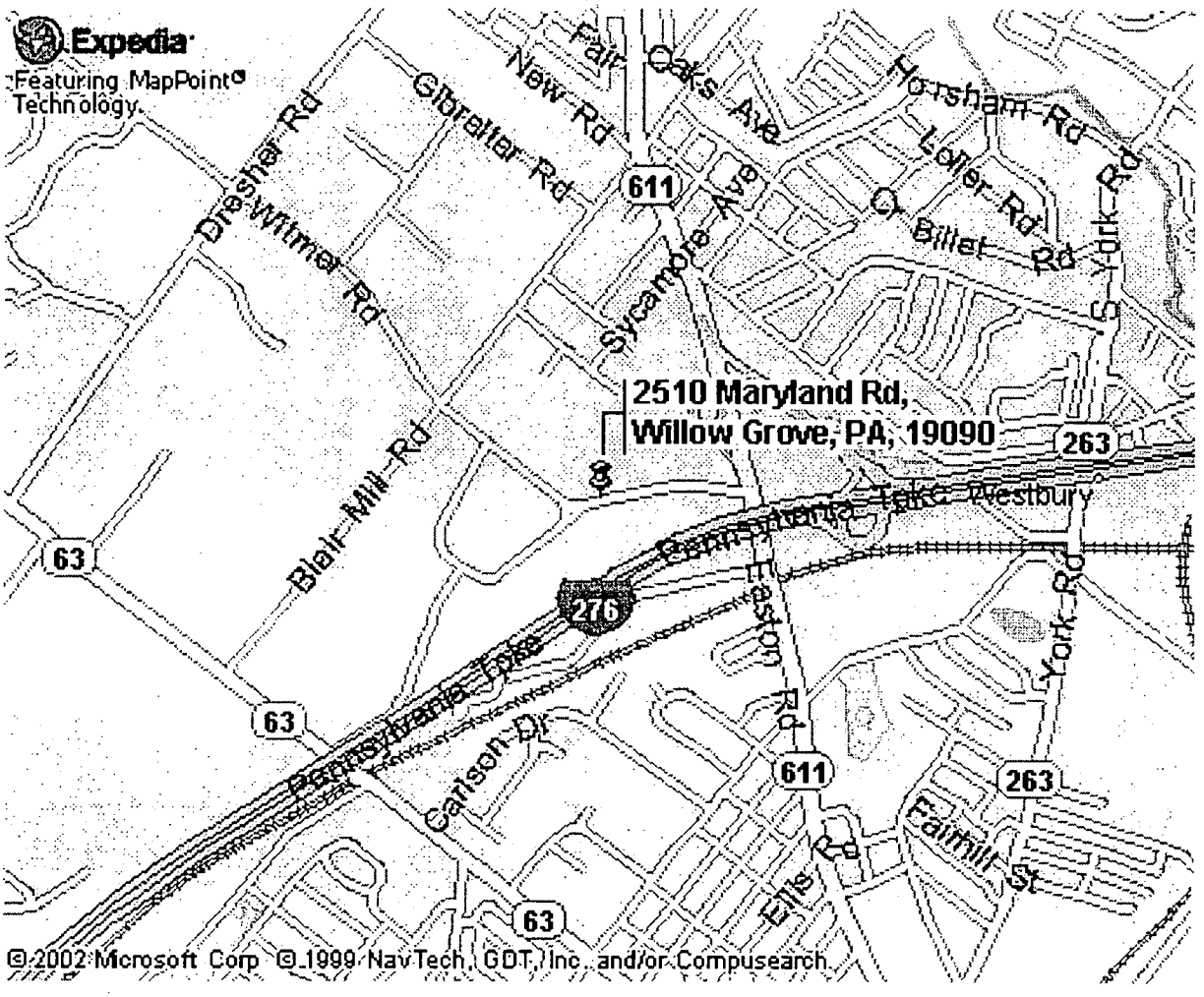
EXPLAIN WHAT HAPPENED (include what the employee was doing at the time the near miss and how it occurred:) _____

REPORT PREPARED BY: _____ DATE: _____

APPENDIX D

ROUTE TO HOSPITAL

Abington Hospital
2510 Maryland Road
Willow Grove, PA 19090
215-659-4513



FINAL

Quality Assurance Project Plan for
Installation Restoration Program Studies
Sites 10 and 11
Naval Air Station Joint Reserve Base
Willow Grove, Pennsylvania

Contract No. N62472-92-D-1296
Contract Task Order No. 0074

Katherine Sheedy
CTO Manager

3/28/03
Date

Paul Caprio, P. G.
Quality Assurance Officer

3/28/03
Date

March 2003
FINAL
EA Project No. 296.0074.5200

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1. INTRODUCTION

This Quality Assurance Project Plan (QAPP) is written in order to describe the analytical laboratory program in place which will be utilized for the collection of analytical data in support of investigations at the Installation Restoration Program (IR) Sites 10 and 11 compiled by EA Engineering, Science, and Technology, Inc. (EA) under Contract No. N62472-92-D-1296, Contract Task Order 0074.

IR Site 10 is a former Fuel Farm area where a Light Non-Aqueous Phase Liquid (LNAPL) Recovery System has been operated by EA for several years. Based on recent collected data representatives of the Navy have determined after discussions with the Pennsylvania Department of Environmental Protection, that the level of contaminants at this site may be low enough to warrant possible site closeout.

IR Site 11 is an area where soil contaminated with petroleum was discovered during past construction activities. Although some contaminated soils were removed, confirmation soil sampling was not undertaken and no evaluation of the groundwater was persued. EA will perform an investigation to determine if this once contaminated site presents and impact to the environment.

1.1 PURPOSE AND SCOPE

The QAPP has been prepared for use by EA and its subcontractors to ensure that data collected are scientifically valid and legally defensible, and to establish the field, analytical protocols, and documentation requirements that will ensure the data collected meet the needs and objectives of the NASJRB Willow Grove, PA.

This QAPP presents the policies, organizations, functions, and Quality Assurance/Quality Control (QA/QC) requirements designed to achieve all data quality goals. It further discusses the criteria and procedures that will be followed during implementation of all activities specified in the Sampling Analyses Plan (SAP).

1.2 REVISIONS

This QAPP has been written to ensure comparability in data quality for all analytical contractors. The QAPP is a dynamic document and should be revised or updated to reflect any changes in

organization and procedures needed to meet the Data Quality Objectives (DQOs). Whenever revisions are made or addenda added to the QAPP, a document control system shall be put into place to assure (1) all parties holding a controlled copy of the QAPP shall receive the revisions/addenda and (2) outdated material is removed from circulation. The distribution list for controlled copies follows the title page of this QAPP. The document control system does not preclude making and using copies of the QAPP; however, the holders of controlled copies are responsible for distributing additional material to update any copies within their organizations.

1.3 PROJECT MANAGEMENT

This project will be managed through an organized effort of scientific and engineering personnel and technical resources to perform multiple tasks at the NASJRB, Willow Grove, Pennsylvania. There are 2 sites identified at NASJRB. Currently, these two sites are being investigated to determine if they can be closed out under Pennsylvania Act II Regulations.

In order to meet the data collection objectives, each field investigation will employ field procedures, sampling techniques, and analytical methods specified in site-specific work plans and in this Quality Assurance Project Plan (QAPP). Field and project activities will be performed by EA personnel who will also supervise any subcontractors needed for the project. EA will direct the field activities, including subcontractors who may be working on the site. All analytical work will be performed by Lionville Laboratory, Inc. of Lionville, PA.

1.3.1 Key Personnel and Responsibilities

EA's project team has been selected and organized to provide the technical expertise, field supervision, and management support needed to ensure that execution of the investigation is successful, efficient, and safe. Key personnel and responsibilities are described in the individual work plans for each specific task.

1.3.2 Lionville Laboratory

The objective of the QAPP is to provide analytical data that are valid and defensible and that meet the user's needs. Accordingly, the management of Lionville Laboratory encourages excellence in analytical testing and provides the necessary resources and environment. The laboratory quality assurance guidelines are included within this QAPP and identify the policies,

organization, objectives, functional activities, and specific activities designed to achieve the desired quality goals set forth by the laboratory for this project.

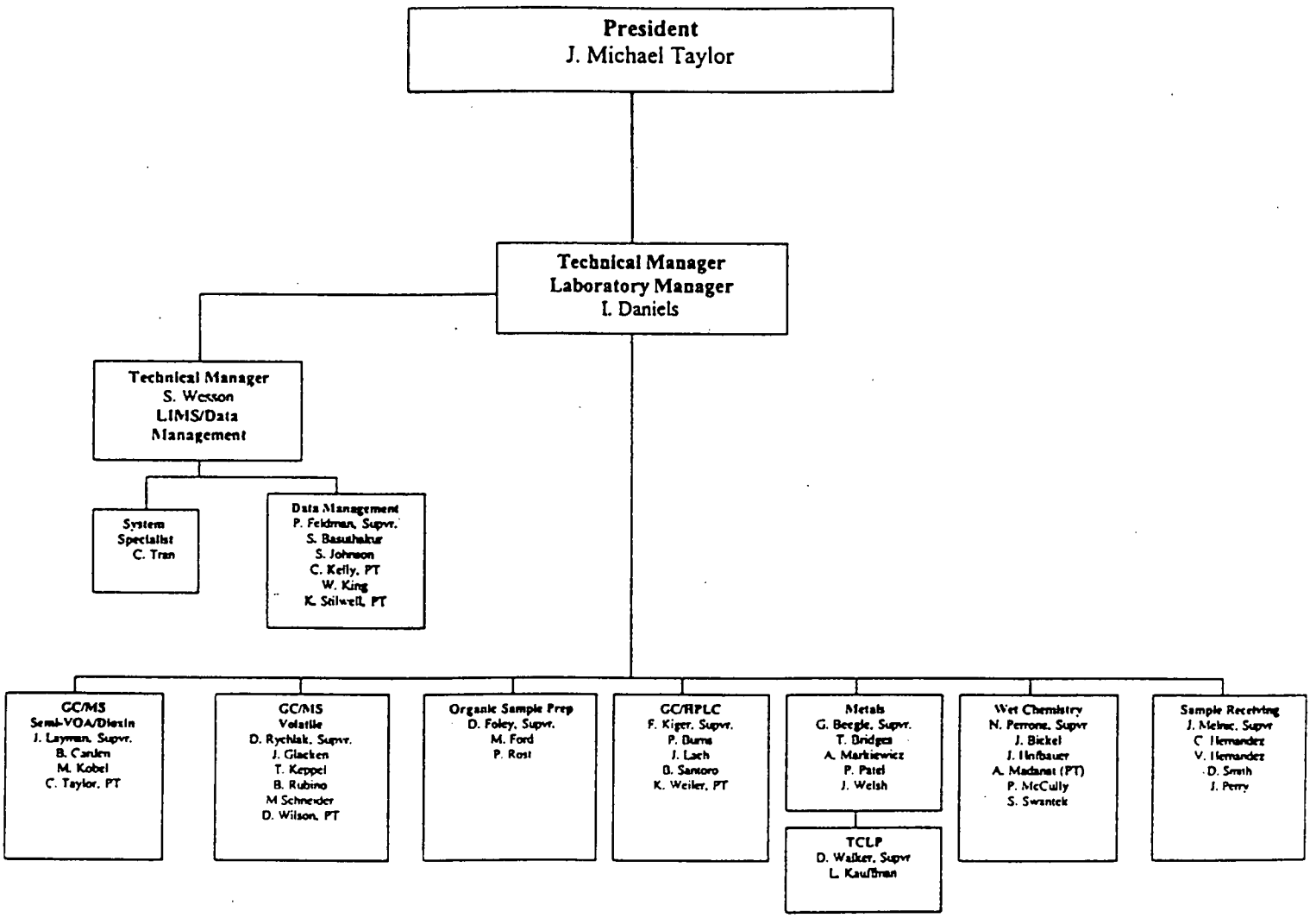
The organizational positions of Lionville Lab personnel are shown on Figure 1-1. The Technical Director, Dr. C. P. Nulton, ensures the laboratory data quality through interactive management and support of the quality program, and is responsible for all operational and support activities within Lionville Laboratory to ensure client satisfaction with laboratory performance in all areas of concern, including service, data quality, deliverables, and on-time delivery. C. Schrenkel is the laboratory's Quality Services Manager, and oversees the development of the Quality Assurance Program. Through the maintenance of an independent quality assurance staff, she provides continuous oversight and development of the elements which ensure the production of quality data. The Laboratory Project Manager, Mark Haslett, serves as client-laboratory contact throughout the project duration and works interactively with laboratory personnel to coordinate all aspects of the production of data packages to support the specific needs of this project.

Various analytical groups within the laboratory are supervised by the Section Chiefs, F. Kiger (inorganics), G. Beegle (metals), D. Rychlak (volatile organics), and J. Layman semivolatiles, extractions, and HPLC). Section Chiefs are responsible overall for the management of the respective analytical programs operating in each section and coordination and supervision of personnel working within each area.

Lionville Laboratory's Sample Management Officer, J. Melnic, is responsible for receiving, logging, and maintaining internal custody of all samples during their residence in the laboratory.

All analytical support will be provided by Lionville Laboratory which is located at 208 Welsh Pool Road, Lionville, PA 19341-1333. In the event that additional analyses must be subcontracted, it will be done with the approval of the Navy. Lionville Laboratory's Laboratory Standard Operating Procedures, Quality Assurance, SOP No. QA-001 is include in Attachment A.

Figure 1-1 Lionville Laboratory Organization



2. QUALITY ASSURANCE OBJECTIVES

Data Quality Objectives (DQOs) specify the data type, quality, quantity, and uses needed to make decisions and are the basis for designing data collection activities. DQOs must be consistent with the applicable or relevant and appropriate requirements (ARARs) and attainable with acceptable field and analytical procedures to support the selection of a remedial alternative. The following sections contain an overview of the DQOs. A Sampling and Analysis Plan is prepared for IR Site 10 and 11, and the specific DQOs are presented there.

2.1 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The fundamental mechanisms that will be employed to achieve the project's quality goals can be categorized as prevention, assessment, and correction. These include:

- Prevention of defects in the sample quality through planning and design, documented instructions and procedures, and careful selection of skilled, qualified personnel.
- Quality assessment through a program of regular field and laboratory audits and inspections to supplement continual informal review.
- Permanent correction of conditions adverse to quality through a closed-loop corrective action system.

This QAPP has been prepared in response to these goals. Attachment A provides a copy of the Standard Operating Procedures (SOPs) employed by Lionville Laboratory.

2.2 DATA QUALITY OBJECTIVES

2.2.1 Precision and Accuracy

Laboratory precision and accuracy performance (Table 2-1) can meet project objectives, particularly when compliance with established criteria is based on laboratory (internal) duplicates. Analytical accuracy measures the bias as the percent recovery from the laboratory control sample (LCS). Laboratory criteria and action limits will be in accordance with the information supplied in Appendix C of this QAPP.

Field sampling precision and accuracy are not easily measured. Field contamination, sample preservation, and sample handling will affect precision and accuracy. Field sampling procedures are presented in Chapter 4. Field duplicates and blanks will be used to estimate field sampling precision and accuracy. Field quality control samples will be sampled according to the frequencies stated in the Work Plans and analyzed in the laboratory identically to field samples.

Data quality with respect to its intended use will be assessed based on laboratory-supplied quality assurance/quality control (QA/QC) data and appropriate protocols for verification of analytical results. Results that are outside of criteria as outlined in Appendix D will be qualified by the laboratory. Qualified data will be used to the greatest practicable extent, depending upon the extent of the non-conformance to control criteria.

2.2.2 Representative

The sampling program is designed to provide analytical data that are representative of site conditions. Representativeness describes the degree to which analytical data accurately and precisely define the population being measured. Several elements of the sampling and sample handling process must be controlled to maximize the representativeness of the analytical data as defined in this QAPP. The physical state of the samples, sampling equipment, containers, sample preservation and storage, holding times, sample identity, and chain-of-custody will be designed to ensure that the samples analyzed are representative of site conditions. Site-specific sampling plans will be outlined in each site Work Plan.

TABLE 2-1 DATA QUALITY INDICATOR FORMULAS

CHARACTERISTIC	FORMULA	SYMBOLS
Precision (as relative percent difference, %RPD)	$RPD = \frac{\lvert x_1 - x_2 \rvert}{(x_1 + x_2)/2} \times 100 = \frac{\lvert x_1 - x_2 \rvert}{(x_1 + x_2)} \times 200$	x1, x2 = duplicate values.
Precision (as relative standard deviation, %RSD)	$RSD(\%) = \frac{s}{\bar{x}} \times 100$	s = standard deviation $\bar{x}$ = mean of the measurements.
Accuracy (as percent recovery (%R) for samples without a background level of the analyte, such as reference materials, laboratory control samples, and performance evaluation samples)	$\%R = \frac{X}{T} \times 100$	X = found concentration T = true or assumed concentration
Accuracy (as percent recovery (%R) for measurements in which a known amount of analyte (a spike) is added to an environmental sample)	$\%R = \frac{X - B}{T} \times 100$	X = found concentration B = background concentration T = true or assumed concentration

2.2.3 Completeness

Completeness describes the amount of data generated that meets the objectives for precision, accuracy, and representativeness versus the amount of data expected to be obtained. For relatively simple, homogenous matrices, 100 percent completeness is expected. However, as matrix complexity and heterogeneity increase, completeness may decrease. Where analysis is precluded or where DQOs are compromised, effects on the overall investigation must be considered. Whether or not a particular sample is critical to the investigation will be evaluated in terms of the sample location, the parameter in question, the intended data use, and the risk associated with the error.

Critical data points may not be evaluated until all the analytical results are reviewed. If, in the evaluation of laboratory results, it becomes apparent that the data for a specific medium are of limited quality, either with respect to the number of samples or to an individual analysis, a subsequent sampling event may be necessary.

Completeness is calculated based on the expected number of data points and the actual number of useable data points according to the formula

$$\text{Completeness, \%} = \frac{\text{Number of useable data points}}{\text{Number of total data points}} \times 100$$

For the purpose of this effort, 90 percent is established as the minimum acceptable level of completeness. This goal is established based upon the statistical level of confidence required for a decision. A data point shall be determined to contribute to the completeness of the data set if the information provided is meaningful, useful, and contributes to the project objectives.

2.2.4 Comparability

Comparability is the extent to which comparisons among different measurements of the same quantity or quality will yield valid conclusion. By specifying the use of standard analytical procedures (e.g., SW846, CLP, or other EPA methods) and standard field sampling procedures, the potential for variables to affect the final data quality is minimized. Field sampling procedures are presented in Chapter 4, "Sampling and Field Investigative Procedures."

Analytical methods for the work proposed at NASJRB, Willow Grove are described in Chapter 7 and outlined in Table 7-1.

2.3 DETECTION AND QUANTITATION LEVELS

In addition to the PARCC parameters, analytical sensitivity is an important component of data quality. Analytical sensitivity is evaluated using analyte detection and quantitation levels.

2.3.1 Detection Levels

A detection limit has been defined by the Committee on Environmental Improvement of the American Chemical Society (ACS) [Anal. Chem. 55:2210-2218 (1983)] as "the lowest concentration that can be determined to be statistically different from a blank." Various methods are available for determining detection limits; most of them are based on the standard deviation of measurements in the region near the blank responses. The following detection limits are determined routinely in the laboratory:

Instrument detection limits (IDL) are determined using the protocols given in the inorganic statement of work for the U.S. EPA Contract Laboratory Program; the procedures and calculations are detailed in Lionville Laboratory's Laboratory Standard Operating Procedures, QA-001. A standard deviation is calculated from replicate measurements of a low-level standard and multiplied by three to give the IDL. IDLs are used as an index of instrument performance that does not include sample effects and, therefore, represent the lowest detection limit achievable. IDLs can vary between instruments of the same type and can change when redetermined.

Method detection limits (MDL) are determined using the U.S. EPA procedure published in 40 CFR 136 Appendix B (EAL-SOP-049). The MDL is defined as "the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte." This procedure requires that "sample processing steps of the analytical method be included in the determination of the method detection limit." MDLs therefore are influenced by the sample matrix and sample preparation process as well as the analytical instrumentation. A minimum of seven replicates spiked at one to five times the expected MDL are analyzed. The MDL is calculated by multiplying the standard deviation of the measurements by the Student *t*-value for a 99% confidence level. Because of the wide variety of matrix types

analyzed by the laboratory, MDLs are routinely determined in reagent water or standard solid matrix. These MDLs represent, therefore, the optimum values, and the MDLs for actual sample matrices are likely to be higher. MDLs can be determined for specific matrices when requested by the client.

Unless superseded by other program, project, or client requirements, IDLs and MDLs are determined annually. In addition, IDLs and MDLs are redetermined after an instrument is moved or modified and MDLs after a method has been significantly changed. Where more than one instrument is used in sample analyses by a given technique (e.g., GC/MS, GC, GFAA, or ICP), detection limit studies are performed for each instrument. A standard laboratory reporting limit is determined for each analyte based on the highest detection limit determined. Data for instruments are maintained for use in reporting data when project-specific requirements dictate lower detection limits.

A detection limit measured at a given time is an estimate of the "true" detection limit because the measured standard deviation used to calculate the detection limit is subject to random error and is an estimate of the population standard deviation. The confidence limits on the standard deviation, and hence the detection limit, can be determined using the chi-square (C^2) distribution (40 CFR 136 Appendix B). The 95% confidence limits for an MDL determined from seven replicates are 0.64 MDL and 2.20 MDL. A redetermination of the detection limit could produce a value between the chi-square limits, even if the conditions remain the same. Day-to-day changes in instrument performance can further produce changes in the measured detection limit.

When interpreting data and detection limits it is important to remember that, when a measured concentration is greater than the detection limit, the analyte has the specified probability of actually being present (i.e., of having a true concentration greater than zero); however, the detection limit cannot be used to say anything about the presence or absence of an analyte that has a measured concentration less than the detection limit. From the definition of the MDL there is a 1% chance that a sample with no analyte will produce a concentration greater than or equal to the MDL (false positive). The probability is 50%, however, that a sample with a concentration at the MDL will be measured as less than the MDL (false negative).

It is also important when interpreting low-level data to consider the precision of measurements close to the detection limit. The relative standard deviation (s/x) of a value at the MDL is 32%, and the 3s limits are the MDL " MDL. For a sample with an analyte concentration at the MDL,

50% of the time the measured value will be less than the MDL and 50% of the time between the MDL and 3 H MDL.

2.3.2 Quantitation Levels

To ensure better precision in low-level data and to reduce the false negative error rate, quantitation limits have been proposed as the minimum concentration at which an analyte can be quantified with an acceptable degree of confidence. The ACS Committee on Environmental Improvement has recommended that quantitation limits be calculated by multiplying 10 times the standard deviation, giving a relative standard deviation of 10%. The Committee further advised that quantitative interpretation, decision-making, and regulatory actions should be limited to data at or above the limit of quantitation. Lionville Laboratories uses the term Reporting Limit (RL) for the laboratory quantitation limit.

2.4 PROJECT REPORTING LIMITS

For analytical results for NASJRB, Willow Grove, the laboratory will report all analytes to limits as indicated in Tables 7-2 through 7-4. Each site-specific work plan will identify the use of either Reporting Limits or MDLs, based on the DQOs and data utilization intent. When reporting TCLP parameters for hazardous waste characterization, the laboratory's TCLP reporting limits identified on Table 7-4 will be used.

Soils and sediments are reported on a dry weight basis.

3. QUALITY ASSURANCE PROCEDURES

3.1 LABORATORY QUALITY CONTROL

A QC program is a systematic process that controls the validity of analytical results by measuring the accuracy and precision of each method and matrix, developing expected control limits, using these to detect anomalous events, and requiring corrective action techniques to prevent or minimize the recurrence of these events.

The accuracy and precision of sample analyses are influenced by both internal and external factors. Internal factors are those associated with sample preparation and analysis. Internal factors are monitored by the use of internal QC samples (i.e., method blanks, spikes, surrogates).

External factors are associated with sample collection. They are monitored by the use of field QC samples, which are identified as field duplicates, rinsate and field blanks, and trip blanks (see Section 3.2).

3.1.1 Laboratory Quality Control Samples

3.1.1.1 Method (Reagent) Blank

The method blank is used to monitor laboratory contamination. This is usually a sample of laboratory reagent water or contaminant-free solid matrix treated with all the reagents and in the same manner as the sample (i.e., digested, extracted, distilled). One method blank is prepared and analyzed with every analytical preparation batch of twenty or fewer samples of similar matrix.

3.1.1.2 Fortified Method Blank Spike (Laboratory Control Sample)

Normally, fortified method blank samples are analyzed with each batch of 20 or fewer samples. These samples generally consist of laboratory reagent-grade water or solid matrix fortified with the analyte of interest for single-analyte methods and selected analytes for multi-analyte methods according to the appropriate analytical method. They are prepared and analyzed with and in the same manner as the associated field sample batch. The analyte recovery from the LCS is used to monitor analytical accuracy.

3.1.1.3 Fortified Sample (Matrix Spike)

A fortified sample (matrix spike) is an aliquot of a field sample that is fortified with the analyte(s) of interest and analyzed to monitor matrix effects associated with a particular batch of samples. Matrix spikes are analyzed with every sample batch of 20 or fewer samples. For organic analyses, duplicate fortified samples [matrix spike (MS)/matrix spike duplicate (MSD)] are performed for every batch of 20 or fewer samples.

MS/MSD samples will be selected in the field in order to provide sufficient sample volume.

3.1.1.4 Surrogates

Surrogates are organic compounds that are similar to analytes of interest in chemical composition, extraction, and chromatography, but are not normally found in environmental samples. These compounds are spiked into all blanks, standards, samples, and spiked samples prior to analysis for organic parameters. Percent recoveries are calculated for each surrogate. Surrogates are spiked into samples according to the appropriate analytical method. Surrogate spike recoveries are evaluated against the control limits specified in Appendix C. Surrogate recoveries will not be calculated if sample dilution causes the surrogate concentration to fall below the reporting limit.

Surrogate recoveries are used to evaluate the overall system performance of chromatographic methods and are also used to assess sample measurement bias.

3.1.1.5 Laboratory Duplicate Analyses

Samples requiring duplicate analyses are split into separate aliquots prior to analysis and the aliquots analyzed separately. This analysis monitors analytical precision but is affected by sample heterogeneity. Sample duplicates are generally performed with inorganic analyses.

3.1.2 Application of Controls

Laboratory method performance is evaluated based on the results of internal quality control (instrument tune, initial calibration, continuing calibration checks, surrogate spike recoveries) and internal quality control samples such as laboratory control samples and method blanks. The criteria for each of these, control parameters performance is specified in the methods and

outlined in Appendices C and D. Whenever the control criteria are not met, the required corrective actions described in Appendix D are undertaken to restore analytical control.

Sample performance is evaluated on the basis of sample surrogate spikes, sample matrix spikes, and sample duplicate analyses. The criteria for each of these parameters is identified in Appendices C and D. Sample performance is evaluated not only on the control criteria, but against the method performance criteria as well, as sample performance can be affected by the samples matrix. Generally, when sample performance criteria are not met, corrective actions include reanalysis; if similar results are obtained, and the method performance criteria are met, the out-of-control situation may be attributed to matrix effects.

3.2 FIELD QUALITY CONTROL SAMPLES

Field QC samples are also known as rinsate blanks, trip blanks, and field duplicates or split samples. The QC samples are collected by the field team for laboratory analysis. Although the sample designation will indicate that the sample is a QC sample when field duplicates are collected, the identity of the sample being duplicated will not be available to the analysts and laboratory personnel. The purpose of field QC samples is to provide site-specific, field-originated checks that help to ensure data generated by the sampling effort and analytical laboratory are of suitable quality. Each type of field quality control sample will undergo the same sample preservation, holding times, analysis, reporting, and validation as the field samples.

3.2.1 Field Duplicates

A Field duplicate is a duplicate sample of an investigative sample. The field duplicate is collected of the same matrix, to the extent possible, at the same time, from the same location, and using the same techniques as the investigative sample. These samples are used to assess the combined field and laboratory precision. The results are anticipated to exhibit more variability than laboratory duplicates, which measure only laboratory precision. As per the PADEP *Groundwater Montioring Guidance Manual* dated 1 December 2001, 1 field duplicate is required per event with a rate of 5 to 10% used.

An additional sample volume will be collected for *matrix spike/matrix spike duplicate.* These are laboratory quality control samples consisting of a field sample that is spiked with the analyte(s) of interest and analyzed to monitor matrix effects associated with a particular batch of samples. Matrix spikes are analyzed with every sample batch of 20 or fewer samples. For

organic analyses, matrix spike duplicate samples are performed for every batch of 20 or fewer samples. Additional aliquots will be collected at a frequency of 1 per 20 samples per matrix (one per analytical batch, or partial batch). In addition as per PADEP *Groundwater Monitoring Guidance Manual*, dated 1 December 2001, 1 MS/MSD is required per site. However, the lab may have different guidelines as discussed.

Field duplicate and MS/MSD results will be compared to assess sample homogeneity, handling, shipping, storage, preparation, and analysis.

3.2.2 Rinsate Blanks

Rinsate blanks are samples that are obtained by running contaminant-free water over/through sample collection equipment before and/or after it has been cleaned. These samples will be used to determine residual chemical concentrations on sampling equipment after decontamination. When rinsate blanks are required, they will be collected once before non-dedicated equipment utilized for sampling and once after for each site as per the PADEP *Groundwater Monitoring Guidance Manual* dated 1 December 2001. If dedicated equipment is used for the sampling event, one rinsate blank is required prior to use as per the PADEP *Groundwater Monitroing Guidance Manual* dated 1 December 2001. Rinsate blanks will be collected in empty laboratory-provided sample containers appropriate for the parameters being analyzed in the field samples.

3.2.3 Field Blanks

Field blanks are samples of contaminant-free media prepared in the field. Field blanks are prepared by pouring contaminant-free water into laboratory-cleaned sampling containers during sampling activities. Field blanks are analyzed for the parameters sampled for during the field effort. The purpose of field blanks is to provide a check on contaminants that could be introduced to the samples during sample collection. One field blank is required per site as per the PADEP *Groundwater Monitoring Guidance Manual* dated 1 December 2001.

3.2.4 Trip Blanks

The purpose of trip blanks is to determine whether samples were contaminated during storage or transportation back to the laboratory. Trip blanks will be collected by filling 40 mL VOA sample bottles with reagent-grade deionized water at the laboratory and shipping them to the site with the empty bottles. Trip blanks are kept with the investigative samples throughout the

sampling event and then packaged for shipment with the other samples and sent for analysis. They will remain sealed until they are analyzed with the field samples. These blanks will be preserved, handled, transported, and analyzed in an identical manner to the actual samples. One trip blank (2-40 mL) will be submitted for every discrete shipping container containing samples for VOC analyses for groundwater samples. In addition, one trip blank (2-40 mL) will be submitted for every discrete shipping container containing samples for methane analyses for groundwater.

4. SAMPLING AND FIELD INVESTIGATIVE PROCEDURES

4.1 SAMPLING

The scope of work for the collection of samples is detailed in the individual Sampling and Analysis Plan for IR Site 10 and 11 associated with this QAPP. Specifically, the relevant field-sampling equipment and procedures to be utilized during each field investigation are described, as well as site-specific data quality objectives, data types, and data quantity and quality needs.

Data quality needs are determined by the specified compound reporting limits and the QA/QC protocols required by the analytical methods used. Reporting limits adequate to evaluate the data are provided in Chapter 7. Definitions of the required QA and QC samples are provided in Chapter 3.

4.2 SAMPLE IDENTIFICATION

Soil samples will follow the general nomenclature presented below:

Example: **IR10B07-14**
IR10 or IR11-Site Number
B07-Boring Number 7
14-Denotes depth to the top of the sampled interval below grade in feet.
These characters are omitted for groundwater samples.

Duplicate samples will be given a false nomenclature in order to provide a "blind" sample to the laboratory. For example, if samples are to be collected from IR10B07-14, the duplicate could be designated IR10FIELDDUP or another designation which does not correspond to a sampling location on the base.

Other QA/QC samples will be given unique sample designations. The sample type will be the first part of the designation, as follows:

- FLD—field blank
- RIN—rinsate blank
- TRP—trip blank

The sample date will follow the sample type (i.e., FLD 123199 for a field blank taken on December 31, 1999).

Field personnel will record designations of field samples corresponding to each QA/QC sample in a field logbook.

5. SAMPLE CUSTODY

5.1 SAMPLE BOTTLE PREPARATION

The Chain-of-Custody (COC) procedure begins with the preparation of the sample containers and preservatives to be used for sample collection. Unless superseded by specific project requirements, Lionville Laboratory purchases and distributes pre-cleaned sample containers. Vendors are required to provide documentation of analysis for each lot of containers, and the documentation is kept on file in the laboratory's Sample Management Office. Additionally, potential contaminant levels in each vendor lot are evaluated by the laboratory through analysis of randomly selected containers. Tables 5-1 and 5-2 define the types of container required, preservation techniques, and holding times for specific analyses for solid and aqueous samples. Preservatives will be added to the sample containers in the laboratory prior to shipment.

Sample kits, which are coolers containing COC forms, custody seals, sample containers (with preservatives), and packing material, are prepared by the Sample Management Office in Lionville Laboratories in response to receipt of an Analytical Task Order (ATO) provided by the CTO manager.

5.2 SAMPLE DOCUMENTATION

Upon completion of sample collection, logging, and preservation, the chain-of-custody forms will be completed identifying sample-specific information and a listing of the analytical parameters required on each sample. At that time the samples will be secured for shipment to the laboratories. Sample tracking will start at the point of collection with log book entries. The log entries will be recorded in waterproof ink in a bound field logbook updated daily and maintained at the site. Information, to be recorded in the logbook, will include the project name and number for which sampling is being conducted (NASJRB, Willow Grove, 296.0074); a unique, sequential sample number for each sample taken; sampling date and time; specific sampling location in sufficient detail to allow resampling at the same location, if required; method of sampling; preservation techniques; analyte classes of interest (i.e., metals, VOC, PCB); significant observations made during the sampling process; results of any field measurements, such as depth of soil sample; and printed name and signature of the person performing the sampling.

In addition to the sampling logbook, each sample will be labeled in waterproof ink with the following information:

1. Project name (NASJRB, Willow Grove).
2. Sample number.
3. Sampling date and time.
4. Name of sampler.
5. Analysis requested.
6. Preservatives added.

Custody seals will be used to ensure that the samples are not tampered with during shipment. One chain-of-custody form will be completed for each cooler shipped each day. The chain-of-custody form will accompany the sample throughout the shipping and analytical process. Each cooler will have a chain-of-custody form properly sealed into the cooler prior to shipment.

5.3 SAMPLE PACKAGING AND SHIPPING

Shipment of samples will be in accordance with Department of Transportation (DOT) regulations described in 49 CFR 171 and 49 CFR 172, and NEIC procedures (EPA-330). This is usually guaranteed air freight. If the nature of the samples precludes air shipment, the fastest motor freight is used. Samples are preserved, cooled, and shipped in accordance with EPA protocols. Shipping schedules are arranged to ensure sample processing within holding times specified for analytical parameters. Shipping documents such as package registration are kept to record the shipping process and to serve as tracers.

1. Each sample will be labeled with indelible ink and will contain the information listed in Section 5.2.

2. Waterproof plastic ice chests or coolers will be used.

3. Bubble packing will be placed in bottom of cooler.

4. Bottles will be enclosed in clear plastic bags, through which sample tags and labels are visible. Bags will be sealed. Bottles will be placed upright in cooler in such a way that they do not touch and will not touch during shipment.

5. Additional bubble packing, or similar packing material, will be inserted to partially cover sample bottles (more than halfway). Bags of ice will be placed around, among, and on top of sample bottles. Samples will be packed so as to maintain a temperature of 4°C ±2°C.

6. The remaining area of the cooler will be filled with bubble packing or similar packing material.

7. The chain-of-custody record will be placed in a waterproof plastic bag and taped with strapping tape to the inside of the lid of the cooler.

8. The drain will be taped shut.

9. The lid will be secured by taping. The cooler will be wrapped completely with strapping tape at a minimum of two locations. Labels will not be covered.

10. The custody seals will be numbered, signed, and attached on front right and back left of cooler. Seals will be covered with wide, clear tape.

11. The cooler will be shipped via overnight carrier to Lionville Laboratories in Lionville, PA. Samples may be picked up at NASJRB by a courier from Lionville Laboratories.

12. Sample label and custody documents will be filled out in indelible ink.

If samples are hand-carried, numbers 10 and 12 will be excluded.

5.4 CUSTODY PROCEDURES

5.4.1 Sample Receipt and Logging

Upon receipt at the laboratory, the Sample Management Officer will inspect the samples for integrity and check the shipment against the COC form. The temperature and condition of all samples shipped will be noted on the COC. Discrepancies will be addressed at this point and documented on the COC form. When the shipment and the COC are in agreement, the custodian will enter the samples into the Laboratory Log and assign each sample a unique laboratory

number. This number will be affixed to each sample bottle. The custodian will then enter the sample and analysis information into the laboratory computer system. The original of the COC form will be given to EA's data management group, with copies to the Laboratory Project Manager and each of the laboratory's Section Chiefs and Group Leaders. These log-in procedures are documented in Lionville Laboratory's Laboratory Standard Operating Procedures, No. QA-001, 10 Oct 2002.

5.4.2 Sample Storage and Security

While in the laboratory, the samples and aliquots that require storage at approximately 4°C ± 2°C are maintained in a locked refrigerator unless they are being used for analysis. Samples for VOC determinations are stored in a separate locked refrigerator from other samples, sample extracts, and standards.

All the refrigerators in the laboratory used for storage of samples are locked and numbered. VOC samples are maintained in a separate refrigerator which is monitored for cross-contamination using a holding blank (SOP, QA-001). Similarly, there are refrigerators designated for extracts and standards. Samples that are required to be frozen are stored in a freezer (<-10° C). The sample storage areas are within the laboratory to which access is limited to laboratory chemists and controlled by assigned passkeys. The samples are routinely retained at the laboratory for 60 days (or longer if required by the project) after the data have been forwarded to the client so that any analytical problems can be addressed. The samples are discarded at the end of 60 days.

Specific tasks for sample storage are as follows:

- Samples and extracts are stored in a secure area designed to comply with the storage method(s) defined in the contract.
- Samples are removed from the shipping container and stored in their original containers unless damaged.
- Damaged samples are disposed of in an appropriate manner and this disposal is documented.

- The storage area is kept secure at all times. The Sample Management Officer controls access to the storage area.

- Whenever samples are removed from storage, this removal is documented. All transfers of samples are documented on internal COC records.

- Samples and extracts are stored after completion of analysis in accordance with the contract or until instructed otherwise by the CTO Manager.

- Standards are not stored with samples or sample extracts.

- So that the laboratory may satisfy sample COC requirements, the following additional standard operating procedures for laboratory/sample security are implemented:

    - Access to the laboratory is through a monitored area. Other outside-access doors to the laboratory are kept locked.

    - Visitors sign a visitor's log and are escorted while in the laboratory.

    - After a sample has been removed from storage by the analyst, the analyst is responsible for the custody of the sample. Currently the laboratory is not tracking the internal movement of samples because the laboratory is secured and accessible only to chemists.

TABLE 5-1 REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR AQUEOUS SAMPLES[a]

Parameter	Volume Required (mL)	Container[b]	Preservative	Recommended Holding Time[c]
Metals				
Mercury	250	P, G	HNO_3 to pH <2	28 days
Other Metals	1000	P, G	HNO_3 to pH <2	6 months
Organics				
Volatile Organics	120	G, teflon-lined septum	Cool, 4 C[d] HCl to pH <2	14 days
Semivolatile Extractables[e]	4,000	G, teflon-lined cap	Cool, 4 C[d]	7 days until extraction 40 days after extraction
Natural Attenuation				
Methane	120	G,teflon-lined septum	HCl to pH<2	14 days

(a) From time of sample collection (40 CFR Part 136.3).
(b) Polyethylene (P) or glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.
(c) Where shipping regulations prevent the use of the proper preservation technique or the holding time is exceeded, such as the case of a 24-hour composite, the final reported data for these samples should indicate the specific variance.
(d) Use 0.008% $Na_2S_2O_3$ in the presence of residual chlorine.
(e) Includes phthalates, nitrosamines, organochlorine pesticides, PCBs, nitroaromatics, isophorone, polynuclear aromatic hydrocarbons, haloethers, chlorinated hydrocarbons, phenols, and TCDD. If sampled for dioxin/furan analyses, an additional 2,000 mL are required.

TABLE 5-2 REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR SOLID SAMPLES[a]

Parameter	Mass Required (g)	Container[b]	Preservative	Recommended Holding Time[c]
Metals				
Mercury	5	P, G	None required	28 days
Other Metals	5	P, G	None required	6 months
Inorganics, Nonmetallic				
Cyanides	50	P, G	Cool, 4 C	14 days
Sulfides	10	P, G	Cool, 4 C	7 days
Corrosivity (as pH)	25	P, G	None required	Analyze immediately
Ignitability	30	P, G	Cool, 4 C	None specified
Organics				
Volatile Organics	200	G, teflon-lined septum	Cool, 4 C	14 days
Semivolatile extractables[d]	200	G, teflon-lined cap	Cool, 4 C	14 days until extraction 40 days after extraction

(a) From time of sample collection (40 CFR Part 136.3, 40 CFR Part 261).
(b) Polyethylene (P) or glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.
(c) Holding times are based on the date of sample collection. Where shipping regulations prevent the use of the proper preservation technique or the holding time is exceeded, such as the case of a 24-hour composite, the final reported data for these samples should indicate the specific variance.
(d) Includes phthalates, nitrosamines, organochlorine pesticides, PCBs, nitroaromatics, isophorone, polynuclear aromatic hydrocarbons, haloethers, chlorinated hydrocarbons, phenols, and TCDD. If dioxin/furan analysis is requested, an additional container of sample is required.

TABLE 5-3 REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES [a] FOR HAZARDOUS WASTE CHARACTERISTICS - SOLID SAMPLES

Parameter/ Method	Method	Mass (g) Required	Container[b]	Preservative	Recommended Holding Time [c]
RCRA Characteristics - Bulk Sample Analysis					
Corrosivity as pH	9045	25	P,G	None Required	None specified
Corrosivity Toward Steel	1110	50	P,G	None Required	None specified
Ignitability	1010	100	P,G	None Required	None specified
Reactivity, Releasable Cyanide	9012A	50	P,G	Cool, 4° C	14 days
Reactivity, Releasable Sulfide	9030	10	P,G	Cool, 4° C	7 days
Toxicity Characteristic Leaching Procedure	1311	500	G, teflon-lined septum	Cool, 4° C	See below
RCRA Characteristics - TCLP Leachate					
Mercury	7470A	---	P,G	None Required	28 days for TCLP 28 days from TCLP for analysis
Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, Silver	3010A/ 6010B	---	P,G	None Required	6 months for TCLP 6 months from TCLP for analysis
Volatiles	5030B/ 8260B	---	G, teflon lined septum	Cool, 4° C HCl to pH<2	14 days for TCLP 14 days from TCLP for analysis
Semivolatiles	3520C/ 8270C	---	G, teflon-lined cap	Cool, 4° C	14 days for TCLP 7 days from TCLP for extraction 40 days from extraction for analysis

(a) From time of sample collection (40 CFR Part 136.3, 40 CFR Part 261).
(b) Polyethylene (P) or glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.
(c) Holding times are based on the date of sample collection. Where shipping regulations prevent the use of the proper preservation technique or the holding time is exceeded, such as the case of a 24-hour composite, the final reported data for these samples should indicate the specific variance.

6. CALIBRATION AND PREVENTIVE MAINTENANCE

6.1 FIELD CALIBRATION AND PREVENTIVE MAINTENANCE

It is the CTO Manager's responsibility to confirm that the field team members are trained in the calibration, use, and maintenance of all applicable field instruments and equipment.

All field equipment will be calibrated and operated in accordance with the manufacturers' instructions. The calibration results for each field instrument will be recorded in the field logbook or on appropriate field data sheets, and will include the date, standards, personnel, and results of the calibration.

6.2 LABORATORY CALIBRATION

Instruments and equipment used in Lionville Laboratory are controlled by a formal calibration program. The program verifies that equipment is of the proper type, range, accuracy, and precision to provide data compatible with specified requirements. All instruments and equipment that measure a quantity, or whose performance is expected at a stated level, are subject to calibration. Calibration is performed by Lionville Laboratory personnel using reference standards or externally by calibration agencies or equipment manufacturers.

This section prescribes the practices used by Lionville Laboratory to implement a calibration program. Development and documentation of the laboratory calibration program is the responsibility of the laboratory managers. Implementation is the responsibility of the supervisors and chemists. The Quality Services Officer (QSO) monitors the procedures. Specifics are not provided because the requirements for the calibration of instruments and equipment are dependent upon the type and expected performance of individual instruments and equipment. Therefore, Lionville Laboratory uses the guidelines provided herein to develop a calibration program.

Two types of calibration are discussed in this chapter:

- Operational calibration, which is routinely performed as part of an analytical procedure or test method, such as the development of a standard curve for use with an atomic absorption spectrophotometer. Operation calibration is generally performed for instrument systems.

- Periodic calibration, which is performed at prescribed intervals for equipment, such as balances and thermometers. In general, equipment that can be calibrated periodically is a distinct, singular purpose unit and is relatively stable in performance.

6.2.1 Calibration System

The following sections contain a discussion of the elements comprising the calibration system.

6.2.1.1 Calibration Procedures

Written procedures are used by Lionville Laboratory for all instruments and equipment subject to calibration. Whenever possible, recognized procedures, such as those published by ASTM or EPA or procedures provided by manufacturers, are adopted. If established procedures are not available, a procedure is developed considering the type of equipment, stability characteristics of the equipment, required accuracy, and the effect of operational error on the quantities measured. As a minimum, the procedures include:

- Equipment to be calibrated.
- Reference standards used for calibration.
- Calibration technique and sequential actions.
- Acceptable performance tolerances.
- Frequency of calibration.
- Calibration documentation format.

6.2.1.2 Equipment Identification

Equipment that is subject to calibration is identified by a unique number assigned by Lionville Laboratory, and calibration records reference the specific instrument identification.

6.2.1.3 Calibration Frequency

Instruments and equipment are calibrated at prescribed intervals and/or as part of the operational use of the equipment. Frequency is based on the type of equipment, inherent stability, manufacturer's recommendations, values provided in recognized standards, intended data use, specified analytical methods, effect of error upon the measurement process, and prior experience.

6.2.1.4 Calibration Reference Standards

Two types of reference standards are used within Lionville Laboratory for calibration:

- Physical standards, such as weights for calibrating balances and certified thermometers for calibrating working thermometers, refrigerators and ovens, are generally used periodically.

- Chemical standards, such as Standard Reference Materials (SRMs) provided by the National Institute of Standards and Technology (NIST) or EPA. These may include vendor-certified materials traceable to NIST or EPA SRMs. These are primarily used for operational calibration.

Whenever possible, physical reference standards have known relationships to nationally recognized standards (e.g., NIST) or accepted values of natural physical constants. If national standards do not exist, the basis for the reference is documented.

Physical reference standards are used only for calibration and are stored separately from equipment used in analyses. In general, physical reference standards are at least four to ten times as accurate as the requirements for the equipment which they are used to calibrate. In general, physical standards are recalibrated annually by a certified external agency, and documentation is maintained by the QA staff.

Whenever possible, chemical reference standards are directly traceable to NIST SRMs. If SRMs are not available, compounds of vendor-certified high purity are used to prepare calibration standards.

6.2.1.5 Calibration Failure

Equipment that cannot be calibrated or becomes inoperable is removed from service. Such equipment must be repaired and satisfactorily recalibrated before reuse. For equipment that fails calibration, a nonconformance report (NCR) is initiated to record the corrective action and to demonstrate satisfactory calibration.

Scheduled calibration of equipment does not relieve the laboratory staff of the responsibility for using properly functioning equipment. If an equipment malfunction is suspected, the equipment is tagged and removed from service and recalibrated. If it fails recalibration, the above process shall apply. The laboratory managers are responsible for the development and implementation of a contingency plan for major equipment failure. The plan includes guidelines on waiting for repairs, use of other instrumentation, subcontracting analyses, and evaluating scheduled priorities.

6.2.1.6 Calibration Records

Records are prepared and maintained for each piece of equipment subject to calibration. Records demonstrating accuracy of preparation, stability, and proof of continuity of reference standards is also maintained.

Records for periodically calibrated equipment shall include, as appropriate:

- Unique identification number of equipment and type of equipment.
- Calibration frequency and acceptable tolerances.
- Identification of calibration procedure used.
- Date calibration was performed.
- Identity of Lionville Laboratory personnel and/or external agencies performing calibration.
- Reference standards used for calibration.
- Calibration data.
- Certificates or statements of calibration provided by manufacturers and external agencies and traceability to national standards.
- Information regarding calibration acceptance or failure and any repair of failed equipment.

Records for periodically calibrated equipment are maintained in the instrument logbooks, or in equipment files maintained by the QSO, and physical reference standards are kept in a separate folder.

For instruments and equipment that are calibrated on an operational basis, calibration generally consists of determining instrumental response against compounds of known composition and concentration or the preparation of a standard response curve of the same compound at different concentrations.

Records of these calibrations are maintained in the instrument logbook, which provides an ongoing record of the calibration undertaken for a specific instrument. The logbook should be indexed in the laboratory operations records but should be maintained at the instrument by the chemist. Entries are signed and dated by the chemist and reviewed periodically by the Section Chiefs.

In addition to the instrument logbook, copies of the raw calibration data are kept with the analytical sample data. In this way results can be readily processed and verified because the raw data package is complete as a unit. If samples from several projects are processed together, the calibration data are copied and included with each group of data.

6.2.2 Operational Calibration

Operational calibration is generally performed as part of the analytical procedure and refers to those operations in which instrument response (in its broadest interpretation) is related to analyte concentration. Included is the preparation of a standard response (calibration) curve and often the analysis of blanks.

6.2.2.1 Preparation of Calibration Curve

Preparation of a standard calibration curve is accomplished by using calibration standards. Known amounts of analyte(s) are added to a solvent which is introduced into the instrument. The concentrations of these calibration standards are chosen to cover the working range of the instrument or method, and all sample measurements are made within this working range. The calibration curve is prepared by plotting or regressing the instrument responses versus the analyte concentrations, and the concentrations of analyzed samples are back-calculated from the calibration curve.

6.2.2.2 Instrument Calibration Procedures

Appendix D includes the minimum operational calibration operations and criteria that are used for the various instrument groups and that are necessary for the analysis of water, soil/sediment, and hazardous waste samples.

6.2.3 Periodic Calibration

Periodic calibrations are performed for equipment, such as balances and thermometers, that are required in analytical methods but that are not routinely calibrated as part of the analytical procedure. Table 6-1 lists the periodic calibration requirements used by Lionville Laboratory.

6.3 PREVENTIVE MAINTENANCE

Periodic preventive maintenance is required for all sensitive equipment. Instrument manuals will be kept on file at the laboratory for reference if equipment needs repair. The troubleshooting chapter of factory manuals may be used in assisting personnel in performing maintenance tasks. The frequency of preventive maintenance for field equipment is indicated in each operating instruction manual. Field equipment is checked by field personnel under the supervision of the field coordinators. It is the responsibility of EA's Technical Services Group's Field Coordinator to conduct all preventive maintenance.

Major instruments in the laboratory are covered by annual service contracts with manufacturers. Under these agreements, regular preventive maintenance visits are made by trained service personnel. Maintenance is documented and maintained in permanent records by the individual responsible for each instrument.

Laboratories management is responsible for preparation and documentation of the program. Section Chiefs and QC Chemists implement the program, and the QSO reviews implementation to verify compliance. For each operational group, the preventive maintenance program includes the following:

- Listing of the instruments and equipment that are including in the program.
- Frequency of maintenance considering manufacturer's recommendations and/or previous experience with equipment.

- For each instrument in the program a file is maintained for the following information:

  - List of spare parts maintained by the laboratory.
  - External service contracts.
  - Items to be checked and/or serviced during maintenance and directions for performing maintenance (if external service is not provided of if not stated in manufacturer's instrument manuals).

Specific preventive maintenance practices and frequency for some laboratory and field equipment are described in Tables 6-2 and 6-3.

TABLE 6-1
SUMMARY OF PERIODIC CALIBRATION REQUIREMENTS FOR LABORATORY EQUIPMENT

Instrument	Calibration Frequency		Acceptance Limits	Corrective Actions
Analytical Balances	Daily:	Sensitivity (with a Class P weight)	0.001 g	Adjust sensitivity
	Monthly:	Checked with Class S Weights	Std. dev. less than 0.1 mg	Service balance
	Annually:	Calibrated by outside vendor against certified Class S weights		Service balance
Thermometers	Annually:	Calibrated against certified NIST thermometers by outside vendor	±0.5 C	Tag and remove from service
Automatic Pipettors	Quarterly:	Gravimetric check	High volume (>100 ml): ≤1.0% relative error as RSD Low volume (<100 ml): ≤2.0% relative error as RSD	Service or Replace

TABLE 6-2 LABORATORY PREVENTIVE MAINTENANCE PROCEDURES

Instrument	Item Checked/Serviced	Frequency
Gas Chromatograph	EC (Ni-63) wipe test	Semiannually
	Change column	As needed
	Change gas wool plug	As needed
	Replace septum	As needed
	Change fuses	As needed
	Clean and silanize or replace glass liners or injectors	As needed
	Clean FID/NPD detectors	As needed or annually
	Clean purge vessel	Daily
	Bake trap	Between each analysis
	Replace trap	As needed
	Replace carrying gas filters	As needed
GC/MS	GC/MS maintenance is the same as GC with the following additions:	
	Mechanical pump oil	Quarterly
	Turbo pump oil	Semi-Annually
	Source-cleaning, polish lenses	As needed
	Replace quartz injection port insert	As needed
	Replace septum	As needed
	Injection port liner checked	Daily
	Column maintenance	As needed
HPLC	Pressure	Daily
	Plunger Scale	Annually
	High Pressure Pump	Annually
	Low Pressure Pump	Annually
	Check valves	Annually or as needed
	Lamps / detector	As needed
	Column	As needed
Atomic Absorption Spectrophotometer	5-point calibration performed	Daily, with each run
	Electrical	Each shift
	Lamps	Each parameter
	Optics	Annually
	Clean windows	Daily, with each parameter
	Replace graphite tube	At beginning of each run
	Replace contact rings	Quarterly, or as needed
	Replace quartz windows	As needed
	Clean furnace windows	At beginning of new run
	Align background lamp (3F)	When serviced by repairman
	Check lamp intensity	Each parameter

TABLE 6-2 (continued)

Instrument	Item Checked/Serviced	Frequency
Inductively Coupled Plasma Spectrophotometer	Sample introduction system Check pumps Check electronics Clean, realign torch Change nebulizer Clean mixing chamber Check nebulizer press Replace pump tubing Clean air filters (7P) and water filter	Daily Daily Daily As needed As needed As needed As needed Daily, or as needed Semiannually
Total Organic Carbon Instrument	Check oxygen purity Check heater Add acid	Each new cylinder Daily when used Monthly
UV/Vis Spectrophotometer	Clean cells and windows Lamp Wavelength checked Serviced	Daily As needed Annually As needed
Auto-Analyzer	Pump oiled Tubing Lamps	Monthly As needed As needed
pH Meter	Electronics checked Electrolyte changed	Daily Checked weekly; changed when low
Refrigerators/Freezers	Temperature checked and logged Compartment cleaned	Daily on each work day Quarterly
Walk-in Coolers	Temperature checked and logged Unit cleaned	Daily on each work day Quarterly
Balances	Service representative calibration Internal weight train, gears, electronics Calibration Checked	Annually Annual service Daily with class "P" weights Analytical: Weekly with class "S" weights Toploading: Monthly with class "S" weights
Thermometers	Calibrated	Hg in glass -Annually Liquid in glass, digital, dial: Quarterly
Class S Weights	Calibrated	Annually

TABLE 6-2 (continued)

Instrument	Item Checked/Serviced	Frequency
Deionized/Organopure Water	Conductivity check Ion-exchange bed changed Replace filters	Daily Weekly As needed
Vacuum Pumps and Air Compressor	Check performance Lubrication, belts, etc.	Weekly As needed
Water Baths	Water level Bath cleaned	Added as needed Semiannually

TABLE 6-3 FIELD PREVENTIVE MAINTAINANCE PROCEDURES

Instrument	Item Checked/Serviced	Frequency
Water Quality Meter	Check battery	Daily
Interface Probe (IFP)	Check battery Decon after each use	Daily Each use
Photoionization Detector (PID)	Check battery Clean UV lamp and ion chamber	Daily Monthly
Combustible Gas/O_2 indicator	Check battery	Daily

7. ANALYTICAL PROCEDURES

Environmental samples collected during field investigation will be analyzed for select parameters outlined in Table 7-1 of this QAPP. Analytical parameters will be specified in a task-specific work plan.

7.1 FIELD ANALYTICAL PROCEDURES

Field methodologies are described in the Sampling and Analysis Plan.

7.2 LABORATORY OPERATIONS

7.2.1 Analytes and Analytical Methods

Chemicals of concern for this project will be the specified Target Compound List (TCL) volatiles, semivolatiles, Target Analyte List (TAL) metals, and Methane((CH_4) for natural attenuation)) designated in the Contract Laboratory Program (CLP) Statements of Work for organic and inorganic analyses, dioxins/furans, and RCRA chemical parameters and hazardous waste characteristics. Associated reporting limits and method detection limits are presented in Table 7-2 for soil and Table 7-3 for aqueous samples. Methods will be followed as written with the following exceptions.

7.2.1.1 Volatile Organic Compounds

Lionville Laboratory will perform the volatile analysis of aqueous samples according to SW846 Method 5030B/8260B with the exception of ethylene dibromide/1,2-dibromoethane (EDB). For EDB Method 504 will be used. For solid samples, the analysis will be completed according to SW846 Method 5035B/8260B. Also to achieve the lower Method Detection Limits (MDL) required by PADEP, a 25 mL purge volume will be used for solid samples analyzed for cumene and EDB.

As a part of the analysis, a library search will be performed for non-target sample components for the purpose of tentative identification. Up to 10 peaks, greater than 10 percent of the closest internal standard response, will be processed for tentative identification.

7.2.1.2 Semivolatile Organic Compounds

As a part of the analysis for semivolatile compounds, a library search will be performed for non-target sample components for the purpose of tentative identification. Up to 20 peaks, greater than 10 percent of the closest internal standard response, will be processed for tentative identification.

Aqueous samples will be analyzed using SW846 Method 3520C/8270C and Method 8310 (for benzo(a)pyrene). Also a 25 mL purge will be used for cumene, dibromochloroethane and bromoform. Soil samples will be analyzed according to SW846 Method 3540C/8270C.

7.2.1.3 TAL Metals

Following appropriate digestion/preparation procedures, all metal analytes, except mercury and thallium, will be determined utilizing Atomic Emission (ICP) according to the methodology specified (SW846 Method 6010B), including the use of TRACE ICP, with the following exceptions:

- If interferences are present which cannot be eliminated by dilution without impacting DQOs, samples will be analyzed by Graphite Furnace Atomic Absorption (GFAA) using SW846 series 7000 methods.

- In the event of catastrophic failure of the TRACE ICP, arsenic, lead, and selenium will be determined by GFAA methods.

- Mercury will be analyzed using SW846 Method 7470A, Atomic Absorption – Cold Vapor for aqueous samples and SW846 Method 7471A for soil samples.

- Thallium soil samples will be analyzed using SW846 Method 3020A/7841.

For ICP analyses, spectral interferences are corrected through the use of interelement correction factors (IECs) or by setting background correction points. The application of either depends upon the configuration of the instrument. Although IECs are determined and reported for all ICP instruments, IECs are not applied for those instruments which allow the use of background correction.

7.2.1.4 TCLP Hazardous Toxicants

For samples designated for analysis by Toxicity Characteristic Leaching Procedure (TCLP), the TCLP extract (leachate) will be handled as follows:

- Upon completion of the extraction procedure, aqueous holding times apply.
- For semivolatile compounds analyzed by SW846 Method 3520C/8270C and for pesticides analyzed by SW846 Method 3520C/8081A, 200 mL of TCLP leachate will be extracted for analysis in order to lessen the matrix effects engendered by the acid leachate solution. This results in increased reporting limits, shown in Table 7-4, of five times (5X) the usual laboratory reporting limits for the methods.
- All metals except mercury will be analyzed according to SW846 Method 3010A/6010B; detection and reporting limits are well within the TCLP criteria.

7.2.1.5 Methane (Natural Attenuation)

Lionville Laboratory will perform the methane analysis for aqueous samples according to RSK 175. A 25 mL purge volume will be used. This will provide lowered reporting limits and MDLs, as listed on Table 7-3, for most analytes in order to achieve the target quantitation levels identified.

7.2.2 Record Keeping

The requirements for laboratory record keeping are given in Lionville Laboratory SOP QA-001. All data entries are made in indelible, water-resistant ink. The date of the entry and the observer is clear on each entry. The observer uses his/her full name or initials. An initial and signature log is maintained so that the recorder of every entry can be identified. All information is recorded in a notebook or on other records at the time the observations are made. Recording information on loose pieces of paper is not allowed.

When a mistake is made, the wrong entry is crossed out with a single line, initialed and dated by the person making the entry, and the correct information recorded. Obliteration of an incorrect entry or writing over it is not allowed; neither is the use of correction tape or fluid on any laboratory records.

The following are some of the records that are used to document activities in the laboratory.

Reagent and Titrant Preparation Records—The procedure for each analysis includes the procedures for reagent/titrant preparation, including concentration, storage, and discard information. After a reagent/titrant is prepared, the following information is entered on a label affixed to the storage bottle: (1) its identity, (2) intended use, (3) titer/concentration, (4) preparation date, (5) storage requirement, (6) discard date, and (7) preparer. For titrimetric analyses, the procedure includes directions for standardizing the titrant, and the laboratory data sheets include space for titrant standardization data.

Standards Preparation Logs—The preparation of stock, intermediate, and working standard solutions is recorded in standards preparation logbooks, which are specific to the requirements of each operational group. Each standard is assigned a number that is used to trace the preparation from stock to working standards and to reference the analysis of the standards. The logbooks are completed by the appropriate analysts as they prepare the standards and are reviewed by the supervisor.

Sample Preparation Logs—Sample preparation operations, such as digestions and extractions, are documented in sample preparation logs, which are specific to the operations involved. The information in these logs can include: date, analyst, sample identification, weight or volume of sample used, reagents used, final volume, and volume of spiking, surrogate, or internal standard solution.

Bench Data Sheets—Laboratory bench data sheets are used for those analyses in which instrument responses are manually transcribed from instrument readout or from recorder tracings. The data sheets are preprinted to reflect the requirements of the analysis and are used to ensure that the information is recorded in a complete and organized manner.

Instrument Run Logs—When instrumentation is involved in the data generation, the sequence of the introduction of standards, field samples, and QC samples is recorded in an instrument run log. The following information is recorded when applicable: instrument identification, date, time, analyst, sample identifications, dilutions, and filenames for disk storage.

In addition, instrument malfunctions, repairs, and maintenance activities are recorded in the run logs.

Strip Chart Recordings/Chromatograms/Computer Output—All strip chart recordings, chromatograms, computer output, and other instrument-generated records are clearly labeled with the following information: instrument identification, date, analyst, sample identifications, and operational conditions, if applicable.

TABLE 7-1 ANALYTICAL METHODS FOR NASJRB WILLOW GROVE, PENNSYLVANIA

Parameter	Method	Method Number	Matrix
SAMPLE PREPARATION			
Releasable Cyanide	Acidification, Nitrogen Purge	§7.3.3.2	SO
Releasable Sulfide	Acidification, Nitrogen Purge	§7.3.4.2	SO
Metals Digestion (FAA/ICP)	Nitric Acid-Hydrochloric Acid	3010A	W
Metals Digestion (GFAA)	Nitric Acid	3020A	W
Metals Digestion	Nitric Acid - Hydrogen Peroxide	3050B	SO
Semivolatile Organics Extraction	Soxhlet Extraction	3540C	SO
Semivolatile Organics Extraction	Continuous Liquid/Liquid	3520C	W
Volatile Organics Preparation	Purge and Trap	5030A	SO
		5030B	W
Methane	Purge and Trap	RSK 175	W
Toxicity Characteristic Leaching Procedure	Liquid Extraction	1311	W,SO
ORGANIC CLEANUP			
Acid Cleanup	Treatment with sulfuric acid	3665	SO
Gel Permeation Cleanup (GPC)	Size Exclusion Procedure	3640A	W,SO
Florisil Column Cleanup	Adsorption Column Chromatography	3620A	W,SO
Sulfur Cleanup	Treatment with Cu, Hg, or TBA-sulfite	3660	W,SO
ORGANICS			
TCL Volatile Organic Compounds	Gas Chromatography - Mass Spectrometry	8260B	W,SO
TCL Semivolatile Organic Compounds	Gas Chromatography – Mass Spectrometry	8270C	W,SO
EDB and cumene	Gas Chromatography – Mass Spectrometry	8260B[a]	SO
Bromoform, Dibromochloroethane, Cumene	Gas Chromatography - Mass Spectrometry	8260B[a]	W
EDB	Gas Chromatography - Mass Spectrometry	504	W
Benzo(a)anthracene	High Performance Liquid Chromatography - UV, Fluorescence	8310	W
METALS			
Aluminum	Atomic Emission - ICP	6010B	W,SO
Antimony	Atomic Emission - ICP	6010B	W,SO

TABLE 7-1 (continued)

Parameter	Method	Method Number	Matrix
METALS (continued)			
Arsenic	Atomic Emission - Trace ICP	6010B	W,SO
Barium	Atomic Emission - ICP	6010B	W,SO
Beryllium	Atomic Emission - ICP	6010B	W,SO
Cadmium	Atomic Emission - ICP	6010B	W,SO
Calcium	Atomic Emission - ICP	6010B	W,SO
Chromium, Total	Atomic Emission - ICP	6010B	W,SO
Cobalt	Atomic Emission - ICP	6010B	W,SO
Copper	Atomic Emission - ICP	6010B	W,SO
Iron	Atomic Emission - ICP	6010B	W,SO
Lead	Atomic Emission - Trace ICP	6010B	W,SO
Magnesium	Atomic Emission - ICP	6010B	W,SO
Manganese	Atomic Emission - ICP	6010B	W,SO
Mercury	Atomic Absorption - Cold Vapor	7470A	W
Mercury	Atomic Absorption - Cold Vapor	7471A	SO
Nickel	Atomic Emission - ICP	6010B	W,SO
Potassium	Atomic Emission - ICP	6010B	W,SO
Selenium	Atomic Emission - Trace ICP	6010B	W,SO
Silver	Atomic Emission - ICP	6010B	W,SO
Sodium	Atomic Emission - ICP	6010B	W,SO
Thallium	Atomic Absorption - GFAA	7841	W,SO
Vanadium	Atomic Emission - ICP	6010B	W,SO
Zinc	Atomic Emission - ICP	6010B	W,SO
METHANE	GC Headspace/Equilibrium Technique	RSK 175	W
PHYSICAL DETERMINATIONS			
Ignitability (Solid)	Regulatory Definition	§7.1	SO
Corrosivity (Solid)	pH Measurement (1+1 solid and water)	9045	SO
Reactivity (Solid)	Reaction Over pH Range 2-12, (1+1 solid and water)	§7.3	SO

Notes:
[a] 25 mL Purge

Matrix codes:

W - groundwater, leachates, surface water, and wastewater
SO - soils, sediments, wastes

Reference:

United States Environmental Protection Agency. 1997. Test Methods for Evaluating Solid Waste. Physical/Chemical Methods. EPA SW-846, 3rd edition, including Final Update III. U.S. EPA, Washington, D.C.

TABLE 7-2 LIONVILLE LABORATORIES REPORTING LIMITS FOR SOIL SAMPLES

Parameter	Units	Laboratory RL[a]	Laboratory MDL[a]	EPA Region III RBCs Industrial[b]	EPA Region III RBCs Residential[b]
Semivolatile organics GC/MS - (SW846 Method 3540C/8270C)					
Acenaphthene	µg/kg	330	140	120,000,000	4,700,000
Acenaphthylene	µg/kg	330	97	61,000,000[i]	2,300,000[i]
Anthracene	µg/kg	330	120	610,000,000	23,000,000
Benzo[a]anthracene	µg/kg	330	93	7,800*	880*
Benzo[b]fluoranthene	µg/kg	330	92	7,800*	880*
Benzo[k]fluoranthene	µg/kg	330	94	78,000*	8800*
Benzo[a]pyrene	µg/kg	330	93	780*	88*
Benzo[ghi]perylene	µg/kg	330	120	61,000,000[i]	2,300,000[i]
Benzyl butyl phthalate	µg/kg	330	89	410,000,000	16,000,000
Bis(2-chloroethyl) ether	µg/kg	330	110	5,200*	580*
Bis(2-chloroethoxy)methane	µg/kg	330	100	--	--
Bis(2-ethylhexyl) phthalate	µg/kg	330	94	410,000*	46,000*
4-Bromophenyl phenyl ether	µg/kg	330	120	120,000,000	4,500,000
Carbazole	µg/kg	330	110	290,000	320,000
4-Chloroaniline	µg/kg	330	85	8,200,000	310,000
4-Chloro-3-methylphenol	µg/kg	330	96	--	--
2-Chloronaphthalene	µg/kg	330	120	160,000,000	6,300,000
2-Chlorophenol	µg/kg	330	110	10,000,000	390,000
4-Chlorophenyl phenyl ether	µg/kg	330	130	--	--
Chrysene	µg/kg	330	110	780,000*	88,000*
Dibenz[a,h]anthracene	µg/kg	330	130	780*	88*
Dibenzofuran	µg/kg	330	130	8,200,000	310,000
Di-n-butyl phthalate	µg/kg	330	150	200,000,000	7,800,000
1,2-Dichlorobenzene	µg/kg	330	110	180,000,000	7,000,000
1,3-Dichlorobenzene	µg/kg	330	110	180,000,000	7,000,000
1,4-Dichlorobenzene	µg/kg	330	99	240,000*	27,000*
3,3'-Dichlorobenzidine	µg/kg	330	71	13,000*	1,400*
2,4-Dichlorophenol	µg/kg	330	82	6,100,000	230,000
Diethyl phthalate	µg/kg	330	88	1,000,000,000	63,000,000
2,4-Dimethylphenol	µg/kg	330	92	41,000,000	1,600,000
Dimethyl phthalate	µg/kg	330	84	1,000,000,000	780,000,000

(a) Lionville Laboratory Reporting Limit (RL) or laboratory quantitation limits. These are the minimum concentrations reported for routine laboratory analyses in specified environmental matrices. See Section 2.3.2. Method Detection Limit determined according to 40 CFR 136. MDLs are updated periodically, therefore, these values may change.
(b) EPA Region III Risk-Based Concentrations (April 1996) for soil ingestion (industrial and residential) using a hazard quotient of 0.1 for noncarcinogenic effects, and a lifetime cancer risk of 10^{-6} for carcinogenic effects. The most recent RBCs will be employed for data evaluation.
(c) As hexavalent chromium.
(d) EPA Region III Risk-Based Concentrations (April 1996) for Tap Water.
(e) As thallium chloride.
(g) RBCs are not available specifically for endosulfan II and endosulfan sulfate. The RBC for endosulfan is used.
(h) RBCs are not available specifically for endrin ketone and endrin aldehyde. The RBC for endrin is used.
(i) RBC not available; RBC for naphthalene is used.
(k) Guidelines are for total.
(l) RBC for mixture is 0.099*.
(m) 25 mL purge.
* Denotes cancer RBC.

TABLE 7-2 (continued)

Parameter	Units	Laboratory RL[a]	Laboratory MDL[a]	EPA Region III RBCs Industrial[b]	EPA Region III RBCs Residential[b]
Semivolatile organics GC/MS - (SW846 Method 3540C/8270C) (continued)					
2,4-Dinitrophenol	µg/kg	1700	190	4,100,000	1,600,000
2,4-Dinitrotoluene	µg/kg	330	110	4,100,000	1,600,000
2,6-Dinitrotoluene	µg/kg	330	110	2,000,000	78,000
Di-n-octyl phthalate	µg/kg	330	85	41,000,000	1,600,000
Fluoranthene	µg/kg	330	150	82,000,000	310,000
Fluorene	µg/kg	330	150	82,000,000	3,100,000
Hexachlorobenzene	µg/kg	330	110	3,600*	400*
Hexachlorobutadiene	µg/kg	330	110	73,000*	8,200*
Hexachlorocyclopentadiene	µg/kg	330	95	14,000,000	550,000
Hexachloroethane	µg/kg	330	110	410,000*	46,000*
Indeno[1,2,3-cd]pyrene	µg/kg	330	110	7,800*	880*
Isophorone	µg/kg	330	100	6,000,000	6,700,000
2-Methyl-4,6-dinitrophenol	µg/kg	1700	240	--	--
2-Methylnaphthalene	µg/kg	330	110	82,000,000[j]	3,100,000[j]
2-Methylphenol	µg/kg	330	91	100,000,000	3,900,000
4-Methylphenol	µg/kg	330	100	10,000,000	390,000
Naphthalene	µg/kg	330	100	82,000,000	3,100,000
2-Nitroaniline	µg/kg	1700	96	120,000	4,700
3-Nitroaniline	µg/kg	1700	91	6,100,000	230,000
4-Nitroaniline	µg/kg	1700	77	6,100,000	230,000
Nitrobenzene	µg/kg	330	100	1,000,000	39,000
2-Nitrophenol	µg/kg	330	100	--	--
4-Nitrophenol	µg/kg	1700	87	130,000,000	4,800,000
N-Nitrosodiphenylamine	µg/kg	330	87	1,200,000	1,300,000
N-Nitroso-di-n-propylamine	µg/kg	330	99	820*	91*
2,2'-Oxybis (1-chloropropane)	µg/kg	330	230	820,000	91,000
Pentachlorophenol	µg/kg	1700	140	48,000*	5,300*
Phenanthrene	µg/kg	330	130	61,000,000[i]	2,300,000[i]
Phenol	µg/kg	330	89	1,000,000,000	47,000,000
Pyrene	µg/kg	330	76	61,000,000	2,300,000
1,2,4-Trichlorobenzene	µg/kg	330	100	20,000,000	780,000
2,4,5-Trichlorophenol	µg/kg	1700	99	200,000,000	7,800,000
2,4,6-Trichlorophenol	µg/kg	330	92	520,000*	58,000*

(a) Lionville Laboratory Reporting Limit (RL) or laboratory quantitation limits. These are the minimum concentrations reported for routine laboratory analyses in specified environmental matrices. See Section 2.3.2. Method Detection Limit determined according to 40 CFR 136. MDLs are updated periodically, therefore, these values may change.
(b) EPA Region III Risk-Based Concentrations (April 1996) for soil ingestion (industrial and residential) using a hazard quotient of 0.1 for noncarcinogenic effects, and a lifetime cancer risk of 10^{-6} for carcinogenic effects. The most recent RBCs will be employed for data evaluation.
(c) As hexavalent chromium.
(d) EPA Region III Risk-Based Concentrations (April 1996) for Tap Water.
(e) As thallium chloride.
(g) RBCs are not available specifically for endosulfan II and endosulfan sulfate. The RBC for endosulfan is used.
(h) RBCs are not available specifically for endrin ketone and endrin aldehyde. The RBC for endrin is used.
(i) RBC not available; RBC for naphthalene is used.
(k) Guidelines are for total.
(l) RBC for mixture is 0.099*.
(m) 25 mL purge.
* Denotes cancer RBC.

TABLE 7-2 (continued)

Parameter	Units	Laboratory RL[a]	Laboratory MDL[a]	EPA Region III RBCs Industrial[b]	EPA Region III RBCs Residential[b]
Semivolatile organics HPLC - PAHs (SW846 3540C/8270C)					
Acenaphthene	µg/kg	33	5.3	120,000,000	4,700,000
Acenaphthylene	µg/kg	67	34	61,000,000[i]	2,300,000[i]
Anthracene	µg/kg	5.0	0.54	610,000,000	23,000,000
Benzo[a]anthracene	µg/kg	5.0	0.75	7,800*	880*
Benzo[b]fluoranthene	µg/kg	6.7	1.2	7,800*	880*
Benzo[k]fluoranthene	µg/kg	5.0	0.69	78,000*	8800*
Benzo[a]pyrene	µg/kg	5.0	0.52	780*	88*
Benzo[ghi]perylene	µg/kg	6.7	1.5	61,000,000[i]	2,300,000[i]
Chrysene	ug/kg	5.0	0.75	780,000*	88,000*
Dibenzo[a,h]anthracene	ug/kg	8.3	1.3	780*	88*
Fluoranthene	ug/kg	6.7	1.1	82,000,000	310,000
Fluorene	ug/kg	6.7	1.1	82,000,000	3,100,000
Indeno[1,2,3-cd]pyrene	ug/kg	5.0	0.67	7,800*	880*
Naphthalene	ug/kg	33	5.8	82,000,000	3,100,000
Phenanthrene	ug/kg	5.0	0.63	61,000,000(i)	2,300,000(i)
Pyrene	ug/kg	6.7	1.6	61,000,000	2,300,000
Volatile organics GC/MS - (SW846 Method 5035/8260B)					
Acetone	µg/kg	10	3	200,000,000	7,800,000
Benzene	µg/kg	5	0.4	200,000*	22,000*
Bromodichloromethane	µg/kg	5	0.1	92,000*	10,000*
Bromoform	µg/kg	5	0.6	720,000*	81,000*
Bromomethane	µg/kg	5	2	2,900,000	110,000
2-Butanone	µg/kg	10	3	1,000,000,000	47,000,000
Carbon disulfide	µg/kg	5	1	200,000,000	7,800,000
Carbon tetrachloride	µg/kg	5	1	44,000*	4,900*
Chlorobenzene	µg/kg	5	0.4	41,000,000	1,600,000
Chloroethane	µg/kg	5	0.9	820,000,000	31,000,000
Chloroform	µg/kg	5	0.2	940,000*	100,000*
Chloromethane	µg/kg	5	0.5	440,000*	49,000*
Cumene (isopropylbenzene)[m]	µg/L	1	0.21	200,000	78,000
Dibromochloromethane	µg/kg	5	0.5	68,000*	7,600*

(a) Lionville Laboratory Reporting Limit (RL) or laboratory quantitation limits. These are the minimum concentrations reported for routine laboratory analyses in specified environmental matrices. See Section 2.3.2. Method Detection Limit determined according to 40 CFR 136. MDLs are updated periodically, therefore, these values may change.
(b) EPA Region III Risk-Based Concentrations (April 1996) for soil ingestion (industrial and residential) using a hazard quotient of 0.1 for noncarcinogenic effects, and a lifetime cancer risk of 10^{-6} for carcinogenic effects. The most recent RBCs will be employed for data evaluation.
(c) As hexavalent chromium.
(d) EPA Region III Risk-Based Concentrations (April 1996) for Tap Water.
(e) As thallium chloride.
(g) RBCs are not available specifically for endosulfan II and endosulfan sulfate. The RBC for endosulfan is used.
(h) RBCs are not available specifically for endrin ketone and endrin aldehyde. The RBC for endrin is used.
(i) RBC not available; RBC for naphthalene is used.
(k) Guidelines are for total.
(l) RBC for mixture is 0.099*.
(m) 25 mL purge

* Denotes cancer RBC.

TABLE 7-2 (continued)

Parameter	Units	Laboratory RL[a]	Laboratory MDL[a]	EPA Region III RBCs Industrial[b]	EPA Region III RBCs Residential[b]
Volatile organics GC/MS - (SW846 Method 5035/8260B) (continued)					
1,1-Dichloroethane	µg/kg	5	0.2	200,000,000	7,800,000
1,2-Dichloroethane	µg/kg	5	0.5	63,000*	7,000*
1,1-Dichloroethene	µg/kg	5	0.8	9,500*	1,100*
1,2-Dichloroethene (total)	µg/kg	5	0.4	18,000,000	700,000
1,2-Dichloropropane	µg/kg	5	0.3	84,000*	9,400*
cis-1,3-Dichloropropene	µg/kg	5	0.4	33,000[k]*	3,700[k]*
trans-1,3-Dichloropropene	µg/kg	5	0.3	33,000[k]*	3,700[k]*
Ethylene dibromide (1,2-dibromoethane)[m]	µg/kg	1	0.91	67	7.5
Ethylbenzene	µg/kg	5	0.7	200,000,000	7,800,000
2-Hexanone	µg/kg	10	2	--	--
4-Methyl-2-pentanone (MIBK)	µg/kg	10	3	160,000,000	6,300,000
Methylene chloride	µg/kg	5	0.3	760,000*	85,000*
Styrene	µg/kg	5	0.3	410,000,000	16,000,000
1,1,2,2-Tetrachloroethane	µg/kg	5	1	29,000*	3,200*
Tetrachloroethene	µg/kg	5	0.8	110,000*	12,000*
Toluene	µg/kg	5	0.6	410,000,000	16,000,000
1,1,1-Trichloroethane	µg/kg	5	0.5	72,000,000	2,700,000
1,1,2-Trichloroethane	µg/kg	5	0.5	100,000*	11,000*
Trichloroethene	µg/kg	5	0.7	520,000*	58,000*
Vinyl chloride	µg/kg	5	0.9	3,000*	340*
Xylenes (total)	µg/kg	5	1	1,000,000,000[k]	160,000,000[k]
Metals - Graphite Furnace Atomic Absorption (SW846 3050B/7000 series)					
Arsenic	mg/kg	1.0	0.1	3.8*	0.43*
Lead	mg/kg	0.30	0.14	--	--
Selenium	mg/kg	0.50	0.1	10,000	390
Thallium	mg/kg	1.0	0.14	160[e]	6.3[e]
Metals - Cold Vapor Atomic Absorption (SW846 7471A)					
Mercury	mg/kg	0.020	0.0053	610	23

(a) Lionville Laboratories Reporting Limit (RL) or laboratory quantitation limits. These are the minimum concentrations reported for routine laboratory analyses in specified environmental matrices. See Section 2.3.2. Method Detection Limit determined according to 40 CFR 136. MDLs are updated periodically, therefore, these values may change.
(b) EPA Region III Risk-Based Concentrations (April 1996) for soil ingestion (industrial and residential) using a hazard quotient of 0.1 for noncarcinogenic effects, and a lifetime cancer risk of 10^{-6} for carcinogenic effects. The most recent RBCs will be employed for data evaluation.
(c) As hexavalent chromium.
(d) EPA Region III Risk-Based Concentrations (April 1996) for Tap Water.
(e) As thallium chloride.
(g) RBCs are not available specifically for endosulfan II and endosulfan sulfate. The RBC for endosulfan is used.
(h) RBCs are not available specifically for endrin ketone and endrin aldehyde. The RBC for endrin is used.
(i) RBC not available; RBC for naphthalene is used.
(k) Guidelines are for total.
(l) RBC for mixture is 0.099*.
(m) 25 mL purge.
* Denotes cancer RBC.

TABLE 7-2 (continued)

Parameter	Units	Laboratory RL[a]	Laboratory MDL[a]	EPA Region III RBCs Industrial[b]	EPA Region III RBCs Residential[b]
Metals-Trace ICP (SW846 3050B/6010B)					
Antimony	mg/kg	0.60	0.13	820	31
Arsenic	mg/kg	1.0	0.20	3.8*	0.43*
Lead	mg/kg	0.30	0.10	--	--
Selenium	mg/kg	0.5	0.20	10,000	390
Metals - Inductively Coupled Plasma (SW3050B/6010B)					
Aluminum	mg/kg	20.0	6.5	1,000,000	78,000
Barium	mg/kg	20.0	0.8	140,000	5500
Beryllium	mg/kg	0.5	0.06	1.3*	0.15*
Cadmium	mg/kg	2.0	0.33	1000	39
Calcium	mg/kg	100	3.9	--	--
Chromium	mg/kg	1.0	0.41	10,000[c]	390[c]
Cobalt	mg/kg	5.0	0.65	120,000	4,700
Copper	mg/kg	1.0	0.51	82,000	3,100
Iron	mg/kg	10.0	5.3	610,000	23,000
Magnesium	mg/kg	100	3.5	--	--
Manganese	mg/kg	2.0	0.82	10,000	1,800
Nickel	mg/kg	4.0	0.50	41,000	1,600
Potassium	mg/kg	100	7.1	--	--
Silver	mg/kg	2.0	0.43	10,000	390
Sodium	mg/kg	100	8.1	--	--
Vanadium	mg/kg	5.0	0.32	14,000	550
Zinc	mg/kg	2.0	1.2	610,000	23,000

(a) Lionville Laboratory Reporting Limit (RL) or laboratory quantitation limits. These are the minimum concentrations reported for routine laboratory analyses in specified environmental matrices. See Section 2.3.2. Method Detection Limit determined according to 40 CFR 136. MDLs are updated periodically, therefore, these values may change.
(b) EPA Region III Risk-Based Concentrations (April 1996) for soil ingestion (industrial and residential) using a hazard quotient of 0.1 for noncarcinogenic effects, and a lifetime cancer risk of 10^{-6} for carcinogenic effects. The most recent RBCs will be employed for data evaluation.
(c) As hexavalent chromium.
(d) EPA Region III Risk-Based Concentrations (April 1996) for Tap Water.
(e) As thallium chloride.
(g) RBCs are not available specifically for endosulfan II and endosulfan sulfate. The RBC for endosulfan is used.
(h) RBCs are not available specifically for endrin ketone and endrin aldehyde. The RBC for endrin is used.
(i) RBC not available; RBC for naphthalene is used.
(k) Guidelines are for total.
(l) RBC for mixture is 0.099*.
(m) 25 mL purge.
* Denotes cancer RBC.

TABLE 7-3 LIONVILLE LABORATORY REPORTING LIMITS FOR WATER SAMPLES

Parameter	Units	Laboratory Report Limit[a]	Laboratory MDL[a]	EPA Region III RBCs Tap Water[d]
Semivolatile organics GC/MS - (SW846 Method 3520C/8270C)				
Acenaphthene	µg/L	10	3	2200
Acenaphthylene	µg/L	10	4	1100 [i]
Anthracene	µg/L	10	4	11000
Benzo[a]anthracene	µg/L	10	3	0.092*
Benzo[b]fluoranthene	µg/L	10	4	0.092*
Benzo[k]fluoranthene	µg/L	10	3	0.920*
Benzo[ghi]perylene	µg/L	10	5	1100 [i]
Bis(2-chloroethyl) ether	µg/L	10	4	0.0092*
Bis(2-chloroethoxy)methane	µg/L	10	4	---
Bis(2-ethylhexyl) phthalate	µg/L	10	7	4.80*
4-Bromophenyl phenyl ether	µg/L	10	5	2100
Butylbenzylphthalate	µg/L	10	4	7300
Carbazole	µg/L	10	5	
4-Chloroaniline	µg/L	10	5	150
4-Chloro-3-methylphenol	µg/L	10	0.73	---
2-Chloronaphthalene	µg/L	10	3	2900
2-Chlorophenol	µg/L	10	3	180
4-Chlorophenyl phenyl ether	µg/L	10	0.82	---
Chrysene	µg/L	10	3	9.20*
Dibenz[a,h]anthracene	µg/L	10	4	0.0092*
Dibenzofuran	µg/L	10	4	150
Di-n-butyl phthalate	µg/L	10	1.40	3700
1,2-Dichlorobenzene	µg/L	10	2	270
1,3-Dichlorobenzene	µg/L	10	3	540
1,4-Dichlorobenzene	µg/L	10	3	0.44*
3,3'-Dichlorobenzidine	µg/L	10	4	0.15*
2,4-Dichlorophenol	µg/L	10	3	110
Diethyl phthalate	µg/L	10	3	29000
2,4-Dimethylphenol	µg/L	10	3	730

(a) Lionville Laboratory Report Limit (RL) or laboratory quantitation limits. These are the minimum concentrations reported for routine laboratory analyses in specified environmental matrices. See Section 2.3.2. Method Detection Limit determined according to 40 CFR 136.
(b) EPA Region III Risk-Based Concentrations (April 1996) for soil ingestion (industrial and residential) using a hazard quotient of 0.1 for noncarcinogenic effects, and a lifetime cancer risk of 10^{-6} for carcinogenic effects. The most recent RBCs will be employed for data evaluation.
(c) As hexavalent chromium.
(d) EPA Region III Risk-Based Concentrations (April 1996) for Tap Water.
(e) As thallium chloride.
(g) RBCs are not available specifically for endosulfan II and endosulfan sulfate. The RBC for endosulfan is used.
(h) RBCs are not available specifically for endrin ketone and endrin aldehyde. The RBC for endrin is used.
(i) RBC not available; RBC for pyrene is used.
(j) RBC not available; RBC for naphthalene is used.
(k) Guidelines are for total.
(l) RBC for mixture is 0.999*.
(m) 25 mL purge.
* Denotes cancer RBC.

TABLE 7-3 (continued)

Parameter	Units	Laboratory Report Limit[a]	Laboratory MDL[a]	EPA Region III RBCs Tap Water[d]
Semivolatile organics GC/MS - (SW846 Method 3520C/8270C) (continued)				
Dimethyl phthalate	µg/L	10	3	370000
4,6-Dinitro-2-methylphenol	µg/L	50	6	---
2,4-Dinitrophenol	µg/L	50	6	73.0
2,4-Dinitrotoluene	µg/L	10	4	73.0 [l]
2,6-Dinitrotoluene	µg/L	10	4	37.0 [l]
Di-n-octyl phthalate	µg/L	10	4	730
Fluoranthene	µg/L	10	5	1500
Fluorene	µg/L	10	4	1500
Hexachlorobenzene	µg/L	10	6	0.0066*
Hexachlorobutadiene	µg/L	10	4	0.14*
Hexachlorocyclopentadiene	µg/L	10	2	0.15
Hexachloroethane	µg/L	10	3	0.75*
Indeno[1,2,3-cd]pyrene	µg/L	10	4	0.092*
Isophorone	µg/L	10	4	71*
2-Methylnaphthalene	µg/L	10	0.98	180 [j]
2-Methylphenol	µg/L	10	4	1800
4-Methylphenol	µg/L	10	0.80	180
Naphthalene	µg/L	10	3	180
2-Nitroaniline	µg/L	50	5	2.20
3-Nitroaniline	µg/L	50	4	110
4-Nitroaniline	µg/L	50	4	110
Nitrobenzene	µg/L	10	4	3.40
2-Nitrophenol	µg/L	10	3	---
4-Nitrophenol	µg/L	50	5	2300
N-Nitrosodiphenylamine	µg/L	10	4	14.0*
N-Nitroso-di-n-propylamine	µg/L	10	4	0.0096*
2,2'-Oxybis (2-chloropropane)	µg/L	10	4	0.26*
Pentachlorophenol	µg/L	50	5	0.56*
Phenanthrene	µg/L	10	5	1100 [i]
Phenol	µg/L	10	4	22000
Pyrene	µg/L	10	4	1100

(a) Lionville Laboratory Report Limit (RL) or laboratory quantitation limits. These are the minimum concentrations reported for routine laboratory analyses in specified environmental matrices. See Section 2.3.2. Method Detection Limit determined according to 40 CFR 136.
(b) EPA Region III Risk-Based Concentrations (April 1996) for soil ingestion (industrial and residential) using a hazard quotient of 0.1 for noncarcinogenic effects, and a lifetime cancer risk of 10^{-6} for carcinogenic effects. The most recent RBCs will be employed for data evaluation.
(c) As hexavalent chromium.
(d) EPA Region III Risk-Based Concentrations (April 1996) for Tap Water.
(e) As thallium chloride.
(g) RBCs are not available specifically for endosulfan II and endosulfan sulfate. The RBC for endosulfan is used.
(h) RBCs are not available specifically for endrin ketone and endrin aldehyde. The RBC for endrin is used.
(i) RBC not available; RBC for pyrene is used.
(j) RBC not available; RBC for naphthalene is used.
(k) Guidelines are for total.
(l) RBC for mixture is 0.999*.
(m) 25 mL purge.
• Denotes cancer RBC.

TABLE 7-3 (continued)

Parameter	Units	Laboratory Report Limit[(a)]	Laboratory MDL[(a)]	EPA Region III RBCs Tap Water[(d)]
Semivolatile organics GC/MS - (SW846 Method 3520C/8270C) (continued)				
1,2,4-Trichlorobenzene	µg/L	10	3	190
2,4,5-Trichlorophenol	µg/L	50	3	3700
2,4,6-Trichlorophenol	µg/L	10	3	6.10*
Semivolatile organic HPLC (SW846 Method 8310)				
Benzo(a)pyrene	µg/L	0.2	0.01	0.0092*
Volatile organics GC/MS (SW846 Method 5030B/8260B)				
Acetone	µg/L	5	2.0	3700
Benzene	µg/L	1	0.3	0.36*
Bromodichloromethane	µg/L	1	0.3	0.17*
Bromoform[m]	µg/L	1	0.61	2.40*
Bromomethane	µg/L	1	0.7	8.70
2-Butanone	µg/L	5	2	1900
Carbon disulfide	µg/L	1	0.4	1000
Carbon tetrachloride	µg/L	1	0.4	0.16*
Chlorobenzene	µg/L	1	0.3	39.0
Chloroethane	µg/L	1	0.4	8600
Chloroform	µg/L	1	0.3	0.15*
Chloromethane	µg/L	1	0.4	1.40*
Cumene (isopropyl benzene)[m]	µg/L	1	0.211	6600
Dibromochloromethane[m]	µg/L	1	0.23	0.13*
1,1-Dichloroethane	µg/L	1	0.3	810
1,2-Dichloroethane	µg/L	1	0.4	0.12
1,1-Dichloroethene	µg/L	1	0.4	0.044*
1,2-Dichloroethene (total)	µg/L	1	0.4	55.0
1,2-Dichloropropane	µg/L	1	0.4	0.16*
cis-1,3-Dichloropropene	µg/L	1	0.3	0.077*[(k)]
trans-1,3-Dichloropropene	µg/L	1	0.3	0.077*[(k)]
Ethylbenzene	µg/L	1	0.4	1300
2-Hexanone	µg/L	5	6.1	---
4-Methyl-2-pentanone (MIBK)	µg/L	5	1.6	2900
Methylene chloride	µg/L	1	0.3	4.10
Styrene	µg/L	1	0.3	1600

(a) Lionville Laboratory Report Limit (RL) or laboratory quantitation limits. These are the minimum concentrations reported for routine laboratory analyses in specified environmental matrices. See Section 2.3.2. Method Detection Limit determined according to 40 CFR 136.
(b) EPA Region III Risk-Based Concentrations (April 1996) for soil ingestion (industrial and residential) using a hazard quotient of 0.1 for noncarcinogenic effects, and a lifetime cancer risk of 10^{-6} for carcinogenic effects. The most recent RBCs will be employed for data evaluation.
(c) As hexavalent chromium.
(d) EPA Region III Risk-Based Concentrations (April 1996) for Tap Water.
(e) As thallium chloride.
(g) RBCs are not available specifically for endosulfan II and endosulfan sulfate. The RBC for endosulfan is used.
(h) RBCs are not available specifically for endrin ketone and endrin aldehyde. The RBC for endrin is used.
(i) RBC not available; RBC for pyrene is used.
(j) RBC not available; RBC for naphthalene is used.
(k) Guidelines are for total.
(l) RBC for mixture is 0.999*.
(m) 25 mL purge * Denotes cancerRBC.

TABLE 7-3 (continued)

Parameter	Units	Laboratory Report Limit[a]	Laboratory MDL[a]	EPA Region III RBCs Tap Water[d]
Volatile organics GC/MS (SW846 Method 5030B/8260B) - 25 mL purge (continued)				
1,1,2,2-Tetrachloroethane	µg/L	1	0.3	0.052*
Tetrachloroethene	µg/L	1	0.4	1.10
Toluene	µg/L	1	0.4	750
1,1,1-Trichloroethane	µg/L	1	0.4	790
1,1,2-Trichloroethane	µg/L	1	0.3	0.19*
Trichloroethene	µg/L	1	0.3	1.60*
Vinyl chloride	µg/L	1	0.5	0.019*
Xylenes (total)	µg/L	1	0.7	12000 [k]
Volatile organic GC/MS (SW846 Method 504)				
Ethylene dibromide (1,2-dibromoethane)	µg/L	0.01	0.002	.0075
Methane – GC Headspace/Equilibrium Technique (RSK 175)-Natural Attenuation Parameter				
Methane	µg/L	5	0.16	---
Metals - Cold Vapor (SW846 Method 7470A)				
Mercury	µg/L	0.20	0.20	11.0
Metals - Furnace (SW846 Method 3020A/7841)				
Thallium	µg/L	10.0	1.0	2.90 (e)
Metals - ICP TRACE (SW846 Method 3010A/6010B)				
Antimony	ug/L	6.0	1.3	15
Arsenic	ug/L	10.0	2.0	11 (0.045*)
Lead	ug/L	3.0	1.0	---
Selenium	ug/L	5.0	2.0	180
Cadmium	ug/L	5.0	0.24	18.0
Metals - ICP (SW846 Method 3010A/6010B)				
Aluminum	µg/L	200	65.3	37000
Antimony	µg/L	60.0	24.1	15
Barium	µg/L	200	7.9	2600
Beryllium	µg/L	5.0	1.0	0.016*
Cadmium	µg/L	20	3.3	18.0
Calcium	µg/L	1000	39.1	---
Chromium	µg/L	10.0	4.1	180 (c)
Cobalt	µg/L	50.0	6.5	2200
Copper	µg/L	10.0	5.1	1500
Iron	µg/L	100	53.3	11000
Magnesium	µg/L	1000	34.9	---
Manganese	µg/L	20.0	8.2	840
Nickel	µg/L	40.0	5.0	730
Potassium	µg/L	1000	71.1	---
Silver	µg/L	20.0	4.3	180
Sodium	µg/L	1000	81.0	---
Vanadium	µg/L	50.0	3.2	260
Zinc	µg/L	20.0	12.2	11000

TABLE 7-3 (continued)

(a) Lionville Laboratory Report Limit (RL) or laboratory quantitation limits. These are the minimum concentrations reported for routine laboratory analyses in specified environmental matrices. See Section 2.3.2. Method Detection Limit determined according to 40 CFR 136.
(b) EPA Region III Risk-Based Concentrations (April 1996) for soil ingestion (industrial and residential) using a hazard quotient of 0.1 for noncarcinogenic effects, and a lifetime cancer risk of 10^{-6} for carcinogenic effects. The most recent RBCs will be employed for data evaluation.
(c) As hexavalent chromium.
(d) EPA Region III Risk-Based Concentrations (April 1996) for Tap Water.
(e) As thallium chloride.
(g) RBCs are not available specifically for endosulfan II and endosulfan sulfate. The RBC for endosulfan is used.
(h) RBCs are not available specifically for endrin ketone and endrin aldehyde. The RBC for endrin is used.
(i) RBC not available; RBC for pyrene is used.
(j) RBC not available; RBC for naphthalene is used.
(k) Guidelines are for total.
(l) RBC for mixture is 0.999*.
(m) 25 mL purge.
* Denotes cancer RBC.

TABLE 7-4 LIONVILLE LABORATORIES REPORTING LIMITS FOR TCLP HAZARDOUS TOXICANTS

Parameter	Units	EA Reporting Limit[a]	TCLP Regulatory Criteria[b]
Semivolatile organics GC/MS - (SW846 3520C/8270C)			
1,4-Dichlorobenzene	µg/L	50	7,500
2,4-Dinitrotoluene	µg/L	50	130
Hexachlorobenzene	µg/L	50	130
Hexachlorobutadiene	µg/L	50	500
Hexachloroethane	µg/L	50	3,000
2-Methylphenol	µg/L	50	200,000
3+4-Methylphenol	µg/L	50	200,000
Nitrobenzene	µg/L	50	2,000
Pentachlorophenol	µg/L	250	100,000
Pyrdine	µg/L	50	5,000
2,4,5-Trichlorophenol	µg/L	250	400,000
2,4,6-Trichlorophenol	µg/L	50	2,000
Volatile organics GC/MS - 5 mL purge (SW846 5030B/8260B)			
Benzene	µg/L	5	500
2-Butanone (MEK)	µg/L	10	200,000
Carbon tetrachloride	µg/L	5	500
Chlorobenzene	µg/L	5	100,000
Chloroform	µg/L	5	6,000
1,2-Dichloroethane	µg/L	5	500
1,1-Dichloroethene	µg/L	5	700
Tetrachloroethene	µg/L	5	700
Trichloroethene	µg/L	5	500
Vinyl chloride	µg/L	5	200
Metals - Cold Vapor (SW846 7470A)			
Mercury	µg/L	0.20	200
Metals - ICP (SW846 3010A/6010B)			
Arsenic	µg/L	100	5,000
Barium	µg/L	200	100,000
Cadmium	µg/L	20.0	1,000
Chromium	µg/L	10.0	5,000
Lead	µg/L	200	5,000
Selenium	µg/L	200	1,000
Silver	µg/L	20.0	5,000

8. DATA COLLECTION, REDUCTION, AND REPORTING

8.1 LABORATORY DATA COLLECTION

For inorganic and general organic analyses where the instruments are not directly coupled to computerized data systems, the raw data are instrument responses in the form of meter, recorder, or printer output. The technician performing the analysis enters the bench-generated data into a bound laboratory workbook specific for each parameter. All entries are made in ink. These data consist of instrumental responses (absorbances, percent transmittances, etc.), standard and spike concentrations, sample numbers, and any other pertinent information. The workbooks are under the control of the group supervisor/manager who is responsible for their security. For computerized instruments the output is in the form of printer output and files on magnetic disks, which are filed by sample delivery group.

For chromatographic organic analyses, the raw data are instrument responses in the form of chromatograms, integrator output, or computer-generated data files. The chromatograms and printer output are stored in project-specific files. The data files are archived on magnetic tape.

8.2 DATA REDUCTION

Data reduction includes all processes that change either the values or numbers of data items. The data reduction processes used in the laboratory include establishment of calibration curves, calculation of sample concentrations from instrument responses, and computation of QC parameters.

All field instruments are direct-reading instruments; that is, the data do not need to be reduced. No manual temperature compensation for pH or conductivity is necessary. Neither is it necessary to calculate a cell constant for conductivity.

8.2.1 Calibration Curves

The calibration or standard curve is the curve that plots instrument response against analyte concentration. The curve is prepared by measuring the responses of a series of solutions of the analyte (calibration standards) with known concentrations. Least-squares regression can be used to fit a curve through the standard concentration response data. The regression analysis also

Chromatographic Methods

For chromatographic analyses, the unknown concentrations are determined using response factors with either internal or external standardization. Use of the internal standard method with GC/MS analyses requires the determination of response factors (RF), which are calculated from the following:

$$RF = \frac{A_s}{A_{is}} \frac{C_{is}}{C_s}$$

where:

As	=	area of the characteristic ion of the standard for the target compound
A_{is}	=	area of the characteristic ion of the internal standard
C_{is}	=	concentration of the internal standard (μg/L)
C_s	=	concentration of the target compound standard (μg/L)

When the compound has been identified, the quantitation of that compound is based on the integrated abundance of the primary ion(s). If the sample produces an interference for the primary ion, a secondary ion is used to quantify. The concentration in the sample is calculated using the RF.

$$\text{Concentration } (\mu\,g/L) = \frac{C_{is}}{RF} \frac{A_s}{A_{is}}$$

where:

A_s	=	area of the characteristic ion for the target compound
A_{is}	=	area of the characteristic ion for the internal standard
C_{is}	=	concentration of the internal standard (μg/L)

Quantitation by the external standard technique for GC analyses involves calculation of the concentrations of the target compound from the sample response and the responses of a set of standard solutions of the compound. Standard solutions concentrations and responses are used to calculate calibration factors (CF); if the relative standard deviation (RSD) for the calibration factors of the standards is less than or equal to 30%, for example, linearity through the origin is assumed and the samples' concentrations are calculated using the average calibration factor and sample response.

$$CF = A_s / C_s$$

where:

CF	=	calibration factor
A_s	=	peak area of standard
C_s	=	mass of analyte injected, ng

And, for non-extractables,

$$\text{Concentration } (\mu g/L) = (A_{sam}) (V_t) (D) / (Cf_{avg}) (V_i) (V_s)$$

where:

A_{sam}	=	peak area of sample
V_t	=	total volume of sample extract, mL
D	=	dilution factor, if any
CF_{avg}	=	average calibration factor
V_i	=	volume of extract injected, µL
V_s	=	volume of sample extracted, L

When the %RSD of the calibration factors for the standards is greater than 30%, a linear regression analysis is used to calculate sample concentrations. These calculations are generally performed by the associated computerized data systems. The data are transferred to summary tables, which are given to the reports group.

Solid Samples

The dry-weight concentration of a solid sample is calculated from the analytical concentration of the processed sample using the following formula:

$$K = (C) (V) (D) / (W) (\%S/100)$$

where:

C	=	analytical concentration (mg/L)
D	=	dilution factor
K	=	dry-weight concentration (mg/kg)
V	=	final volume (ml) of processed sample solution
W	=	wet weight (g) of sample aliquot taken for analysis
%S	=	percent solids of sample

Significant Figures and Units

The number of significant figures in the reported data is consistent with the limits of uncertainty inherent in the analytical method. The data reporting conventions are set forth in Lionville Laboratory SOP No. QA-001. The units used in reporting data are those commonly used for the analyses performed. Concentrations in liquid samples are expressed in terms of weight per unit volume [e.g., milligrams per liter (mg/L) or micrograms per liter (μg/L)]. Concentrations in solid or semisolid matrices are expressed in terms of weight per unit weight [e.g., milligrams per kilograms (mg/kg)]. In addition, solid concentrations are converted to a dry-weight basis, using the percent solids of the sample.

8.3 DATA REPORTING

8.3.1 Laboratory Data Reporting

After all analyses are completed and approved for release by the Laboratory Section Chiefs and QC Chemists, the data are forwarded to the laboratory reports group, where they are assembled into a draft report. The reports group assembles the final data report by incorporating the data packages for each analysis associated with the reported samples. The reports group is responsible for assembling the data packages and other report-related information, such as copies of chain-of-custody, communication record, and nonconformance forms. The analytical data report will include the following items: all sample identification numbers, date(s) collected, date(s) analyzed, analytical results, detection limits, units, methods identification, project name/location, laboratory identification (name/address/phone number), and approval signature(s). A laboratory report is prepared and reviewed by a member of the Reports staff (someone other than the preparer) for compliance with report deliverables requirements.

The report is then reviewed by the Laboratory Project Manager (LPM), who signs the report narrative to certify that the report meets the DQOs for precision, accuracy, and completeness specified for this project. After completion of the review of the data report, the report is forwarded to the EA Project Manager who incorporates the laboratory report into the final project report. The laboratory copy of the report is filed in the appropriate laboratory Central Project File.

8.3.1.1 Electronic Data Deliverables

In addition to a hardcopy data report, the laboratory will submit an electronic data deliverable (EDD) for each data set in a format consistent with the Lionville Laboratory Standard EDD. The standardized Lionville Laboratory EDD contains the results of all field samples and blanks for all target analytes. Results of laboratory QC samples and tentatively identified compounds (GC/MS methods) will not be included. Table 8-1 lists information included in the EDD.

8.3.2 Field Data Reporting

Field records are evaluated by the site manager for the following:

- completeness
- identification of valid samples
- identification of anomalous field test data
- accuracy and precision of field data and measurement

The review of field record completeness checks that requirements for field activities in the work plan have been fulfilled, that complete records exist for each field activity, and that the procedures specified in the work plan have been implemented. Field documentation must ensure sample integrity and provide sufficient information to characterize each field event. The results of the completeness check are documented by the site manager, and any data affected by incomplete records are identified at this time.

The identification of valid samples involves interpreting and evaluating the field records to detect problems affecting representativeness of field samples. Field records can indicate whether a well is properly constructed; well-development records can indicate whether correct development has occurred. Field audits are another source of data for review. The judgements for data validity will be documented in the technical report, and field data associated with

incorrect field work will be identified. Anomalous field data will be identified and explained to the extent possible in the technical report.

TABLE 8-1 LIONVILLE LABORATORIES STANDARDIZED ELECTRONIC DATA DELIVERABLE

FIELD NAME	DATA TYPE	WIDTH	DESCRIPTION
Report Number	Character	6	Lionville Laboratories report number
Laboratory Sample ID	Character	12	Lionville Laboratories sample identifier
Sample Type	Character	6	Field to distinguish multiple instances of the same physical sample. Examples: N (normal), RE (re-run), DL (dilution)
Dilution Factor	Numeric	12	Dilution factor
Field Sample ID	Character	20	Field-assigned sample identifier
Sampling Date	Date	8	Date of collection
Extraction Date	Date	8	Date of Extraction
Analysis Date	Date	8	Date of Analysis
Matrix	Character	10	Sample Matrix. Examples: Water, soil
Moisture	Numeric	5	Percent moisture
Extraction Method	Character	12	Extraction Method. Examples: SW3050, SW3540
Method Reference	Character	12	Abbreviated reference to a published method. Examples: SW6010, SW8270, EPA 300.0
Analyte	Character	32	Name of analyte
CAS Registry Number	Character	10	Chemical Abstract Service registry number (if available)
Laboratory Result	Numeric	14	Laboratory-generated result
Laboratory Qualifiers	Character	5	Laboratory-generated CLP-type qualifiers
Laboratory Reporting Limit	Numeric	14	Laboratory-generated reporting limit
Units	Character	10	Units of measure
Batch ID	Character	10	Batch where QC originates.
Analyte Group	Character	30	Grouping of Analytes. Examples: Volatile, Pesticides, Metals.

9. PERFORMANCE AND SYSTEM AUDITS

Audits are systematic checks to determine the quality of operation of some activity or function in the field or laboratory. Audits are of two types: performance and system.

Performance audits are independent procedure and/or sample checks made by a supervisor or auditor to arrive at a quantitative measure of the quality of the data produced by one section or the entire measurement process. Performance audits are conducted by reviewing project documents and/or introducing control samples, in addition to those used routinely, into the data production process. These control samples may include performance evaluation samples of known concentrations; field samples spiked with known amounts of analyte; and split field samples that are analyzed by two or more analysts within or without the organization.

System audits are onsite qualitative inspections and reviews of the quality assurance system used by some part of or the entire measurement system. System audits are conducted by the corporate QA group with the assistance and involvement of field, laboratory, and project personnel. The audits are performed against a set of requirements, which may be a QA project or program plan, a standard method, or a safety, health, and emergency response plan. A checklist is generally generated from the requirements and becomes the basis for the audit. The results of any deficiencies noted during the audit are summarized in a audit report.

9.1 RESPONSIBILITY, AUTHORITY, AND TIMING

Quality assurance audits to be conducted for the project may include system, performance, and data audits. Audits will be conducted at appropriate intervals, but at a minimum on an annual basis. The audits may be conducted more frequently for a specific task or activity, such as field sample collection. The project QA Officer will keep on record a tentative schedule that details the number and types of audits, both scheduled and unscheduled, for the current year and a current list of the dates of completed audits.

An individual audit plan will be developed by the QA Officer to provide a basis for each audit. This plan will identify the audit scope, activities to be audited, audit personnel, any applicable documents, and the schedule. Checklists will be prepared by the auditors and used to conduct all audits. They will be developed to accomplish the necessary reviews and to document the results of the audit.

9.2 LABORATORY PERFORMANCE AND SYSTEMS AUDITS

The laboratory regularly participates in performance audits as part of its laboratory certification efforts. Performance Evaluation (PE) samples from the U.S. EPA Water Supply and Water Pollution Studies are currently analyzed twice yearly for state certification programs. In addition, other states and agencies require the periodic analysis of their own PE samples.

The results of performance audits are summarized and maintained by the Quality Services Officer (QSO) and distributed to the supervisors who must investigate and respond to any results that are outside the control limits.

Audits are performed routinely to review and evaluate the adequacy and effectiveness of laboratory performance and quality assurance program, to ascertain if the Sampling and Analysis Plan (SAP) is being completely and uniformly implemented, to assess the effectiveness of the laboratory quality assurance program, to identify nonconformance, and verify that identified deficiencies are corrected. The laboratory QSO is responsible for such audits and will perform them according to a schedule planned to coincide with appropriate activities on the project schedule and sampling plans. Such scheduled audits may be supplemented by additional audits when significant changes are made in the project specific work plans or in the SMP, to verify that corrective action has been taken on a nonconformance reported in a previous audit, and/or when requested by the CTO Manager.

9.2.1 Audit Procedures

Prior to an audit, the designated lead auditor prepares an audit checklist. During an audit and upon its completion, the auditor(s) will discuss the findings with the individuals audited and discuss and agree on corrective actions to be initiated. Within 7 days of completion of an audit, the auditor will prepare and submit an audit report to the Lab Manager of the audited group and the Project Manager. Minor administrative findings that can be resolved to the satisfaction of the auditor during an audit are not required to be cited as items requiring corrective action. Findings that are not resolved during the course of the audit and findings affecting the overall quality of the project will be included in the audit report.

Within 7 days, the Lab Manager of the audited group will prepare and submit to the QA Officer and the EA Project Manager a reply to the audit. This reply will include, at a minimum, a plan for implementing the corrective action to be taken on nonconformance indicated in the Audit

Report, the date by which such corrective action will be completed, and actions taken to prevent re-occurrence. If the corrective action has been completed, supporting documentation should be attached to the reply. The Auditor will ascertain (by reaudit or other means) if appropriate and timely corrective action has been implemented.

Records of audits will be maintained in the project files. Audit files will include, as a minimum, the Audit Report, the reply to the audit, and any supporting documents. It is the responsibility of the Project Manager to conform to the established procedures, particularly as to development and implementation of such corrective action(s).

9.2.2 Documentation

To ensure that the previously defined scope of the individual audits is accomplished and that the audits follow established procedures, a checklist will be completed during each audit. The checklist will detail the activities to be executed and ensure that the auditing plan is accurate. Audit checklists will be prepared in advance and will be available for review. At a minimum, the checklist will allow space for the following information:

- date and type of audit
- name and title of auditor
- description of group, task, or facility being audited
- names of lead technical personnel present at audit
- reference documents
- checklist of audit items according to scope of audit
- deficiencies or nonconformances

Following each system, performance, and data audit, the lead auditor will prepare a report to document the findings of the specific audit. The report is submitted to the Program Manager, CTO Manager, and the Section Chief of the audited group to ensure that objectives of the QA program are met. In general, the format of the audit quality assurance reports will consist, at a minimum, of the following:

- description and date of audit
- name of auditor(s)
- copies of completed, signed, and dated audit form and/or checklist

- summary of findings of the audit including any nonconformance or deficiencies
- date of report and appropriate signatures
- description of corrective actions
- corrective action follow-up report

A copy of the signed and dated report for each laboratory audit will be maintained by the QSM, and will also be placed in project files as necessary.

9.3 FIELD AUDITS

The CTO Manager is responsible for ensuring the following tasks are conducted:

- The Site Manager will supervise and check on a daily basis that the monitoring wells are installed and developed correctly, field measurements are made accurately, equipment is thoroughly decontaminated, samples are collected and handled properly, and field work is accurately and neatly documented.

- Where data validation is required, the Data Validator will review the data packages submitted by the laboratory in a timely manner. The data validator will check that the data were obtained through the approved methodology, that the appropriate level of QC effort and reporting were conducted, that holding times were met, and that the results are in conformance with the QC criteria. On the basis of these factors, the data validator will evaluate the data quality and limitations.

The Program Quality Assurance Officer is responsible for ensuring the following tasks are conducted:

- System audits for the laboratory is performed on a regular basis.

- A formal audit of the field sampling procedures will be conducted in addition to the auditing that is an inherent part of the daily project activities.

- The auditors will check that sample collection, sample handling, decontamination protocols, and instrument calibration and uses are in accordance with the approved project SOPs. The auditors will also check that the field documentation logs and chain-of-custody forms are being filled out properly.

- The auditors will review documentation of field work which may include the availability and implementation of approved operating procedures; calibration and operation of equipment; packaging, storage, and shipping of samples obtained; documentation procedures and instruction; nonconformance documentation; availability of the health and safety plan; and implementation of the plan requirements.

The records of field operations will be further reviewed to verify that field-related activities were performed in accordance with appropriate procedures.

10. DATA QUALITY ASSESSMENT

10.1 DATA QUALITY ASSESSMENT

10.1.1 Laboratory Data Assessment

Data assessment is a systematic process of reviewing data against a set of criteria to identify outliers or errors and to delete suspect values or to flag them for the user. Laboratory data review starts with the laboratory QC procedures discussed in Section 2.1. The QC data produced are reviewed by the analyst, supervisor, and QA staff throughout sample analysis and data generation using the criteria and procedures described in this chapter to validate data integrity during collection and reporting of analytical data. Data review checklists are used to document the performance and review of the QC and analytical data.

10.1.1.1 Responsible Personnel

Initial Review - Review of analytical and quality control data is initially performed by the responsible analyst. The data are checked for errors in transcription, calculations, and dilution factors and for compliance with quality control requirements. Failure to meet method performance quality control criteria results in reanalysis of the sample or lot. After the initial review is completed, the data are collected from summary sheets, workbooks, or computer files and assembled into a data package.

QC Chemist - The next level of data review is the prime responsibility of the QC Chemist. The QC Chemist is a senior analyst whose primary role is data review and evaluation. They check the data packages and compare results for analyses performed in their respective areas. During this review, total and dissolved results are compared, analytical species are reviewed to ensure that the total is equal to or less than the sum of the species analyzed, and data may be reviewed against historical results if the project has an adequate database for comparison. The QC Chemist then evaluates the whole data package for completeness, reviews all of the control results against the appropriate QC criteria, and writes an analytical data narrative describing the samples' chronological history, laboratory method performance, and sample performance.

QA Audit - As a final check on laboratory performance, the Quality Assurance staff audits a minimum of ten percent of all completed data packages before their release to the client. The

QA audit includes, but is not limited to, a review of docmentation and format, chain-of-custody, and report completeness.

10.1.1.2 Criteria

The areas routinely reviewed at all levels include the following:

- Proper COC and sample handling procedures followed
- Parametric holding times met
- Samples prepared and analyzed according to specified methods
- Instrumentation calibrated according to specified methods
- Spike (surrogate or standard) recoveries within specified ranges
- Blanks prepared and analyzed as required
- Calculations performed correctly and verified
- Transcription of raw and final data correct
- Detection limits determined correctly and within required limits

Any problems discovered during the review and the corrective actions necessary to resolve them are communicated to the responsible QC Chemist, who discusses the findings with the QSO for resolution.

10.1.2 Field Data Assessment

Assessment of the field data is the prime responsibility of the CTO Manager, who addresses the following areas:

- Proper COC, sample handling, and decontamination procedures followed
- Samples collected according to specified methods
- Field instrumentation calibrated according to specified methods
- QC samples (e.g., blanks, duplicates) collected as required
- Field data sheets and logbooks completed and in agreement with sample container labels and COC forms

10.1.3 Final Report Review

A reviewer designated by the CTO Manager examines the final laboratory data for consistency with previous data and the hydrogeological characteristics of the site. Compliance with study plan requirements is also reviewed. Final assessment is the responsibility of the Program QA Officer or designated quality reviewers.

10.2 DATA VALIDATION

All laboratory-generated analytical data will be subject to data validation by an independent third party. Data will be validated according to the U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, the U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, and the Region III Modifications to the National Functional Guidelines, modified for use with project specified methods. Data will be validated versus the method requirements specific to each of the methods used and the specific criteria and modifications identified in this QAPP and in the individual work plans.

When the EDD is updated with the validation results, two fields will be added: the first will be "data validation qualifier"; the second will be "modified analytical concentrations." The modified analytical concentrations field is necessary in case the validator finds miscalculations by the analytical laboratory or if values are validated as false positives.

11. CORRECTIVE ACTION

11.1 OBJECTIVES

The objectives of the corrective action procedures presented below are to ensure that recognized errors in performance of sample and data acquisition leads to effective remedial measures and that those steps required to correct an existing condition are properly documented. This provides assurance that any data quality deficiencies are recognized in later interpretation and are not recurrent in the course of the project.

11.2 RATIONALE

Many times corrective measures are undertaken by project staff in a timely and effective fashion but go undocumented. Such incidents may be of a recurrent type that might not be recognized by other staff performing the same activity. In other cases, corrective actions are of a complex nature and may require scheduled interactions between departmental groups. In either case, documentation in a formal or informal sense can reinforce the effectiveness and duration of the corrective measures taken.

11.3 CORRECTIVE ACTION METHODS

Corrective actions are of two kinds: immediate and long-term.

11.3.1 Immediate Corrective Actions

Immediate corrective actions are of a routine nature such as correcting malfunctioning equipment, correction of data transcription errors, and other such activities made in the field, laboratory, or office by technicians, analysts, and other project staff. These will be documented as prescribed in the project QC procedures. Specific documentation should be limited to notations in logbooks, notebooks, or on data sheets or other such forms. Such notations should be initiated and dated by the person performing the corrective action.

11.3.2 Long-Term Corrective Actions

Long-term corrective action shall be used to identify and eliminate causes of nonconformances which are of a complex nature and that are formally reported between management groups. A formal system for reporting and recording these corrective actions shall use the following procedure.

11.3.3 Corrective Action Steps

For either immediate or long-term corrective actions, steps comprising a closed-loop corrective action system are as follows:

- Define the problem
- Assign responsibility for investigating the problem
- Investigate and determine the cause of the problem
- Determine a corrective action to eliminate the problem
- Assign and accept responsibility for implementing the corrective action
- Establish effectiveness of the corrective action and implement the correction
- Verify that the corrective action has eliminated the problem

Nonconformance events associated with analytical work are documented using Lionville Laboratory Corrective Action (CA) Forms which are reviewed and approved by the QSO (QA-001).

11.4 CORRECTIVE ACTION REPORT REVIEW AND FILING

Immediate and long-term corrective actions require review to assure that, during the time of non-conformance, erroneous data were not generated or that, if possible, correct data were acquired instead. Such confirmation and review is the responsibility of the supervisor of the staff implementing the corrective action. Confirmation shall be acknowledged by notation and dated signature on the affected data record or appropriate form or by memorandum to cognizant project management. Such corrective action forms and memoranda shall be retained on file by responsible task leaders and filed centrally by the CTO Manager.

11.5 CORRECTIVE ACTIONS REPORTS TO MANAGEMENT

The Program QA Officer shall provide project management with corrective action reports. The CTO Manager is informed verbally of analytical non-conformance events as soon as possible and decisions made after evaluation are documented in the CA Form. Copies of each CA Form are maintained in the report file, and addressed in the final data report.

12. QUALITY ASSURANCE REPORTS

Fundamental to the success of this QA/QC is the active participation of the CTO Manager and the Program QA Officer in the project. The CTO Manager and the Program QA Officer will be aware of project activities and will participate in development, review, and operation of the project. Project management will be informed of QA activities through the receipt, review, and/or approval of:

- Project-specific QA project plans
- Corporate and project-specific QA/QC plans and procedures
- Corrective action notices
- NCRs

Periodic assessment of field and laboratory QA/QC activities and data accuracy, precision, and completeness will be conducted and reported by the laboratory. Items to be included in the QA reports are the summary of results for the performance or the system audit and, where applicable:

- Assessment of adherence to work scope and schedule for the audited task
- Assessment of the precision, accuracy, and completeness of sample batches and subsequent status of data processing and analyses
- Significant QC problems and the status of any ongoing corrective actions
- Changes to the QAPP
- Status of the implementation of the QAPP

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ATTACHMENT A

Lionville Laboratory Incorporated
Laboratory Standard Operating Procedures
Quality Assurance

SOP No.	Revision No.	Effective Date	Page
QA-001	01	10/16/02	1-1 of 1-1

LABORATORY QUALITY ASSURANCE MANUAL/QUALITY ASSURANCE PLAN

This Quality Assurance Manual (QAM) governs the quality program for all operating units of Lionville Laboratory Incorporated, as shown in the organization chart presented in the manual.

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LABORATORY QUALITY ASSURANCE MANUAL/QUALITY ASSURANCE PLAN

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3.0 QUALITY POLICY STATEMENT

"It is the policy of Lionville Laboratory Incorporated to understand and meet the requirements of its clients while exceeding their service expectations, to provide services and deliverables that are technically sound and are responsive to its clients' needs and to maintain a focus on continuous improvement." Lionville Laboratory Incorporated (LvLI) is committed to implementation and maintenance of this policy and will deploy the appropriate resources to ensure its attainment.

3.1 Quality Objectives

It is the objective of Lionville Laboratory Incorporated to be acknowledged as an organization that understands and meets the requirements of both external and internal clients, while exceeding their relationship expectations; provides services and deliverables that are professionally sound and are responsive to the clients' needs, including protection of confidential and proprietary rights; and maintains a focus on continuous improvement. It is essential to:

- Develop a reputation for dependability by maintaining the highest standards of professionalism and ethical business practices.
- Deal fairly at all times with suppliers, competitors, and clients in accordance with the highest standards of professionalism and ethical business practices.
- Aspire, through excellence of performance, to achieve the highest level of distinction, both organizationally and individually.

LvLI is committed and dedicated to providing the highest quality analytical data possible to its clients. It is the policy of LvLI to incorporate the highest standard of quality with all analytical programs by adhering to the following practices:

- LvLI will only offer environmental analyses for which it can consistently demonstrate compliance with high quality, traceable, and legally defensible performance standards.
- All LvLI staff is committed to the practice of complete honesty in the production and reporting of data.
- Staff who are aware of misrepresentation of facts or data manipulation to bypass QA/QA requirements, are required to immediately inform their supervisor or any member of upper management. No reprisal will be made based upon such reporting.

LvLI's principal focus is the analysis of environmental samples. Associated with this activity are services to assure client requirements are known, communicated, and satisfactorily addressed, and provide a deliverables package presenting the analytical results. LvLI is committed to ensuring that resources are available and deployed to meet client expectations. All quotes are signed or approved by an officer of the company, thus verifying that the laboratory has the appropriate facilities and

resources in place to perform the work. Other project information is gathered prior to sample receipt to ensure client expectations will be met with respect to:

- Sampling containers
- Analytical methods employed
- Accuracy and precision
- Reporting limits
- Personnel qualifications, training, and experience
- Calibration and quality control measures employed
- Regulatory requirements
- Report contents
- Supporting documentation, records and evidence
- Validation of data

Organizational support for implementing the quality policy and achieving the quality objectives is derived from Policy Directives and Operating Procedures. Within these documents, management with executive responsibilities ensures that the quality policy is understood, implemented, and maintained at all levels of the organization. The development and implementation of appropriate accountabilities, duties, and authority by organizational positions are clearly delineated. Line organizations achieve and verify that specifications are achieved, QA organizations assist and provide oversight and verification of processes through planning, reviews, audits, and surveillances. Top management leadership, support and direction ensure that the Corporate Policies and Procedures are appropriately implemented.

3.2 Quality Planning, Contract Review and Design Control

Standard of quality refers to a specific, defined, pre-established level of excellence. The phrase "standard of quality" will usually be preceded by a descriptive word or phrase such as "EPA", "USAEC", "AFCEE", "NFESC", "USACE", or "NELAC" which references documented descriptions of the requirements to be achieved.

A standard of quality shall be established for every LvLI project and work element. The vehicle through which this standard is documented and communicated is this Quality Assurance Manual, in conjunction with a Project Technical Profile and/or Quality Assurance Project Plan (QAPjP). Quality planning, contract review, and project management (e.g., design control), are inherently interrelated processes and addressed by laboratory specific standard procedures, including LvLI SOPs PM-001 and PM-002, Technical Profiles.

The Project Technical Profile will summarize basic project requirements, such as QC and deliverable requirements, analyte lists, certification requirements, turnaround times, and project specific

information (e.g., the project manager, work order number, subcontracting restrictions, hazard restrictions, etc.).

Project and/or client-specific quality control measures can be customized in a Quality Assurance Project Plan (QAPjP), Technical Profile, Analytical Quote, Proposal, and/or Contract; which all together comprise the quality plan for the laboratory deliverable. This allows the client to add, supersede or take exception to basic laboratory QA Manual guidance in order to satisfy the needs of individual projects or programs with specialized requirements. Laboratory personnel are available to develop and/or discuss advantages and disadvantages of quality control options for inclusion in QAPjPs.

Typical information included in QAPjPs is listed below, but inclusion is dependent on project scope, program requirements and client needs.

- Project description
- Project organization and responsibility
- Quality assurance objectives
- Sample custody
- Analytical methods
- Analytes, compounds and reporting limits
- Internal quality control checks
- Corrective action
- Reporting requirements

LvLI provides environmental services to industrial and governmental clients including the Pennsylvania Department of Environmental Protection, USACE, Department of Energy, as well as many other projects overseen by various U.S. EPA Regions.

3.3 Document Authorities and Definitions

This plan has been prepared based on the guidelines and principles set forth in the following documents:

- EPA QA/R-2, "EPA Requirements for Quality Management Plans ", EPA/240/B-01/002, March 2001(for content),

- EPA QA/R-5, "EPA Requirements for Quality Assurance Project Plans ", EPA/240/B-01/003, March 2001 (for content),

- ASME NQA-1-1997 Edition (with 1999 supplement), "Quality Assurance Program Requirements for Nuclear Facilities," American Society of Mechanical Engineers, 345 East 47th Street, New York, New York 10017 (for the 18 criteria, but not necessarily all supplements and appendices),

- DOE Order 414.1

- National Environmental Laboratory Accreditation Program (NELAP) Quality Systems Document, Chapter 5; most recent revision

- DOD Quality Systems Manual For Environmental Laboratories, Version 1 Final, 10/2000 (based on NELAC Rev 12, 7/99)

Tables 3.1 through 3.3 provide matrices showing the correlation of sections in the Quality Assurance Manual with sections of the following documents:

- Table 3.1, QA/R-5
- Table 3.2, NELAC Chapter 5 (5.5.2, Rev 14 (2000) and Rev 15 (2001))
- Table 3.3, DOD Quality Systems Manual (QSM)

Definitions commonly used in the field and within this Quality Assurance Manual can be found in the listed references and NELAC Chapter 1, Appendix A.

3.4 Servicing

The laboratory establishes and maintains procedures for performing and verifying that client servicing meets requirements. Typical services provided are:

- Sample Containers/Supplies -- SR-001,
- Project QAP preparation, refer to QAP section 3.2 Quality Planning,
- Regulatory advisory functions, PM-001 and PM-002.
- Consulting, PM-001 and PM-002.

Regulatory and advisory functions are addressed under the same procedures used for project planning.

Table 3.1
Correlation of Lionville Laboratory Incorporated Quality Assurance Manual with EPA QA/R-5

EPA QA/R-5 ELEMENT		LvLI QAM SECTION	
A1	Title and Approval Sheet	1.0	Title Page
A2	Table of Contents	2.0	Table of Contents
A3	Distribution List	7.2	Document and Data Control
A4	Project/Task Organization	4.0	Organization and Responsibilities
A5 A6	Problem Definition/Background Project/Task Description	3.0	Quality Assurance Policy
A7	Quality Objectives and Criteria	5.0	Quality Assurance Objectives
A8 A9	Special Training/Certification Documents and Records	4.5 7.2 7.3	Personnel Qualification and Training Document and Data Control Quality Records
B1 B2	Sampling Process Design Sampling Methods	6.0	Sampling Procedures
B3	Sample Handling and Custody	7.0	Chain of Custody
B4	Analytical Methods	8.0	Analytical Procedures
B5	Quality Control	11.0	Internal Quality Control Checks: Laboratory
B6	Instrument/Equipment Testing, Inspection, and Maintenance	10.0	Preventative Maintenance
B7	Instrument /Equipment Calibration and Frequency	9.0	Calibration Procedures and Frequency
B8	Inspection/Acceptance of Supplies and Consumables	7.4	Material Procurement and Control
B9 B10	Non-direct Measurements Data Management	12.0	Data Reduction, Validation and Reporting
C1	Assessments and Response Actions	13.0 14.0	Corrective Action Performance and Systems Audits
C2	Reports to Management	15.0	Quality Assurance Reports to Management
D1 D2	Data Review, Verification, and Validation Verification and Validation Methods	12.0	Data Reduction, Validation and Reporting
D3	Reconciliation with User Requirements	11.0	Procedures Used to Assess Data Quality

Table 3.2

Correlation of Lionville Laboratory Incorporated Quality Assurance Manual with NELAC Chapter 5 (2000 and 2001)

NELAC Chapter 5 Reference (5.5.2 Quality Manual)		LvLI QAM SECTION Or Related Quality Document	
a)	Quality Policy Statement	3.0	Quality Policy Statement
b)	Organization and Management	4.0	Organization and Responsibilities
c)	Relationship between management, technical operations, support services, and quality system	4.0	Organization and Responsibilities
d)	Records retention/document control	7.2 7.3	Document and Data Control Quality Records
e)	Job descriptions of key staff	4.4	LvLI Personnel Descriptions
f)	identification of approved signatories, title page	1.0	Title Page
g)	Procedure for traceability of measurements	10.1	Standard Receipt and Traceability
h)	List of test methods for accredited testing	Appendix C NELAC Accredited Methods and Analytes	
i)	Mechanism for review of new work		PM Series SOPs
j)	Reference to calibration and/or verification test procedures	10.0	Calibration Procedures and Frequency
k)	Procedures for handling submitted samples	6.0	Sample Custody
l)	Reference to major equipment and reference measurement standards; facilities and services	Appendix B Instrument List 10.1	 Standard Receipt and Traceability
m)	References to procedures for calibration, verification, and maintenance of equipment	10.0 12.0	Calibration Procedures and Frequency Preventative Maintenance
n)	Reference to verification practices: interlaboratory comparisons, proficiency test programs, use of reference materials, and internal quality control	9.0 14.0	Quality Control Checks Performance and System Audits
o)	Procedures to be followed for feedback and corrective action	13.0	Corrective and Preventive Action
p)	Management arrangements for exceptionally permitting departures from documented policies and procedures	13.0	Corrective and Preventive Action
q)	Procedures for dealing with complaints		PM Series SOPs
r)	Procedures for protecting confidentiality		Employee Handbook, Annual Refresher Training
s)	Procedures for audits and data review	14.0 11.0	Performance and System Audits Data Reduction and Reporting

t)	Processes/procedures to establish personnel are adequately trained	4.5	Personnel Qualification and Training
u)	Ethics policy	3.0	Quality Policy Statement Annual Refresher Training
v)	Reference to procedures for reporting analytical results	11.0	Data Reduction and Reporting
w)	table of contents, lists of references, appendices	2.0	Table of Contents

Table 3.3

Correlation of Lionville Laboratory Incorporated Quality Assurance Manual with DOD Quality Systems Manual

DOD QSM Reference		LvLI QAM SECTION Or Related Quality Document	
1.0	Scope	3.0	Quality Policy Statement
2.0 3.0	References Definitions	3.3	Document Authorities and definitions
4.0	Organization and Management	4.0	Organization and Responsibilities
5.0	Quality System	4.3 9.0 14.0	Quality System Quality Control Checks Performance and System Audits
6.0	Personnel	4.4 4.5	LvLI Personnel Descriptions Personnel Qualification and Training
7.0	Physical Facilities	4.2	Facility Description
8.0	Equipment and Reference Materials	Appendix B 10.1	Instrument List Standard Receipt and Traceablility
9.0	Measurement Traceability and Calibration	10.0	Calibration Procedures and Frequency
10.0	Test Methods and Standard Operating Procedures	7.0	Analytical Procedures
11.0	Sample Handling, Sample Acceptance Policy, and Sample Receipt	6.0	Sample Custody
12.0	Records	6.9 7.3	Electronic Data Records Quality Records
13.0	Laboratory Report Format and Contents	11.3	Data Reporting
14.0	Subcontracting Analytical Samples	SOPs: PM-014, QA-011	
15.0	Outside Support Services and Supplies	7.4	Material Procurement and Control
16.0	Complaints	13.3	Responses to Client Feedback

4.0 ORGANIZATION AND RESPONSIBILITIES

4.1 General

The goals of LVLI are to enhance the quality of human life and the physical environment through the creative and sound application of human, economic, and natural resources; advanced science; and applied technology. LVLI provides an organizational structure to help accomplish the corporate goals. Our objective is to provide quality comprehensive and integrated professional analytical services effectively and efficiently.

LvLI provides expert personnel for supervision, technical consultation, and project review for effective planning and implementation of analytical assignments.

A description of the LvLI analytical laboratory is summarized in Section 4.2. Also, LvLI's organization is shown in Figure 4.1, a description of the QA System is given in Section 4.3; and management responsibilities and accountabilities with respect to ensuring that quality goals are met are summarized in Section 4.4. Professional qualifications and experience for the individuals filling these positions are maintained with the laboratory's training records.

4.2 LvLI Facility Description

LvLI is wholly owned by the Glen Rose Partnership LLP, a holding company incorporated in Delaware. Lionville Laboratory Incorporated is also incorporated in the state of Delaware. The laboratory is located at 208 Welsh Pool Road, in Lionville, PA, which is approximately 25 miles west of Philadelphia. It is staffed by 75 professionals and managed by J. Michael Taylor. The laboratory is a 39,000 square foot state-of-the-art commercial laboratory housing all of the laboratory operations. It is equipped with a "screening room" designed specifically for handling and screening mixed waste samples.

LvLI has the instrumentation, personnel and expertise to handle most analytical requirements. The laboratory was professionally designed and constructed to produce a highly functional and efficient environment.

The laboratory has facilities divided into separate work areas to facilitate sample throughput. These areas include the following:

- Sample receipt and refrigerated storage
- Organic sample preparation
- Glassware preparation
- Metals digestion
- Wet chemistry laboratory
- Instrumentation laboratories

The main instrumentation laboratories are equipped with state-of-the-art instrumentation and sufficient duplicate equipment to provide back-up service for most major systems. The current laboratory instrumentation list is attached in Appendix B. Each of the laboratory areas has separate heating, ventilation, and air conditioning systems.

4.3 LvLI Quality System Description

LvLI maintains a quality system to ensure that analytical products and services conform to client specified requirements. The quality system is documented by this Quality Assurance Manual/Plan and standard operating procedures (SOPs). LvLI maintains a master listing or index of standard operating procedures which comprise the quality system. In addition, other documents may be used by the laboratory to clarify compliance with quality system or other client requirements. This Quality Assurance Manual provides an outline and structure of the documentation used in the quality system. It may be augmented with other documents such as the National Environmental Laboratory Accreditation Program (NELAP), Chapter 5, Quality Systems. The Quality Manual is reviewed annually and revised as necessary to remain current with laboratory operations.

The QA Manager and the QA personnel are responsible for implementing and monitoring the QA Program. They are the focal point for QA/QC activities and are responsible for oversight and/or review of QC data. QA personnel will have a general knowledge of the analytical test methods for which data review is performed. The QA Manager will have documented training and/or experience in QA/QC procedures, as well as knowledge of the quality system as defined under NELAC. The Quality Assurance Manager for LvLI is Carol Schrenkel, who is responsible for ensuring that the quality system is established, implemented and maintained. QA management may delegate liaisons with external parties on matters relating to the supplier's quality system, such as certifications and audit responsibilities.

The Quality Assurance Manager reports to the Technical Director on the performance of the quality system for review and continuous improvement. The QA personnel have sufficient authority, access to work areas, and organizational freedom (including sufficient independence from cost and schedule considerations) to:

- Initiate action to prevent the occurrence of any nonconformities related to product, process and quality system,
- Identify and record any problems affecting the product, process and quality system,
- Evaluate data objectively and perform assessments without managerial influence,
- Initiate, recommend, or provide solutions to problems through designated channels
- Verify implementation of solutions, and

- Assure that further work is stopped or controlled until proper resolution of a non-conformance, deficiency, or unsatisfactory condition has occurred and the deficiency or unsatisfactory condition has been corrected

However, should a situation arise where acceptable resolution of identified problems cannot be agreed upon at the laboratory level, the QA Manager has direct access to Senior Management. This provides laboratory QA personnel non-laboratory management support, if needed, to ensure that QA policies and procedures are enforced.

4.4 LvLI Personnel Descriptions

The specific duties and responsibilities of the Technical Director, Technical Manager, Laboratory Manager, Project Manager, Sample Management Office Coordinator (SMO), Unit Leaders, Quality Assurance Personnel, Health and Safety Manager, Waste Management Personnel, Information Systems Management Personnel, and Chemists/Technicians are as follows. Any effective laboratory quality assurance/quality control program depends on the entire organization, including management and every individual on the laboratory staff. Management processes have been reviewed to ensure that personnel are free from commercial, financial, and other undue pressures that might adversely affect the quality of the work.

In the absence of any one individual, the staff or assistant within each department who has the required skills and/or training will perform the function of the administrator or support personnel. This will allow for the continuance of the day-to-day operations of the laboratory. The Technical Manager will provide backup during the absence of either the Technical Director or the QA Manager.

4.4.1 Sr. Vice President, Technical Director

The ultimate responsibility for the generation of reliable laboratory data rests with the Technical Director, who is accountable to the President for this function. The Technical Director has the authority to effect those policies and procedures to ensure that only data of the highest level of excellence are produced. It is the Technical Director's responsibility to see that all tasks performed in the laboratory are conducted according to the requirements of this Quality Assurance Manual, the Project Technical Profile and/or the appropriate QAPjP; to assure that the quality of service provided complies with the project's requirements. The Technical Director is also responsible for the overall direction of a project and has primary responsibility for project quality assurance, and is accountable for the following:

- Defining the level of excellence for the project performance and/or results,
- Assuring the preparation of a tailored Project Technical Profile and/or Quality Assurance Project Plan (QAPjP),

- Ensuring peer review of the adequacy of QAPjP's,
- Ensuring allocation of proper quality control budgets,
- Attaining concurrence with Technical Managers on performance and/or results objectives,
- Achieving acceptable project implementation performance,
- Approving the quality of the project results (e.g., data, reports)

The Sr. VP/Technical Director reports to the President and does not have line authority over those performing the work. The Technical Director supports a QA Section which is not subordinate to or in charge of any person having direct responsibility for sampling and analysis, and that has additional reporting responsibilities to Senior Management.

4.4.2 Laboratory Manager

The Laboratory Manager is responsible for daily operations, including all activities pertaining to operational and technical performance of the laboratory. The Laboratory Manager assures there is sufficient equipment, space, resources, and personnel to conduct analyses and implement the Laboratory Quality Assurance Program. The Laboratory Manager

- Requires effective implementation of the Laboratory Quality Assurance Program to ensure the overall quality of all data and laboratory reports generated,
- Ensures appropriate corrective action is taken when analytical systems are out-of-control or questionable,
- Ensures timeliness of data reporting through coordination of work schedules and assignment of target completion dates for analyses,
- Resolves technical problems with Inorganic and Organic Unit Leaders..

4.4.3 Technical Manager

Technical Manager(s) report to the Laboratory Manager and Technical Director and serve as the technical expert on assigned projects, provide technical liaison, and assist in resolving any technical issues within the area of their expertise. They are responsible for providing input and review in the development and implementation of project-specific QA/QC requirements; and for providing the critical review of proposal and project work for programs as directed by the Technical Director. They will coordinate these activities with the Project Manager and Quality Assurance Section.

4.4.4 Services

The HR/Controller/Services Manager designated on the organization chart is responsible for managing the facilities (HVAC, etc). Maintenance and other facility related issues are directed to his attention.

4.4.5 Project Manager

LvLI recognizes the importance of efficient project management. The laboratory Project Managers (PMs) are responsible for preparing the Project Technical Profile summarizing QA/QC requirements for the project, maintaining the laboratory schedule, ensuring that technical requirements are understood by the laboratory, and advising the Project Director and Laboratory Manager of all variances. The laboratory PM will provide technical guidance and the necessary laboratory related information to the preparer of project-specific Quality Assurance Project Plans (QAPjP), which are generally prepared by the client, and provide peer review of the final document to ensure accuracy of the laboratory information.

4.4.6 Unit Leaders

To assist the Laboratory Manager in achieving section goals, the Laboratory Unit Leaders are responsible for the implementation of established policies and procedures. They possess the authorities commensurate with their responsibilities for the day-to-day enforcement and monitoring of laboratory activities.

Unit Leaders have the responsibility for ensuring that their personnel are adequately trained to perform analyses; that equipment and instrumentation under their control is calibrated and functioning properly; and that system and performance audits are performed on an as-needed basis. These performance audits will include the analysis of external check samples to determine the analyst/instrument capability to identify and quantify routine analyses.

4.4.7 Data Management Supervisor

The Data Management Supervisor is responsible for coordinating receipt of all data from the various service groups within the laboratory, reviewing data for compliance to laboratory QC criteria and/or criteria in the Project Technical Profile, and ensuring that data are reported in a timely manner and in the proper format. The Data Management Supervisor also coordinates Electronic Data Deliverable processing and is responsible for archival and retrieval of Quality Records. The Data Management Supervisor also performs the functions of the SMO Coordinator.

4.4.8 Sample Management Office Coordinator

The Sample Management Office (SMO) Coordinator verifies each subcontracting request with the PM to ensure that special client restrictions are not jeopardized (i.e., samples must be analyzed by the

receiving affiliated or network laboratory and must maintain specific certification(s)). The SMO is also responsible for verifying the credentials; establishing the service agreement; ensuring data review; and invoicing of all laboratory subcontractors. The SMO or project PM discusses any deficiencies or anomalies with the subcontractor prior to reporting any data to the client. When subcontracting samples and/or a portion of the testing to another party, records are maintained in the project management files and with the SMO coordinator. The reports containing results of tests performed by the subcontractor are clearly identified by the subcontractor name or applicable accreditation number. The SMO processes and functions are further defined in the Standard Operating Procedures (SOPs) DM-014, QA-008, and QA-011.

4.4.9 Quality Assurance Manager (Officer)

The Quality Assurance Manager has the full-time responsibility to evaluate the adherence to policies and to assure that systems are in place to produce the level of quality defined in the Quality Assurance Manual. To fulfill this responsibility, the QA Manager conducts or arranges for internal audits on the entire technical operation annually. These internal audits are conducted using prepared quality systems checklists to ensure a consistent standard of quality. The QA Manager notifies management of any deficiencies found via a corrective action report. In addition, the QA Manager may assist in the preparation, compilation, and submittal of quality assurance plans. The Quality Assurance Manager reviews program plans for consistency with organizational and contractual requirements and will advise appropriate personnel of deficiencies. The Quality Assurance Manager maintains a sufficient staff to initiate and oversee audits and corrective action procedures, perform data review, and maintain documentation of training. In addition, the Quality Assurance Manager has the authority to stop work on projects if QC problems arise which affect the quality of the data produced.

4.4.10 Quality Assurance Personnel

The Laboratory Quality Assurance Personnel have responsibility for monitoring the laboratory Quality System and ensuring programs and procedures are followed. This is done by conducting and evaluating results from system and method audits that are conducted by personnel who are independent of the activities being audited. In addition, the preparation of operating procedures and quality assurance documentation for the laboratory shall be coordinated by the QA Section. They will ensure that that the quality documentation is available to, understood by, and implemented by all laboratory personnel. The QA Section will review program plans, as requested, for consistency with organizational and contractual requirements and will advise appropriate personnel.
The group also:

- Performs data package inspection,
- Tracks performance evaluation studies, personnel training, MDL/IDL studies and solvent purity,
- Manages document control, and
- Maintains certifications and approvals.

4.4.11 Health and Safety/Waste Management Personnel

The Health and Safety Manager is responsible for the safety and well being of all employees while at the laboratory. This includes, but is not limited to, developing a safety plan that complies with federal regulations, conducting laboratory safety tours for all new employees, providing instructions on safety equipment, cleaning up laboratory spills, being on call and instructing personnel of laboratory procedures for emergency situations. The Health and Safety Manager or designee is on-call for all laboratory emergency situations.

The Health and Safety Manager responsibilities also include waste management of laboratory-generated hazardous waste in accordance with appropriate regulations. This includes maintenance of required documentation, such as waste manifests, segregation of waste in accordance with requirements, and training of personnel in proper segregation of waste.

4.4.12 Information Systems Management Personnel

The overall role of the Information Systems (IS) Management personnel is to enhance laboratory productivity through improved information access, flow, and security. For information to be of greatest value, it must be readily accessible and reliable. It is the responsibility of IS personnel to provide software tools that allow quick and user friendly access to that information, while at the same time controlling access to that information to those that have the need and proper authority.

Information flow can be enhanced through automation. Automation is the minimization of human intervention in a process. Reduction in human intervention can result in significant error reductions and time-savings. The IS personnel assist the laboratory in automation by providing hardware and software solutions to help minimize human intervention in data collection, processing, and storage.

The IS personnel are responsible for providing data security by controlling access, as mentioned above, and for providing for disaster recovery. Data stored on the central Laboratory Information System (LIMS) is the direct responsibility of the IS unit. No fewer than two copies of all data should exist at any time so that lost or destroyed data can always be retrieved from an alternate source. These copies may consist of data within the system and on magnetic tape in the case of live data, or two copies on magnetic tape for archived data. Data stored electronically in other departments is the direct responsibility of those departments. However, the IS unit is responsible for providing procedures and training to all laboratory operations, as appropriate, to assist in making backup copies of local data within the respective operating unit.

4.4.13 Chemists/Technicians

The Chemists and Technicians are responsible for the performance of analyses using approved methods and procedures. The initial review for acceptability of analytical results rests with the analysts conducting the various tests. Observations made during the performance of an analytical method may

indicate that the analytical system is not in control. Analysts must use quality control indicators to assure that the method is in-control before reporting results.

4.5 Personnel Qualification and Training

4.5.1 Basic Training Requirements

Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Chemists/technicians accountable for performing tasks in any of the following areas must meet associated minimum experience requirements:

- General Chemistry and Instrumentation — Six months
- Gas Chromatography — One year
- ICP — One year
- Atomic Absorption — One year
- Mass Spectrometry — One year
- Spectra Interpretation — Two years

When an analyst does not meet these requirements, they can perform a task under the supervision of a qualified analyst, peer reviewer, unit leader or section manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions. (Note: some states/agencies require additional training experience and documentation. These will be addressed on a case-by-case basis during application or contract review.)

Each employee participates in a comprehensive training program tracked by the Laboratory's QA Section. This program is designed to provide an introduction to laboratory policies and procedures and document the processes that provide proof of an analyst's proficiency. Highlights of the program include an orientation process that includes LvLI's commitment to quality and ethical standards, initial training to attain requisite proficiency, continual monitoring of the employee's progress, opportunity for career enhancement seminars or training courses, and documentation files to track each analyst's progress. Training for Health and Safety and Waste Management procedures include handling of samples containing radioactivity and mixed/hazardous waste. Annual refresher training reviews the Quality Assurance Manual and Quality Systems, Ethics Policy, Client Confidentiality, Computer User Responsibilities, and the Chemical Hygiene Plan. Details of the laboratory's training program are described in SOP QA-115. Where applicable, Method Validation Studies (Method Detection Limit, Instrument Detection Limit ,and Precision and Accuracy Studies), Initial Demonstration of Capability (IDOC) and Continued Demonstration of Capability (usually Proficiency Test) documentation are included in the analyst training files to document qualifications for method performance. For methods where an IDOC is not applicable, e.g., solids, flash point, paint filter test; a PE sample and/or documentation of training with an experienced analyst will satisfy the demonstration of capability.

4.5.2 Project-Specific Training Requirements

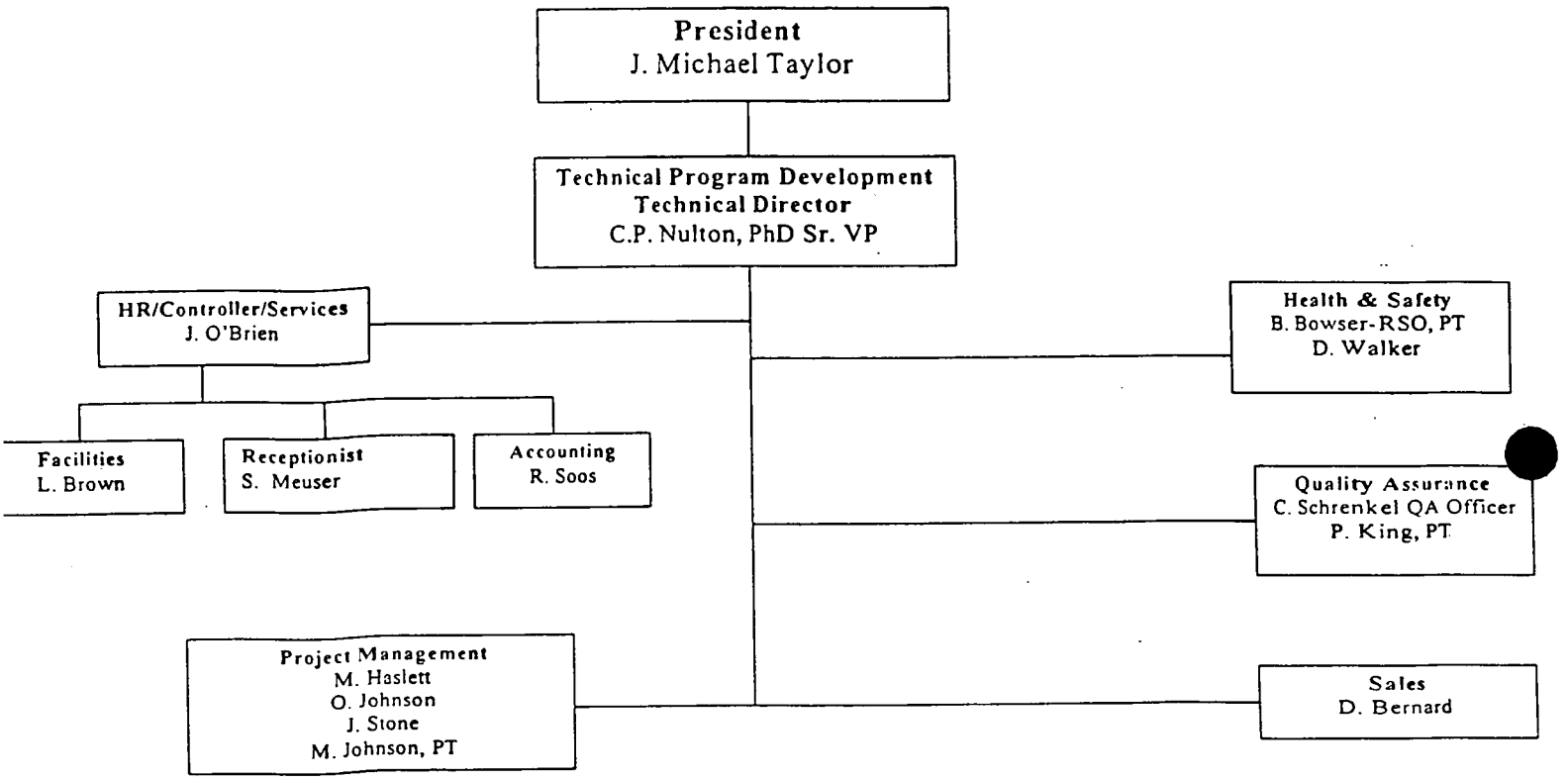
Project management operating procedures detail the processes for reviewing new work to ensure that the appropriate resources can be assigned and deployed. Prior to work on a new project, the dissemination of project information and/or project opening meetings will occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project Technical Profile, turn around times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM may introduce new projects to the laboratory staff through Project Kick-Off Meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality.

Any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes, i.e., use of a non-standard method or modification of a method, must be documented prior to implementation. Documentation pertains to any document, i.e., letter, variance, contract addendum, which has been signed by both parties.

Such changes are communicated to the laboratory through the Project Manager via direct discussions and email for documentation. . The Project Manager updates the Technical Profile and redistributes to applicable Unit Leaders. The laboratory staff is then introduced to the modified Technical Profile via the PM or the individual laboratory Unit Leader.

Figure 4.1
Lionville Laboratory Incorporated Organizational Chart:

Lionville Laboratory Incorporated Administration/QA/H&S
October 2002



5.0 SAMPLING PROCEDURES

The laboratory has the capability to conduct select field sampling in accordance with specific agency guidelines, established operating practices, and/or project specific Sampling and Analysis Plans (SAPs). When field sampling is requested, the sampling protocols are selected to correspond with the project scope and objectives, and to ensure that all samples collected are received in accordance with the sample acceptance policy (section 6.1).

5.1 Sample Preservation and Holding Times

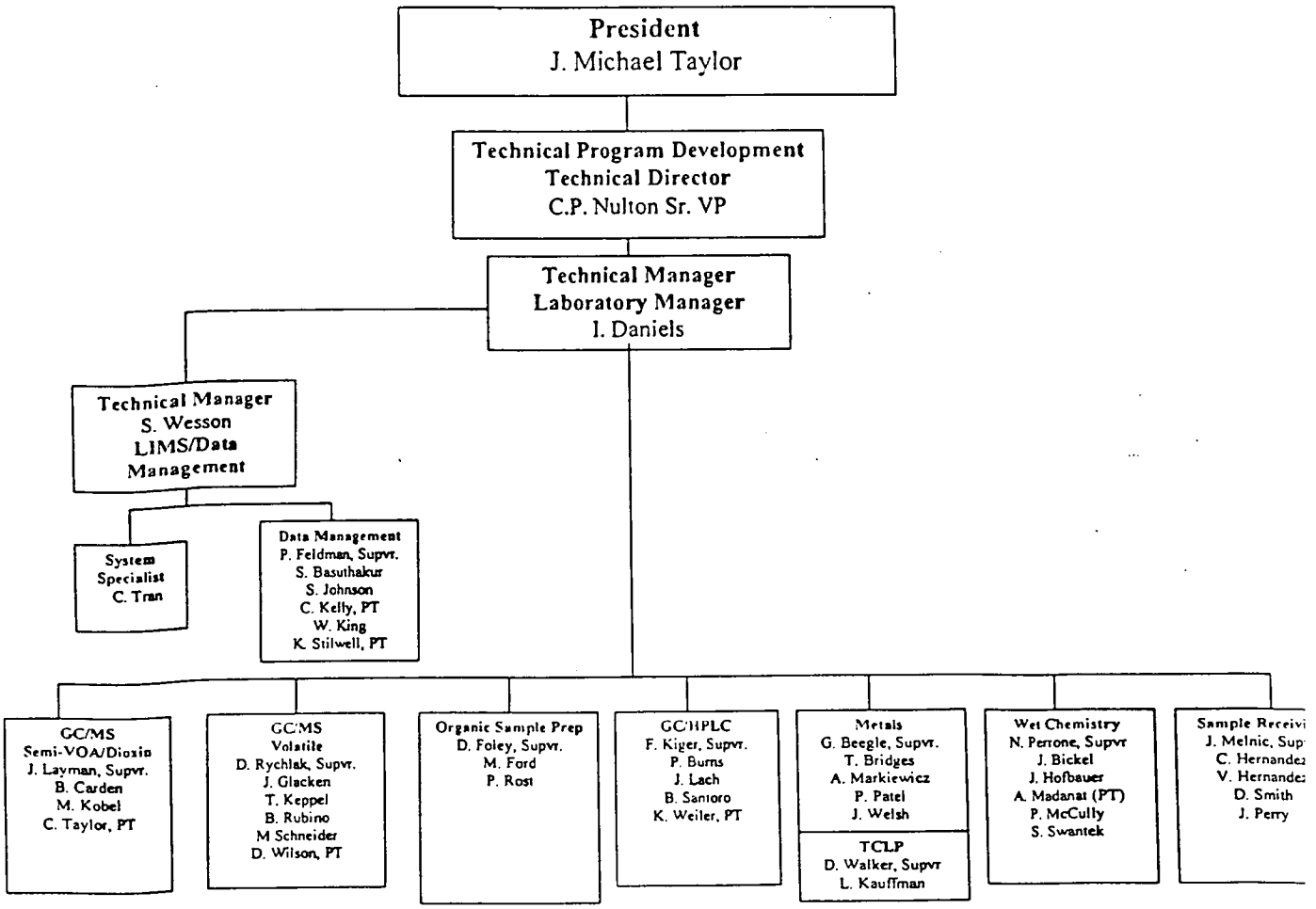
Depending on the selected methods and regulatory program, Lionville Laboratory Incorporated adheres to sample preservation requirements as stated in Table II of 40 CFR Part 136, EPA Manual for Certification of Laboratories Analyzing Drinking Water, U.S. EPA CLP Document Nos. OLC02.0, OLM04.2 and ILM04.1, as updated, and the most recent promulgated version of SW-846. All samples are required to be preserved in the field immediately following sample collection. Upon sample receipt and log-in, the samples are maintained in a temperature controlled environment to insure sample integrity.

The project manager is contacted whenever any sample received is not appropriately preserved. The project manager contacts the client for a decision on preserving the sample in the laboratory or refers to instructions in the Technical Profile or quote, which may delineate the client's requirements regarding actions for sample(s) not appropriately preserved. With either action, the sample's preservation status at the time of laboratory receipt is noted on the chain-of-custody form and sample receipt checklist. For additional information regarding sample receipt and integrity, refer to Section 6.0.

The analysis holding time is the maximum time that may elapse before sample preparation or analysis. It is measured from the date of sample collection in the field, unless the sample analyses are requested for compliance to specific programs (e.g., U.S. EPA CLP) in which holding times are determined from verified time of sample receipt (VTSR). Generally, drinking water, wastewater and RCRA program analyses require holding times measured from sample collection. These holding times are listed in 40 CFR Part 136 and/or the EPA Manual for the Certification of Laboratories Analyzing Drinking Water: Criteria and Procedures, Quality Assurance, March 1997; SW-846 3rd Edition, Methods of Chemical Analysis of Water and Waste; Standard Methods for the Examination of Water and Wastewater, latest approved; or other established program requirements.

Holding times are tracked in the laboratory with the aid of the Laboratory Information Management System (LIMS). Each laboratory section may have additional tracking systems to ensure that holding times are met. All sample collection dates and receipt dates are recorded on the chain-of-custody. This information is transferred into LIMS by sample log-in personnel and LIMS

Lionville Laboratory Incorporated Operations



calculates the appropriate holding time for each parameter. This information is then available to laboratory personnel for tracking and scheduling purposes.

The LIMS backlog reports list sample preparation and analysis due dates for each method based on the requested reporting date or the holding time, whichever is earlier.

All analyses which have holding times of 48 hours or less are identified by the sample custodian(s). Log-in then notifies the appropriate operating section or unit that short hold time samples have been received by the laboratory and are ready for analysis.

5.2 Sample Bottles

Lionville Laboratory Incorporated provides sample bottles and preservatives to clients upon request. The laboratory maintains a bottle preparation section that coordinates the assembly and shipment of sample bottles, preservatives and shipping coolers.

The laboratory may procure sample bottle types with varying levels of supporting quality control (QC). For the most rigorous QC, bottles are cleaned according to U.S. EPA washing procedures and each bottle lot is analyzed for purity. The lot number is labeled for traceability to a certificate of analysis. For less rigorous supporting QC, bottles are cleaned according to U.S. EPA washing procedures, but a certificate of analysis is not provided with the bottles. All bottles used by the laboratories are washed in accordance with EPA guidance and contain a certificate of analysis.

Other than sample bottles and preservatives, the following items are included in sample shipping coolers: packing materials, custody seals, chain-of-custody forms and zip-lock bags (for paperwork). Supplies are checked regularly to insure that ample amounts are available to support the laboratory's analytical projects.

5.2.1 Bottle Washing

All sample bottles are cleaned using U.S. EPA guidance. Typically, the bottle suppliers use one of three procedures described further in this section or cleaning procedures which produce equivalent results as determined by the laboratory's Quality Assurance Manager or designate through the review of the supplier's certificate of analysis.

5.2.1.1 Cleaning Procedure A

Glass containers are cleaned by Procedure A, with the exception of vials fitted with septum caps, which are cleaned using procedure B (Section 5.2.1.2)

- Bottles, liners and caps are washed in laboratory-grade, non-phosphate detergent
- Rinsed 3 times with laboratory pure water
- Rinsed with 1:1 nitric acid
- Rinsed 3 times with laboratory pure water
- Oven-dried for 1 hour, or air dried in a contaminant free area
- Rinsed with hexane
- Rinsed 3 times with laboratory pure water
- Oven-dried for 1 hour

5.2.1.2 Cleaning Procedure B

Vials with septum caps are cleaned by Procedure B.

- Vials, septa and caps are washed in laboratory-grade, non-phosphate detergent
- Rinsed 3 times with distilled water
- Rinsed 3 times with laboratory pure water
- Oven-dried for 1 hour

5.2.1.3 Cleaning Procedure C

Plastic bottles are cleaned by Procedure C.

- Bottles, liners and caps are washed in laboratory-grade, non-phosphate detergent
- Rinsed 3 times with laboratory pure water
- Rinsed with dilute nitric acid (e.g., 1:1)
- Rinsed 3 times with laboratory pure water
- Air-dried

- Bottle Preservatives

The laboratory uses preservatives that are prepared internally from reagent-grade chemicals or pre-measured reagents purchased from suppliers. The internally prepared reagents are added to the sample bottles prior to shipping, unless the client specifies field preservation. For field use, preservatives are shipped to the site with the sample bottle order in pre-measured ampules. All preservatives are shipped in a manner consistent with local and federal shipping regulations.

Ampuled preservatives obtained from suppliers are color-coded and received with pre-purchase certification of purity (Certificates of Purity are available from the vendor). An identifying lot number is on each preservative to assure traceability.

5.2.3 Placement of Bottle Orders

Clients can make arrangements with laboratory project managers for sampling supplies, containers, preservatives, and shipping materials if they do not have these resources. Requests for sample bottles are initiated with a bottle request form and then forwarded to the bottle preparation section (see LvLI SOP SR-001). Bottle order forms are maintained by the bottle prep section. Typically, this form includes the following information: Client name, company contact, shipping address, telephone number, date, LvLI contact, courier used, date needed, date sent, number of samples, bottle type(s), parameter requested, preservative needed, shipping costs, facility/I.D., matrix, number of coolers used, and space for additional comments.

- Sample Cooler Preparation

All bottles are packed and arranged to minimize breakage during transport. Depending on the client need and regulatory program requirements, blue ice or ice is shipped with the cooler. All documentation information is enclosed in a plastic zip-lock bag and placed inside the cooler to prevent water damage. The cooler is then closed and sealed.

5.2.5 Sample Cooler Shipment

Coolers are shipped to the sampling site by various means: a common courier service may be used; the laboratory's field personnel may take coolers to the site; or the client may pick up coolers at the laboratory. All shipments of sample coolers are performed in accordance with the guidelines established by the International Air Transport Association (IATA) and/or the Department of Transportation (DOT).

Typically, orders requiring next day air delivery are shipped via Federal Express. In this event the Federal Express Power Ship II computer tracking system is used to track all shipments. For orders not requiring next day delivery, regular United Parcel Service (UPS) or Federal Express is typically used. (Delivery times vary from one to seven days for receipt of shipment.) UPS or other common couriers may be used to provide next-day air and second-day air delivery.

5.2.6 Sample Cooler Maintenance

Sample coolers returned to the laboratory are emptied of packing materials, ice (both water and blue ice), and any extra or broken bottles or other materials. The coolers are washed and placed back into stock. Laboratory-marked blue ice is washed in tap water before being reused. Typically, empty client coolers are returned via regular UPS or Federal Express.

6.0 SAMPLE CUSTODY

6.1 Sample Receipt

Designated sample custodian(s) and staff are responsible for samples received at the laboratory. In addition to receiving samples, the sample receipt staff is also responsible for documentation of sample receipt and storage before and after sample analysis. They notify the Project Manager, who then contacts the client as necessary, if any samples are received outside of the criteria specified in the sample acceptance policy, SOP SR-002. The Standard Operating Procedures (SOPs) for sample receipt are described in detail in the SR series SOPs. A summary of these procedures follows:

Upon receipt, the sample custodian signs, dates, and documents the time of sample receipt on the air bills or other shipping manifests received from the couriers. The sample custodian signs the chain-of-custody assuming custody of the samples. If a chain-of-custody is not received with a set of samples, a "Custody Transfer/Lab Work Request" form is initiated. Refer to Figure 6.1 for an example of a "Custody Transfer/Lab Work Request". The sample custodian inspects the sample cooler for integrity and then documents the following information: the type of courier, shipped or hand delivered (copies of the airbills are maintained); availability and condition of custody information; sample temperature ambient or chilled; actual temperature if requested for project; the presence of leaking or broken containers; and indication of sample preservation.

Additionally, the sample holding time and date collected are checked. If all samples were received within the appropriate holding time, it is documented on the custody transfer record.

Any additional comments are documented in the designated "Notes" section on the chain-of-custody, or on the sample receipt checklist. Any errors made on the chain-of-custody are corrected by drawing a single line through the incorrect entry, initialing and dating the cross out.

The sample custodian or designee matches the sample container information (e.g., sample tag/label), chain-of-custody records, and all pertinent information associated with the sample. The sample custodian then verifies sample identity to assure that all information is correct. Any inconsistencies are resolved with the client through the project manager and corrective action measures are documented before sample analysis proceeds.

The sample custodian assigns a unique Batch Number (as described in Section 6.4) to each sample received. The Batch Number is recorded on the chain-of-custody and on the container labels using a permanent marker. The Batch Number is the primary means of tracking a sample through the laboratory.

The chain-of-custody form is maintained at the laboratory. Copies of the chain-of-custody are provided to the sample custodian, project manager, section managers, and sample preparation personnel. In addition, the sample custodian notifies the appropriate production unit(s) of any analyses requiring immediate attention due to short holding times.

The sample custodian logs the sample information into the LIMS. These data include laboratory number, field sample identification, dates collected and received, project or client identification, and parameters requested for analysis.

6.2 Sample Containers

Sample containers are verified against the requested analysis to ensure compatibility. For example, organic extractables must be sampled in glass jars with Teflon®-lined caps, since plastics can contaminate the sample. Each sample container is given a unique designation which is recorded on the Chain of Custody/Lab Work Request. When a sample bottle is signed out for preparation or analysis, the unique id is recorded in the appropriate logbook. The unique id (individual bottle) can be traced from initial sample log-in through the final data package sent to the client.

6.3 Sample Custody

Chain-of-custody procedures document the historical possession of sample containers and samples, sample extracts and sample digestates. The associated documentation provides traceability of sample containers from the time of sample collection through shipment, storage, analysis and disposal of the sample. When requested (e.g., NJDEP), custody can be initiated from the time of container preparation. Custody, as defined by this document, is referred to as:

- It is in someone's actual possession, or
- It is in someone's view, after being in their physical possession, or
- It was in someone's possession and then locked, sealed or secured in a manner which prevents unsuspected tampering, or
- It is placed in a designated and secured area

The laboratory recognizes that all laboratory data has the potential to be used as evidence for litigation, and that an evidentiary trail is necessary to prove that the samples collected in the field were the samples actually analyzed. An appropriately documented chain-of-custody form provides the essential evidentiary trail that maintains sample integrity.

Chain-of-custody procedures are described within this section. Listed below are typical laboratory and field records used to establish chain-of-custody and sample identification.

- Field chain-of-custody forms, field sampling forms or other information that arrives with the sample.

- The laboratory's "Custody Transfer Record/Lab Work Request" form. The sample custodians document, relinquish and return-receipt of samples to the analyst for analysis or preparation/extraction procedures. Final custody is transferred upon sample disposal.

- Sample labels or tags that may be attached to sample containers may contain such information as: sample date/time of collection; sample description; sample matrix; filtration, preservation and other known hazards; sample management (disposal information); and parameter groupings. Any sample labels/tags are verified for accuracy against the associated information received with the samples. The signed chain-of-custody form serves as documentation of this information verification. If directed by the client or program requirements, sample tags are removed and placed in the sample/project file.

- Custody seals may be attached to sample containers and/or the transport coolers. Custody seals also prevent the containers or coolers from being unsuspectingly opened without authorization.

- Sample preparation logs, e.g., organic extraction and metals digestion, or separate chain-of-custody logs, e.g., electronic chain-of-custodies, document the custody transfer of the sample extracts/digestates from the preparation group to the analyst. These preparation logbooks are hardbound laboratory books that are documented in legible handwriting, and signed and dated by the analyst. The sample extracts remain in appropriate storage while in the custody of the analytical section. Custody is transferred upon sample disposal.

- Sample storage log (same as the laboratory's "Custody Transfer Record/Lab Work Request" chain-of-custody form).

- Sample disposition log, which documents sample disposal by a contracted waste disposal company.

- Errors in all documentation are deleted with one line through it, the appropriate correction made, initialed and dated by the person making the correction. All custody documentation/logbooks are signed/initialed by the appropriate personnel.

6.4 Sample Identification

The sample custodian organizes the sample containers, chain-of-custody records, and all pertinent information associated with the sample. The sample custodian then verifies the sample identity against all associated sample information. Any inconsistencies are resolved and corrective action initiated prior to assigning an internal identification number to the sample.

This unique identification number Batch Number is an eleven-digit number in the following format: YYMMLBBB-XXXz,

where YYMMLBBB is the batch #, and

YYMM = year/month, e.g., 0003

L = Laboratory identifier, L = Lionville

BBB = a computer assigned consecutive batch number which typically rolls over after 999 to 001. It may roll over sooner to assure project continuity or as otherwise documented.

XXX = a consecutively assigned sample number unique to a specified field sampling point. Because of preservation and volume requirements for requested analytes, a sample from one field sampling point may arrive in more than one container. In this case, each bottle from the same sampling point is assigned the same number.

z = a consecutively assigned alpha character unique to each individual sample bottle. Multiple bottles from the same location would be designated a, b, etc. The next sample would be –002a, 002b, etc.

Samples are maintained in refrigerated storage coolers (maintained at 4 ± 2°C, unless otherwise directed by state or Agency requirements) prior to analysis.

6.5 Sample Storage

The standard operating procedures for sample storage are described in detail in SOP SR-002. A summary of these procedures is described below:

Refrigerated storage coolers are maintained at 4 ± 2°C unless otherwise directed by state or Agency requirements. The temperature of each unit is recorded daily during business days in a bound notebook. Additionally, some storage systems are monitored by an independent security system. If

equipment failure occurs during non-working hours (e.g., compressor failure, door left open, circuit breaker) and temperatures exceed the upper or lower control limits, the appropriate personnel are notified. If the temperature cannot be returned to an in-control status, the samples are moved to a suitable storage cooler until the problem is corrected.

Cooler storage is designed to segregate samples in such a way as to minimize the possibility of cross-contamination. This includes the storage of volatile samples separate from semi-volatiles and inorganic samples. Within each cooler, samples are organized by batch number for easy retrieval.

Within laboratory production units, refrigerators and freezers are used for storing analytical standards and sample extracts. Within the refrigerators or freezers, standards are stored by an internal identification number for easy retrieval. Standards are stored separately from samples.

Access to laboratory facilities is restricted to laboratory personnel and escorted guests, as described in Section 6.8. Therefore, once sample possession is relinquished to the laboratory, the sample is in a designated secure area (e.g., the laboratory facility) accessible only to authorized personnel.

6.6 Sample Tracking

Sample Tracking Procedures are summarized in the following sections:

6.6.1 Organic Extraction/Analysis

The organic sample preparation section receives samples for extraction prior to analysis by gas chromatography, GC/MS, or liquid chromatography. A sample preparation batch number is assigned and all pertinent data are recorded in a bound laboratory notebook. The first two characters of the extraction/preparation batch number are the last two digits of the current year and followed by a unique laboratory code.

The extraction information is transferred to the LIMS and a hard-copy Sample Extraction Record is generated. Original records are used for internal laboratory custody transfer and are stored in the extraction laboratory. Copies are provided to analysts upon transfer by signature of the extracts. Extracts are maintained in refrigerated storage until needed for analysis.

6.6.2 Metals Digestion/Analysis

The metals sample preparation section receives samples for digestion prior to elemental analysis by Atomic Absorption Spectroscopy, Inductively Coupled Plasma Spectroscopy or Mercury autoanalyzer. Before samples are prepared, a sample preparation batch number is assigned and all pertinent data are recorded in a bound laboratory notebook. The first two characters of the

digestion batch number are the last two digits of the current year and followed by a unique laboratory code.

Sample preparation (digestion) information is transferred to LIMS. The Metals' Analysis Section is notified that they are completed and ready for analysis.

6.7 Record Keeping

All data related to sample preparation, analysis, and general observations are recorded in appropriate hardbound laboratory notebooks (SOP QA-107). These logbooks are pre-formatted notebooks that are issued and controlled by the laboratory's Quality Assurance Section. These laboratory notebook pages are reviewed, signed and dated by laboratory analysts and receive a secondary review by a trained data reviewer or supervisor who signs/initials and dates the data pages.

Corrections to notebook entries are made by drawing a single line through the erroneous entry, and writing the correct entry next to the one crossed out. A reason for the correction is noted, as appropriate. All corrections are initialed and dated by the individual performing the correction.

A separate LIMS analytical batch number, defined at the sample preparation step, is established for each set of analyses. This batch number is used to name spreadsheet files. All approved spreadsheets and laboratory data books are maintained as a historical record.

6.8 Building Security

The laboratory maintains controlled building access at all times. All non-LvLI laboratory personnel and service representatives are required to sign the visitors' logbook in the reception area and are accompanied by laboratory personnel while in the building. The laboratory is locked at all times; a security system monitors building access. Laboratory employees enter the facility using access cards.

6.9 Electronic Data Records

The laboratory utilizes a LIMS for the management of sample tracking, data storage, data reduction, and data reporting functions. The LIMS acronym actually refers to the customized programs or software. Personal computers and/or a local area network are utilized to access data from the LIMS, transfer data to the LIMS, and utilize the various LIMS features for data management. File transfers comprise the predominant analyst use of the LIMS.

6.10 LIMS Security System

All users log onto the system via the Multi-Terminal Monitor, or MTM. Security is controlled through individual user passwords that allow or deny access into specific accounts (e.g., Metals, Wet lab, Reports, etc.). Each account may further allow or deny access to specific programs or tasks.

While entry or modification of information in the database is controlled by these security measures, the database itself has some built in safeguards. When a sample is logged in for specific analyses, the analysis for that sample is assigned a status code by the LIMS. The following is a list of typical status codes used by the LIMS. Other codes may be established to assist project tracking.

Status	Meaning
1	Sample and test are logged into the LIMS
2	Sample is on hold
3	Sample extraction is in process
4	Sample has been subbed out
5	Extraction/digestion/prep is complete
6	Analyzed but not yet reviewed
7	Completed (results reviewed by analyst)
8	Released to data management (results/deliverables in data reporting)
9	Canceled
88	Released to client

These and additional codes are automatically updated via programs used by the analysts when reporting data to the LIMS. The status of a result does not reach 8 (Released) until the result and its related quality control has been reviewed and approved by the Unit Leader of the section generating the result. A data summary report can be used by the supervisor to review results and associated QC. If the supervisor approves the data, the status code is then set to 8.

When an analytical result has been entered into the database and the status set to 8, the result cannot be accidentally overwritten if a new result is submitted. The result can only be changed by person(s) with the proper security clearance to change the status to a lower level.

6.11 LIMS System Preventive Maintenance

The System Operator makes daily, weekly, and monthly checks on the system performance. A daily check is made of the computer's system log, which records all activity regarding the computers OS/32 operating system. This log reveals problems with the basic system tasks that

keep the system working. Some programs, aside from the Operating System, create their own logs that are also checked to verify they are performing properly.

A weekly on-line backup is made of the entire database, "on-line" meaning the system does not have to be stopped in order to backup all of the data base records to tape. In addition to backing up the database, a daily or weekly incremental backup of all files (programs and data) is performed to include all files created or modified within the last 24 hours or 7 days. The IS series SOPs describe LIMS routine maintenance and computer backup and security systems.

All system maintenance and problems are recorded in a bound system logbook, which is kept in the LIMS Section.

6.12 Software Updates and Revisions

Updates and modifications in laboratory software are done following a completed Programming Completion Form. This document is kept on file in the LIMS office along with the date the new software was loaded and implemented.

New software is tested and verified for accuracy with dummy data before being implemented on the system. Software is approved for use by the Systems Operator and all documentation that it works correctly are maintained on a verification file. After implementation, all users are advised of the changes and requested to report any problems with the software to the System Operator. When updates in software are received from manufacturers, this is noted in the bound LIMS logbook.

QUALITY ASSURANCE
LABORATORY QUALITY ASSURANCE MANUAL/QUALITY ASSURANCE PLAN

Figure 6.1

Example: Internal Chain-of-Custody

Lionville Laboratory Use Only

Custody Transfer Record/Lab Work Request Page___of___

FIELD PERSONNEL: COMPLETE ONLY SHADED AREAS

Client
Est. Final Proj. Sampling Date
Project #
Project Contact/Phone #
Lionville Laboratory Project Manager
QC Del TAT
Date Rec'd Date Due

Refrigerator #
#/Type Container: Liquid / Solid
Volume: Liquid / Solid
Preservatives

ANALYSES REQUESTED → ORGANIC: VOA, BNA, Pest/PCB, Herb; INORG: Metal, CN

MATRIX CODES: S - Soil, SE - Sediment, SO - Solid, SL - Sludge, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, L - Leachate, WI - Wipe, X - Other, F - Fish

Lab ID	Client ID/Description	Matrix QC Chosen (✓) MS	MSD	Matrix	Date Collected	Time Collected	Lionville Laboratory Use Only

Special Instructions

DATE/REVISIONS: 1 2 3 4 5 6

Lionville Laboratory Use Only
Samples were: 1) Shipped ___ or Hand Delivered; Airbill # ___; 2) Ambient or Chilled; 3) Received in Good Condition Y or N; 4) Samples Properly Preserved Y or N; 5) Received Within Holding Times Y or N
Temp Blank Gas was: 1) Present on Outer Package Y or N; 2) Intact on Outer Package Y or N; 3) Present on Sample Y or N; 4) Intact on Sample Y or N; GC/MS Method Phenol Lab Sample Event Y or N; Code; Temp. ___°C

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

Discrepancies between Sample Labels and COC Record? Y or N
NOTES:

7.0 ANALYTICAL PROCEDURES

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. The choice of method is determined by the type of samples and the client/agency program represented. These programs include, but are not limited to the following:

- Clean Air Act (CAA)
- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- U.S. EPA Contract Laboratory Program (CLP)
- Clean Water Act (CWA)
- National Pollutant Discharge Elimination System (NPDES)
- Resource Conservation and Recovery Act (RCRA)
- Safe Drinking Water Act (SDWA)
- Toxic Substances Control Act (TSCA)

For non-routine analytical services (e.g., special matrices, research projects, non-routine compound lists, etc.), the method of choice is selected based on client needs and available technology.

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the laboratory Project Manager in a Technical Profile for the project (SOP PM-001). The Technical Profile is distributed to appropriate laboratory management, such as the Laboratory Director, Section Managers, Unit Leaders, and QA Manager, to ensure that the proper analytical methods are applied when the samples arrive.

7.1 Method References

The most commonly used method references for the analytical procedures used in the laboratory are listed below. These references are applicable to the analytical test methods used on a daily basis in the laboratory. Methods and revision number(s) are delineated in Standard Operating Procedures (SOPs). The SOPs applicable to any set of preparatory or analytical procedures are in manuals readily available to analysts. Routine procedures will have Demonstration of Capability on file.

On rare occasions special analytical techniques will be requested for research, project specific requirements, or client special needs. In these instances SOPs may not be available; however, the analyst will thoroughly record the analytical steps and observations. Prior to implementation as a routine procedure, a new method will be qualified either as described in the method, or with determination of mdls, a performance evaluation sample, or a precision and accuracy study as applicable.

ASTM = Annual Book of ASTM Standards, American Society for Testing and Materials, updated yearly.

CLP-O = EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organics Analysis, Multi-Media, Multi-Concentration: Document Number OLM01.8, OLM03.2, OLM04.0, OLM04.2 and as updated.

CLP-I = EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Inorganics Analysis, Multi-Media, Multi-Concentration: Document Number ILM04.0, ILM04.1 and as updated.

E = EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1989;
EPA 600/4-88-039, Methods for Determination of Organic Compounds in Drinking Water, July 1991, and Supplements I, II, III, 7/90, 8/92, 8/95
EPA-600/4-90/020, EPA/600/R-92/129, EPA/R-95/131
EPA 600/4-91-010, Methods for the Determination of Metals in Environmental Samples, June 1991 and Supplement I, May 1994. EPA/600/R-94/111
EPA/600/R-93/100 Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.

40CFR = 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants. Appendix A to Part 136 - Methods for Organics Chemical Analysis of Municipal and Industrial Wastewater.

NIOSH = NIOSH Manual of Analytical Methods, 3rd Edition, February 1984, updated through Supplement 4, August 1990.

SW = EPA SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd Edition promulgated updates and proposed Update methodologies.

SM = Standard Methods for the Examination of Water and Wastewater: 15th Edition, 1980, 16th Edition, 1985, 17th Edition, 1989, 18th Edition, 1992, and 19th Edition 1995. (Note method numbers changed format with 17th Edition)

USAEC = U.S. Army Environmental Center Guidelines for Implementation of ER 1110-1-263 for USAEC Projects, May 1993. Methods validated per requirements set forth in Section 5.0.

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc, and established an implementation schedule. As such, the laboratory strives to perform only the latest version of each approved method.

7.2 Document and Data Control

The laboratory maintains procedures to control documents and analytical data. Since the laboratory is an intensive data generator, and this is the primary product, document control is inherently segregated from data control, as described further in Sections 7.2.1 and 7.2.2.

7.2.1 Document Control

A document control system is maintained that tracks the distribution of both external and internal procedures (refer to SOP QA-106 for further document control details). This system tracks the SOP Number or Reference Document, copy number, distributee, document revision number, and effective date of the document for each individual SOP or Reference Document. Upon revision to a document, the tracking list is used to identify previous distributees to ensure that all are provided appropriate updates and the database is then updated accordingly.

Document distribution is processed as a controlled or uncontrolled status. Controlled status is defined as the continuous distribution of document updates. Uncontrolled status is defined as the single distribution of the current SOP. Document updates are not distributed to uncontrolled status holders. For tracking purposes, a control copy number is assigned to documents distributed with a controlled status. All copy numbers are written in red ink or printed on computer generated labels to easily identify the SOP as a controlled copy. Original historical copies of SOPs are maintained in archive.

7.2.2 Data Control

All raw data, such as bound laboratory notebooks and logbooks, strip charts and instrument printouts, LOTUS/EXCEL spreadsheets, and magnetic tapes, as well as final reports, are retained for a minimum period of 6 years. Such data may be maintained longer, as defined by client and project requirements.

Raw data and reports are documented and stored so that they are easily retrievable. Storage of raw data records that are maintained by the laboratory is briefly described below. Procedures including storage and protecting data integrity are documented in the IS and DM series of OPs.

- Instrument printouts for conventional inorganic parameters are filed by parameter group and number. Generally, current year and previous year documents are kept on file in the laboratory.

- All raw data, for example, instrument print-outs, strip charts, and laboratory notebooks, are maintained in storage by the laboratory.

- When an archived report is pulled a record of removal is maintained. This provides documentation of any report removed from the archival system.

- The LIMS computer information is backed up on tape daily, and stored in a temperature/humidity controlled environment to maintain the integrity of the electronic information in the event of system failure. Copies of all back-up tapes are maintained in secured off-site locations under identical conditions.

7.3 Quality Records

The laboratory maintains procedures for the identification, collection, indexing, access, storage, maintenance and disposition of quality records. The DM series SOPs describe the management of quality records.

All laboratory Certification Summaries and Instrumentation lists are maintained in electronic files in the QA directory. Hardcopies are distributed as requested or if revisions are made.

7.4 Material Procurement and Control

It is the policy and practice of the laboratory to conduct its procurement activities with the highest integrity, under the most favorable terms to the laboratory, and its clients, and in full compliance with applicable Government Laws and Regulations.

All supplies are purchased and received/distributed through the laboratory's purchasing agent. Procurement activities are designed to ensure a systematic approach to the procurement process. Suppliers are selected based on their capabilities to provide items or services in accordance with the laboratory requirements. The measurements for evaluation and selection of suppliers; the acceptance of supplies and services; and certificates of conformance are described in the Procurement Quality Assurance SOP, QA-006. Documentation for reagent, solution and standard traceability is addressed in SOP QA-134.

7.4.1 Solvent and Acid Lot Verification

Solvents and acids of specified quality are purchased from suppliers. Certificates of analysis are provided with each lot to demonstrate conformance with quality standards. These may include acetone, acetonitrile, ethyl ether, freon, hexane, iso-octane, methanol, methylene chloride, toluene, bottled deionized water, bottled HPLC water and nitric acid, hydrochloric acid, sulfuric acid, and hydrogen peroxide. For details on this process, refer to SOP QA-103.

7.5 Laboratory Glassware

All glassware must be thoroughly cleaned prior to use to ensure that sample integrity is not affected from artifacts caused by contaminated glassware. The laboratory maintains detailed SOPs for glassware cleaning documented in SPI-0001 (inorganics) and SPO-0001 (organics). These SOPs are posted in the appropriate glassware preparation areas.

For difficult to clean glassware, supervisory assistance is recommended. An attempt will be made to determine the composition of material so that appropriate cleaning procedures and safety measures can be taken. The following may be tried with proper precautions: NOCHROMIX, chloroform, acetone, strong base (50% NaOH), phosphoric or other acids. Safety must be a primary concern. A summary of general cleaning procedures follows:

- General laboratory glassware is cleaned with a low- or non-phosphate detergent, followed by thorough rinsing with tap water and deionized water.
- Volumetric flasks and pipettes used for inorganics (method dependent), test tubes and caps used for micro-COD procedures, phosphate glassware, and metals-related glassware include an acid-washing step.
- BOD glassware cleaning includes a nitric or sulfuric acid and/or a NOCHROMIX-washing step.
- Organic glassware includes a solvent-wash.
- Non-volumetric organic glassware may optionally be kiln dried at 400°C.

7.6 Reagent Storage

All laboratory chemicals are segregated according to group. For example, strong acids are not stored with strong bases. Upon receipt in the laboratory, the outer container for all reagents is marked with the date of receipt. Individual bottles are marked upon the date of opening.

Prudent safety practices are followed for possible accidental spills of laboratory reagents (e.g., sodium bicarbonate solutions for acid/base spills, or oil-drill/Xsorb for oil spills, etc.). Table 7.1 summarizes the general storage protocols for reagents. For specific laboratory safety practices and reagent chemical storage refer to the Chemical Hygiene Plan, SOP HS-005.

Table 7.1

Reagent Storage

Reagent	Method of Storage
Acids	Acid storage lockers or the shipping containers, segregated according to acid type.
Bases	Base storage cabinet or the shipping containers.
Solvents	Solvent storage lockers or controlled solvent room, segregated by group: Extractions, VOAs, Semi-VOAs, and Pesticides/Herbicides.
Dry Granular or Powder Reagents	Reagents are stored in each respective laboratory

Note: All Reagents are documented with the date received, date opened, date expired (as applicable).

8.0 QA TARGETS FOR PRECISION AND ACCURACY

8.1 Precision

Precision is the level of agreement among repeated independent measurements of the same characteristic, usually under a prescribed set of conditions (e.g., under the same analytical protocol). The most commonly used estimates of precision are the relative percent difference (RPD) for cases in which only two measurements are available, and the percent relative standard deviation (%RSD) when three or more measurements are available. In both cases, the quantitative measure of the variability of the group of measurements is compared with their average value. This is especially useful in normalizing environmental measurements to determine acceptability ranges for precision, since it effectively corrects for the wide variability in sample analyte concentration indigenous to samples.

For some procedures, on-going method performance is evaluated as the degree of agreement between a new set of results and a historical database or a table of acceptable criteria for a given parameter. This is measured as percent difference (%D) from the reference value, and is primarily used by the laboratory as a means for documenting acceptability of continuing calibration.

Precision control limits for evaluation of sample results can be established by the analysis of control samples. The control samples can be method blanks fortified with surrogates (e.g., for organics), or laboratory control samples (LCS) purchased commercially or prepared at the laboratory. The LCS is typically identified as blank spikes (BS) for organic analyses. For multi-analyte methods, including preparation methods such as metals digestions, the LCS or BS may only contain a representative number of target analytes rather than the full list.

The RPD for duplicate investigative sample analysis provides a tool for evaluating how well the method performed for the respective matrix. These values are used by the client to further assess a reported result within the context of the project Data Quality Objectives (DQOs). For results outside control limits provided as requirements in the QAPP, corrective action appropriate to the project will be taken and the deviation will be noted in the case narrative accompanying the sample results.

8.2 Accuracy and Bias

Accuracy is the degree of agreement of an analytical measurement with the true or expected concentration. When applied to a set of observed values, accuracy will be a measure of both random error and systematic error (bias).

Bias is systematic error inherent in an analysis caused by some artifact of the measurement system or deviation from protocol. Temperature effects and extraction inefficiencies are examples of the first kind; contamination, mechanical losses, and calibration errors are examples of the latter kind.

Accuracy control limits are established by the analysis of control samples, which are of water and/or solid/waste matrices. The control sample can be a method blank fortified with surrogates (e.g., for organics or ICP), or laboratory control sample (LCS) purchased commercially or prepared at the laboratory. The LCS is typically a blank spike (BS) for organic analysis. For multi-analyte methods, including preparation methods such as metals digestions, the LCS may only contain a representative number of target analytes rather than the full list.

The amount of each analyte recovered in a LCS analysis is recorded and entered into a database to generate statistical control limits. These empirical data are compared with available method reference criteria and available databases to establish control criteria.

The percent recovery (% R) for spiked investigative sample analysis (e.g., matrix spike) provides a tool for evaluating how well the method worked for the respective matrix. These values are used by the client to assess a reported result within the context of the project DQOs. For results outside control limits provided as requirements in the QAPP, corrective action appropriate to the project will be taken and the deviation will be noted in the case narrative accompanying the sample results.

The quality assurance objectives for organic and inorganic analyses are tailored to the analytical technique used and are discussed in the ensuing subsections. The number and types of quality control samples for precision and accuracy and their associated acceptance criteria will be specified by the individual methods or project specific DQOs.

8.2.1 Metals/Inorganics Analysis

For metals and inorganics analysis, analytical accuracy is obtained from the analyte recovery measured in a laboratory control standard and/or a field sample fortified with the element of interest. See also Section 9.0 for further information on matrix QC indicators.

Laboratory-derived control limits should be developed after at least 20 points have accumulated, with a data set that appears to be random. If there are insufficient points to develop such control limits, or if charts of the data show a pattern or trend that places their credibility as a source of control limits in question, the control limits will be evaluated judiciously in light of expected method performance (e.g., method-published precision and accuracy statements), program requirements, and appropriate action taken. Internal statistical laboratory control limits can be employed upon client request.

When client specific objectives/requirements, or program requirements are not established, the laboratory uses either the limits specified below or statistically generated in-house limits for accuracy objectives. The internal default values will apply to routinely analyzed metals (e.g., metals included in the following lists: drinking water, priority pollutant, RCRA, and EPA's Contract Laboratory Program target analyte list for hazardous waste) and inorganics. In the case of unusual analytes or infrequently used methods, control limits may be based on fewer than 20 data points if the data exhibit a random graphic pattern.

Example:

Laboratory Control Standard (LCS) 80-120% Recovery
Fortified Field Sample (matrix spike) 75-125% Recovery

8.2.2 Organic Analysis (GC and GC/MS)

For organic analysis, analytical accuracy is based on a select set of analytes measured in a control sample or a QC check sample. These recovery measurements comprise both target compounds and surrogate compounds, and are representative of compound lists routinely analyzed (e.g., compounds from the following lists: drinking water, priority pollutant, RCRA, and EPA's Contract Laboratory Program target compound list for hazardous waste). When client specific objectives/requirements or program requirements are not established, the laboratory uses either the limits specified in Tables 8.1 and 8.2 or statistically generated in-house limits for accuracy objectives. See Section 9.0 for further information on matrix QC indicators.

Laboratory-derived control limits should be developed after at least 20 points have accumulated, with a data set that appears to be random. If there are insufficient points to develop such control limits, or if charts of the data show a pattern or trend that places their credibility as a source of control limits in question, the control limits will be evaluated judiciously in light of expected method performance (e.g., method-published precision and accuracy statements), program requirements, and appropriate action taken. Internal statistical laboratory control limits can be employed upon client request.

Fortification of the sample with target analytes prior to extraction (matrix spike) provides recovery data for the actual target compound as affected by the respective sample matrix, and requires analysis of a second sample, unspiked, to allow correction for any of the compound indigenous to the sample when evaluating recoveries.

8.3 Representativeness and Comparability

For laboratory procedures, an attempt will be made to ensure that all data are representative of the matrix and conditions of the sample being measured. The data will be calculated and reported in

units consistent with standard reporting conventions to enable comparability to existing data, standards, and/or regulatory action limits.

A measure of inter-laboratory comparability is obtained through the laboratory's participation in performance evaluation programs established with Round Robin suppliers and the U.S EPA Water Supply (WS) and Water Pollution (WP) programs. In addition, the laboratories employ the use of NIST or EPA traceable standards, when available, to provide an additional measure of assurance of the comparability of data.

Project representativeness and comparability are dependent on the sampling plan on a project specific basis, and therefore are not covered in this laboratory plan. Assessment of site and collection representativeness and comparability is performed by the field engineer.

8.4 Method Detection Limits

The method detection limit (MDL) is the lowest concentration that can be measured for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually.

For the performance of non-routine methods, i.e, client/contract requirement, MDLs or Method Validation Studies will be completed on an as needed basis. The turnaround time for such studies will be as determined by the client and PM. Such studies will be review and approved by the client and/or regulatory agency prior to project implementation.

8.5 Instrument Detection Limits

Instrument Detection Limits (IDLs) are generated quarterly for each element by the metals laboratory, for each instrument as specified in the CLP protocol. These limits are used to gauge instrument sensitivity and when routinely evaluated, instrument performance without the introduction of method variance can be determined. For GFAA, a fixed detection limit based on the highest IDL seen on the instrument (over five quarters) will be employed instead of a quarterly IDL.

8.6 Reporting Limits

Reporting Limits are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error [illegible] client requirements, values specified by the EPA methods or other project and client

requirements. Because of the high level of quantitative error associated with determinations at the level of the MDL, the laboratories endeavor to keep reporting limits higher than the MDL. Wherever possible, reporting is limited to values approximately 3-5x the respective MDL to ensure confidence in the value reported. Client specific requests for reporting to the IDL or MDL are special circumstances not to be confused with the previous statement.

Method detection level studies are performed annually, and reporting limits are assessed. If the MDL does not meet the routine laboratory reporting limit or the method specified limit, it is repeated or the laboratory reporting limit is reassessed. If the laboratory continually demonstrates that the method reporting limits are not achieved, equipment, technique, and the method are reviewed to assure optimal performance or appropriate action is taken.

8.7 Completeness

Completeness is a measure of the relative number of analytical data points which meet all the acceptance criteria for accuracy, precision, and any other criteria required by the specific analytical methods. Project specific completeness goals account for all aspects of sample handling, from collection through data reporting. The level of completeness can be affected by loss or breakage of samples during transport, as well as external problems which prohibit collection of the sample.
The ability to meet or exceed completeness objectives is also dependent on the nature of samples submitted for analysis. For example, if the analytical methods proposed for use (particularly for organics analyses) are intended for analysis of environmental samples of low and medium hazard, the applicability of these methods to non-routine matrices such as drum samples, wipes, air samples, etc., may result in poor method performance and therefore adversely impact on achievement of the data completeness goal. Completeness is variable and a project-specific requirement.

An example for calculating analytical completeness is as follows:

$$\text{Completeness} = \frac{\text{Number of acceptable reported QC data}}{\text{Total number of reported QC data}} \times 100\%$$

Criteria for evaluating completeness will be in accordance with the specific data quality objectives for a given project, as defined by the relevant Project Quality Assurance Plan.

Table 8.1

Organic Quality Assurance Objectives: Accuracy for Surrogate Analyses

Fraction	Surrogate Compound	Percent Recovery (SW-846)		Percent Recovery (CLP)	
		Water	Soil	Water	Soil/Sediment
Volatiles	Toluene-d_8	88 - 110	81 - 117	88 - 110	84 - 138
	4-Bromofluorobenzene	86 - 115	74 - 121	86 - 115	59 - 113
	1,2-Dichloroethane-d_4	76 - 114	70 - 121	76 - 114	70 - 121
Semi-Volatiles	Nitrobenzene-d_5	35 - 114	23 - 120	35 - 114	23 - 120
	2-Fluorobiphenyl	43 - 116	30 - 115	43 - 116	30 - 115
	p-Terphenyl-d_{14}	33 - 141	18 - 137	33 - 141	18 - 137
	Phenol-d_5	10 - 94	24 - 113	10 - 110	24 - 113
	2-Fluorophenol	21 - 100	25 - 121	21 - 110	25 - 121
	2,4,6-Tribromophenol	10 - 123	19 - 122	10 - 123	19 - 122
	2-Chlorophenol-d_4	----	----	33 - 110	20 - 130 (advisory)
	1,2-Dichlorobenzene-d_4	----	----	16 - 110	20 - 130 (advisory)
Pesticides/ PCBs	2,4,5,6-Tetrachloro-m-xylene	27 - 129	38 - 122	60 - 150 (advisory)	60 - 150 (advisory)
	Decachlorobiphenyl	22 - 126	28 - 118	60 - 150 (advisory)	60 - 150 (advisory)

Table 8.2 A

Organic Quality Assurance Objectives: Accuracy and Precision for Target Compound Analyses

Fraction	Matrix Spike Compound	% Rec. Limits SW-846		%RPD Limits SW-846	
		Water	Soil/Sed	Water	Soil/Sed
Volatiles	1,1-Dichloroethene	61 - 145	59 - 172	14	22
	Trichloroethene	71 - 120	62 - 137	14	24
	Chlorobenzene	75 - 130	60 - 133	13	21
	Toluene	76 - 125	59 - 139	13	21
	Benzene	76 - 127	66 - 142	11	21
Base-Neutral	1,2,4-Trichlorobenzene	39 - 98	38 - 107	28	23
	Acenaphthene	46 - 118	31 - 137	31	19
	2,4-Dinitrotoluene	24 - 96	28 - 89	38	47
	Pyrene	26 - 127	35 - 142	31	36
	N-nitroso-di-N-	41 - 116	41 - 126	38	38
	propylamine	36 - 97	28 - 104	28	27
	1,4-Dichlorobenzene				
Acid	Pentachlorophenol	9 - 103	17 - 109	50	47
	Phenol	12 - 110	26 - 90	42	35
	2-Chlorophenol	27 - 123	25 - 102	40	50
	4-Chloro-3-methylphenol	23 - 97	26 - 103	42	33
	4-Nitrophenol	10 - 80	11 - 114	50	50
Pesticides	Lindane	56 - 123	46 - 127	15	50
	Heptachlor	40 - 131	35 - 130	20	31
	Aldrin	40 - 120	34 - 132	22	43
	Dieldrin	52 - 126	31 - 134	18	38
	Endrin	56 - 121	42 - 139	21	45
	4,4-DDT	38 - 127	23 - 134	27	50
PCBs	Aroclor 1016	50 – 150	50 – 150	30	50
	Aroclor 1260	50 - 150	50 - 150	30	50

Table 8.2 B

Organic Quality Assurance Objectives: Accuracy and Precision for Target Compound Analyses

Fraction	Matrix Spike Compound	% Recovery Limits CLP		% RPD Limits CLP	
		Water	Soil/Sed.	Water	Soil/Sed
Volatiles	1,1-Dichloroethene	61-145	59 - 172	14	22
	Trichloroethene	71-120	62 - 137	14	24
	Chlorobenzene	75-130	60 - 133	13	21
	Toluene	76-125	59 - 139	13	21
	Benzene	76-127	66 - 142	11	21
Base-Neutral	1,2,4-Trichlorobenzene	39 - 98	38 - 107	28	23
	Acenaphthene	46 - 118	31 - 137	31	19
	2,4-Dinitrotoluene	24 - 96	28 - 89	38	47
	Pyrene	26 - 127	35 - 142	31	36
	N-nitroso-di-N-propylamine	41 - 116	41 - 126	38	38
	1,4-Dichlorobenzene	36 - 97	28 - 104	28	27
Acid	Pentachlorophenol	9 - 103	17 - 109	50	47
	Phenol	12 - 110	26 - 90	42	35
	2-Chlorophenol	27 - 123	25 - 102	40	50
	4-Chloro-3-methylphenol	23 - 97	26 - 103	42	33
	4-Nitrophenol	10 - 80	11 - 114	50	50
Pesticides	Lindane	56 - 123	46 - 127	15	50
	Heptachlor	40 - 131	35 - 130	20	31
	Aldrin	40 - 120	34 - 132	22	43
	Dieldrin	52 - 126	31 - 134	18	38
	Endrin	56 - 121	42 - 139	21	45
	4,4-DDT	38 - 127	23 - 134	27	50
PCBs	Aroclor 1254	50-150	50-150	30	50

9.0 QUALITY CONTROL CHECKS AND ROUTINES TO ASSESS PRECISION AND ACCURACY AND CALCULATION OF METHOD DETECTION LIMITS

9.1 Quality Control Checks

The quality of analytical data generated at the laboratory is controlled through management systems, processes and procedures described in the Quality Assurance Program Plan. This section describes the minimal internal quality control checks used in each laboratory operating section. If method Quality Control (QC) is more stringent than these laboratory guidelines, the method QC will be followed except when a method modification or variance is authorized by the client or a project specific QAPjP. The Project Manager must obtain such exceptions in writing from the client and communicates it to the laboratory through the Technical Profile (PM-001).

9.2 Quality Control Indicators and Analysis Frequency

Quality control (QC) indicators, introduced in various phases of the analytical process, are tools used to evaluate method performance and to assist in the validation of analytical results. There are two basic types of QC indicators: (1) indicators to evaluate method performance at both the preparation and the measurement steps and (2) QC indicators to evaluate matrix effects. Refer to Section 13.0, Corrective Actions, for procedures to follow when QC indicators show deviation from acceptance criteria.

9.2.1 Method Performance QC Indicators: Preparation Batch

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment.

QC indicators are added to each prep batch to monitor method performance. All QC indicators such as blanks, matrix spikes, matrix duplicates, blank spikes, control samples, or duplicates of these controls are processed through the entire analytical procedure with samples.

9.2.1.1 Preparation Blanks

The preparation blank (PB), also referenced as a method blank (MB) or reagent blank (RB), is used to monitor for potential contamination introduced during the sample preparation and analytical processes. For organics, preparation (prep) blanks are prepared by processing laboratory pure water for water samples or a purified solid matrix for soil, sediment or solid samples (when available or when requested). Solid matrices commonly include sodium sulfate, vendor or agency supplied soil

or solid, or purchased sand. These solids may require purification by the laboratory prior to use. The preparation blank volume/weights are selected to approximately equal the typical sample volume/weight used in sample preparation.

For inorganics, the prep blank consists of laboratory pure water for both water (PBW) and soil or sediment (PBS) samples. Final results are calculated as ug/L for the PBW in metals (exception: TCLP metals are reported as mg/L) and mg/L for the PBW in wet chemistry. To facilitate comparison to actual field samples, final results for the PBS may be calculated as mg/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding investigative samples.

Field blanks and trip blanks, when received, will be analyzed in the same manner as other investigative samples. However, a field blank should not be selected for matrix QC, as it does not provide information on the behavior of the target compounds in the investigative samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "TB", or "Rinse Blank".

9.2.1.2 Laboratory Control Samples and Blank Spikes

A laboratory control sample (LCS) used by the inorganics sections and blank spike (BS) used by the organics sections have the same connotation and hereafter both may be referenced as LCS. The LCS is prepared from a reference source of known concentration and processed through the entire preparation and analysis steps concurrently with investigative samples. This QC indicator is used to assess method performance independent of potential investigative sample matrix affects. At least one LCS is included in every prep batch of 20 or fewer samples. The LCS criteria and associated corrective actions are discussed in the method OPs. For multi-analyte methods, the LCS may consist of surrogates in the blank, and or a representative selection of target analytes.

For solid matrices, an aqueous LCS may be processed, unless a solid LCS is requested, through the soil/solids preparation method (e.g., digestion for metals or distillation for cyanide). To facilitate comparison with the actual field samples, final results for the LCSs may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding investigative samples.

9.2.1.3 Known QC Reference Samples

QC reference samples (QC check samples) containing known analytes or compounds are obtained from outside suppliers or agencies. These QC reference samples generally require preparation from concentrated materials by dilution into a standard matrix as instructed by the supplier. However, several suppliers provide fully constituted samples ready to analyze as received. Control limits are

provided by the vendor, extrapolated from other in-house control data, or determined from control charts or method reference limits.

QC reference samples may be used to comply with regulatory requirements; to check the accuracy of an analytical procedure; to troubleshoot method performance problems; to verify an analyst in training's ability to accurately perform a method; and to verify the return-to-control after method performance problems. It is particularly applicable when a minor revision or adjustment has been made to an analytical procedure or instrument. It may also be used as an LCS.

9.2.2 Matrix QC Indicators

Matrix QC indicators include sample duplicates (DUP), sample matrix spikes (MS), and sample surrogate spikes. Matrix QC indicators help monitor for potential physical and chemical effects which may interfere with the precision and/or accuracy of the selected analytical method. Since interferences can enhance or mask the presence of target analytes, matrix QC indicators measure the degree of interference and are used to assist in the interpretation of the analytical results. The laboratories avoid performing matrix QC on known field blank samples, such as trip blanks and rinsates, since these samples are not indicative of the sample matrix. Matrix QC Indicators are analyzed when requested by the client or specified by the method.

9.2.2.1 Matrix Spike (MS)

A matrix spike (MS) is an aliquot of an investigative sample which is spiked with the analytes or compounds of interest. When requested by the client or the analytical method, an MS is analyzed for each associated sample type (e.g., soil, water, oils, etc.) and is used to monitor the effects of the investigative sample matrix on the accuracy of the selected analytical method. The determination of MS percent recovery (% R) requires an analysis of a fortified sample and a non-fortified sample under the same procedural conditions (e.g., sample volumes, dilutions, procedural conditions, etc.). The concentration determined in the non-fortified sample is subtracted from the fortified sample concentration before determining percent recovery (%R). The degree of homogeneity of the sample, particularly in the case on non-aqueous samples or samples with particulates, may affect the ability to obtain representative recoveries.

9.2.2.2 Duplicates

Laboratory duplicate samples (DUP) are performed by analyzing two aliquots of the same field sample independently. A DUP, when requested by the client or the analytical method, is analyzed for each associated sample type (e.g., soil, water, soil, etc.) and is used to monitor the matrix affects on the precision of the selected analytical method. Precision may also be affected by the degree of homogeneity of the sample, particularly in the case of nonaqueous samples or aqueous samples with particulates. The DUP also provides a measure of the reproducibility of laboratory preparation

and measurement techniques. However, sample homogeneity and matrix effect should be considered when field samples are used to assess reproducibility.

If duplicates are not requested by the client, but are required by the method, the sample chosen for the duplicate is picked randomly so that various matrix problems can be noted and addressed. The duplicate data is always reported to the client whose sample is used for the duplicate analysis.

9.2.2.3 Matrix Spike Duplicates

A matrix spike duplicate (MSD) is an alternative to sample duplicates since it provides precision information. The MSD is preferable to a DUP if no target compounds are present in the sample. Generally, inorganic protocols specify an MS/DUP and organic protocols specify an MS/MSD. As with other matrix QC indicators, an MSD is analyzed when requested by the client or the analytical method.

9.2.2.4 Surrogate Spikes

Where required by the method, surrogates, compounds similar to the target analytes in structure, composition and chromatography, but not typically found in the environment, are added to each blank, blank spike and duplicate, matrix spike and duplicate, and sample, prior to preparation (e.g., extraction). Surrogates measure performance of the analysis in relation to the sample matrix. If the surrogates in an analytical batch do not all conform to established control limits, the pattern of conformance in investigative and QC samples is examined to determine the presence of matrix interference or the need for corrective action.

9.2.2.5 Internal Standards

Internal standards monitor the qualitative aspect of organic and inorganic analytical measurements. All internal standards are assessed after acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance. Internal standards are used to correct for matrix effects and to help troubleshoot variability in analytical response.

9.2.2.6 Matrix QC Frequencies

The frequency of matrix QC indicators depends on regulatory program compliance, a project's data quality objectives, or a client's requirements. The following frequency will be applied to samples when the regulatory programs are known and it does not conflict with project or client requirements.

For the Safe Drinking Water Act (SDWA) methods, a DUP is performed at a 10% frequency (1 per 10 samples) or one per preparation batch of 10 samples or less, whichever is more frequent.

For the Clean Water Act (CWA) 600 Series, MS (GC methods) and DUP is performed at a 10% frequency (1 per 10 samples) or one per preparation batch of 10 samples or less, whichever is more frequent. For GC/MS Methods, MS is performed at a 5% frequency (1 per 20 samples) or one per preparation batch of 20 samples or less, whichever is more frequent.

For EPA SW-846 methods, MS/MSD or MS/DUP is performed at a rate of 5% (1 per 20 samples) per client (independent of the preparation batch). For clients submitting less than 10 samples, the method matrix QC requirement may be satisfied by another clients sample within the same prep batch unless the Technical Profile indicates a client requirement for matrix QC. Matrix QC will only be reported to the client who owns the data.

For U.S. EPA CLP Sample Delivery Groups (SDGs), MS/MSD or MS/DUP is performed at a rate of 5% (1 set per 20 samples), or one set per SDG per matrix, independent of the prep batch. For NFESC samples, samples are processed in simultaneous or continuous batches.

Matrix spikes (MS), matrix spike duplicates (MSD), and duplicates (DUP) may not be applicable to some analytical protocols because of the nature of the sample or protocol.

9.2.3 Method Performance QC Indicators: Instrument Measurement

Quality control indicators are used to ensure that optimum instrument performance is achieved. These indicators help ensure that the proper identification and quantitation of target compounds or analytes are achieved. The instrument QC indicators appropriate to each analytical technique are described in laboratory operating procedures for each respective method. A brief description of these checks is included in this section.

9.2.3.1 Inorganics Initial Calibration Verification (ICV)

The initial calibration verification is a calibration standard of known concentration prepared from a source other than that used for the calibration standards. The ICV is analyzed after the standard curve to confirm calibration.

9.2.3.2 Inorganics Initial Calibration Blank (ICB

The ICB is composed of blank water or solvent that is analyzed immediately after the ICV to confirm the calibration and to assure that any potential contamination is less than the reporting limit.

9.2.3.3 Inorganics ICP Interference Check Samples (ICSA/ICSB)

ICP Interference Check Samples (ICS) consisting of an ICSA and/or ICSB will be analyzed consecutively at the beginning of each eight-hour analytical sequence, after the ICV/ICB, and again at an eight hour frequency following a CCV/CCB. When CLP protocols are followed, the ICS will be analyzed with the analytical sequence, before the final CCV/CCB. The ICS is analyzed to verify the absence of spectral interferences.

Results for the ICP Interference Check Samples shall be within limits of 80-120% of the established mean value. If results for the ICS do not fall within the control limit, the analysis will be terminated, the problem will be corrected, and the instrument will be recalibrated. If more than one ICS was analyzed in an analytical sequence, any samples not bracketed by acceptable ICS will be reanalyzed.

Elements for spectral interferences are not limited to Al, Ca, Fe, and Mg. Other elements may be added as needed and will be documented. The mean concentration is established by initially analyzing each lot of ICS Solution at least five times for the analytes of interest. The mean determination is performed during an analytical batch that meets all ICP QC specifications. Alternately, the ICSA/ICSB may be obtained from EPA or a commercial vendor with established mean values provided with the solution.

9.2.3.4 Inorganics Reporting Limit Verification Standard

For graphite furnace AA (GFAA) and cold vapor AA (CVAA) analysis, a standard at the reporting limit (CRA) is analyzed after the ICB to verify linearity near the reporting limit for CLP analyses. Specific acceptance range criteria for the CRA are undefined by the EPA.

For ICP analysis, a standard at two times the reporting limit (CRI) will be analyzed after the ICB to verify linearity near the reporting limit for CLP analyses. The CRI is also analyzed at the end of the eight hour analytical sequence, prior to analysis of the final CCV/CCB. The CRI is not required for non-TAL metals Al, Ba, Ca, Fe, Mg, Na, or K. There are no established control limits for the CRA and CRI. In house acceptance criteria are clarified in the individual laboratory standard operating procedures (SOPs).

9.2.3.5 Inorganics Continuing Calibration Verification (CCV)

A continuing calibration standard (CCV) is a standard of known concentration, which may be made from a source other than that used for the standard curve. The CCV is analyzed for wet chemistry

and metals to confirm that instrument performance has not significantly changed during the analytical sequence; to verify stable calibration throughout the sequence; and/or to demonstrate that instrument response did not drift over a period of non-use. The CCV is analyzed at a rate of 10%. For CLP metals, the CCV is analyzed at 10% or every two hours, whichever is more frequent. A CCV is also analyzed at the end of the analytical sequence.

9.2.3.6 Inorganics Continuing Calibration Blank (CCB)

The continuing calibration blank (CCB) is a reagent water blank used to confirm that the baseline has not drifted and to monitor for contamination at the reporting limit. The CCB is analyzed at a rate of 10% (1 per 10 readings) for inorganics and at a rate of 10% (1 per 10 readings/injections) or every two hours, whichever is more frequent, for CLP metals. A CCB is also analyzed at the end of the analytical sequence.

9.2.3.7 Metals Linear Range Analysis Standard (LRS)

For ICP analysis, linear range is determined quarterly with a blank and a minimum of five standard concentrations to cover the anticipated range of measurement. This is used to verify linearity and document the upper limit of the calibration range for each element. At least one of the calibration standards will be at or near the reporting limit. The calibration curve generated must have a correlation coefficient equal to or greater than 0.995 in order to consider the responses linear over that range. All samples found to be above the ICP linear range are diluted and reanalyzed until the concentration falls within the instruments linear range.

9.2.3.8 Metals Inter-Element Correction (IEC)

For ICP analysis, correction factors for spectral interference due to Al, Ca, Fe, and Mg will be determined at least annually for all wavelengths used for each analyte reported by ICP, or any time the ICP is adjusted in any way that may affect the IECs. Correction factors for spectral interferences other than Al, Ca, Fe, and Mg are recommended and are performed as needed and documented with the ICP instrument records.

9.2.3.9 GC/MS Tuning and Performance

For GC/MS analysis, mass spectrometers are calibrated with perfluorotributylamine (FC-43) or perfluorophenanthrene (FC-5311) as required to ensure correct mass assignment. At the beginning of the daily work shift, the GC/MS system is tuned with decafluorotriphenylphosphine (DFTPP) for semivolatiles analysis, and 4-bromofluorobenzene (BFB) for volatiles analysis. Performance is further monitored through response to target compounds during initial and continuing calibration, with minimum response criteria for specified system performance check compounds (SPCCs), and linearity is verified by evaluating the response factors (RF) for calibration check compounds

(CCCs). Throughout the analysis, blanks, internal standard areas, surrogates, chromatographic baseline, resolution of peaks, and overall quality of the chromatography are used collectively to monitor instrument performance.

9.2.3.10 GC and HPLC Instrument Performance

For GC and HPLC analysis, calibration to target compounds will be as described in Section 10.2.6. Continuing Calibration Verification throughout the analytical sequence is accomplished through analysis of calibration check standards.

Instrument performance for chromatographic methods is monitored through retention time shift evaluation, linearity checks, and degradation checks of selected target compounds (e.g., for endrin or DDT as appropriate). Throughout the analysis, blanks, shifts in chromatographic baseline or retention times, resolution of peaks, and overall quality of the chromatography are used collectively to monitor instrument performance.

9.2.4 Method Performance QC Indicators: Analysis Batch

Matrix specific QC indicators are used to assess the precision and accuracy of the method as applied to the specific sample matrix. These indicators provide information on sample matrix effects that is independent of the efficiency of the preparatory technique. The method performance QC indicators appropriate to each analytical technique are identified in the respective method. A brief description of these checks is included in this section.

These QC checks are performed to provide a tool for evaluating how well the method performed for the respective matrix. These values are used by the client to assess the validity of a reported result within the context of the project's data quality objectives. For matrix specific QC results falling outside laboratory control limits which are attributed to matrix affects, no systematic corrective action is taken.

9.2.4.1 Serial Dilution

For ICP metals, a dilution of an investigative sample is performed at the instrument to check for possible physical and/or chemical interferences. This sample is referred to as a serial dilution. If the analyte concentration is at least fifty times greater than the IDL before dilution, a 5X dilution should be performed. The diluted value should agree within 10% of the original determination to demonstrate no interferences are present.

9.2.4.2 GFAA Analytical Bench Spike

Analytical bench spikes are prepared at the instrument by fortifying the digestate with a known quantity of the analyte of interest. A bench spike is performed on each sample immediately following the unspiked original analysis, as required by the method. Specifics on preparation and acceptance criteria are provided in the applicable method protocols. Bench spikes are not required on samples that have been selected for matrix spikes.

9.2.4.3 Method of Standard Additions

Method of standard additions (MSA) is performed when specified by analytical protocol or by client request. The correlation coefficient of the MSA curve must be $\geq$ 0.995. The sample concentration is defined as the x-intercept.

9.3 Refrigerator Blanks

Refrigerator storage blanks are placed in VOA sample storage coolers and are analyzed for full VOA TCL analytes by GC and/or GC/MS. The reporting limits are consistent with the GC and GC/MS sections. These blanks monitor VOA refrigerators to assure the absence of sample cross-contamination.

9.4 Reagent Water Approval

The laboratory's on-tap laboratory pure water supply is similarly tested on a routine basis for pH, specific conductivity, Total Organic Carbon, Chloride, Ammonia, Residual Chlorine, and Metals. The objective is to maintain adherence to ASTM Type II water quality.

9.5 Balance and Refrigerator Monitoring

All analytical balances are monitored on days when used. Reagent/standard and Sample storage refrigerators and freezers are monitored daily on routine working days. These checks are recorded in the respective balance, refrigerator, or freezer logbooks. Detailed SOPs specify acceptance criteria and give corrective action guidance for out of control situations.

9.6 Blind QC Check Samples

The laboratory participates in many blind QC Proficiency Test Studies (PTs or Performance Evaluation Studies, PES). When PES are analyzed to support certifications where more than one method is approved for analysis, PES are analyzed by several methods to check performance for all analytical capabilities. Listed in the following table are the routine PES Programs and frequency in which the laboratories participate. The laboratory's participation in many other agency- and client-

specific programs and the results are available for review at each facility, unless client confidentiality was requested.

Program	Sample Type	Frequency
Water Pollution (WP)*	Inorganics, Metals, Organics	Semi-Annually
Water Supply (WS)*	Inorganics, Metals, Organics	Semi-Annually
Soils Study	Inorganics, Metals, Organics	Semi-Annually
EML QAP	Radiochemistry	Semi-Annually
Radiochemistry Study	Gross Alpha, Non-volatile Beta, Tritium	Semi-Annually
Mixed Analyte Performance Evaluation Program (MAPEP)	Metals, Organics	Semi-Annually

* To meet NELAC requirements, all certified parameters and/or analytes on the NELAC Fields of Testing (FOT) list have corresponding PT samples obtained from NIST/NVLAP -certified PT providers.

9.7 Routine Methods to Assess Precision and Accuracy

The QA objectives for precision and accuracy were provided and discussed in Section 8.0. This section details the necessary formulas for performing these calculations. All analytical data are reviewed relative to these criteria and specific project requirements to assess the quality of the analytical data.

Where all criteria are met, data are deemed acceptable without qualification. Where precision and accuracy goals are not met, corrective action as described in Section 13.0 is taken. There are several factors which may influence the corrective action steps:

- Project-specific QA/QC requirements
- Availability of sufficient sample for re-analysis
- Holding time considerations
- Regulatory action limits
- Data quality objectives

Refer to Table 9.1 for Precision and Accuracy Methods.

9.7.1 Precision

Precision is measured through the analysis of laboratory control samples (LCS) and/or replicate investigative samples or method QC. Results from these measurements are calculated as relative percent difference (RPD) or percent relative standard deviation (%RSD) and evaluated according to the criteria set forth in Section 8.0. The LCS is used to demonstrate acceptable method performance.

Precision is represented as the relative percent difference (RPD) between measurement of an analyte in duplicate samples or in duplicate spikes. RPD is defined as follows:

$$RPD = \frac{|C_1 - C_2|}{(C_1 + C_2)/2} \times 100$$

Where:

C_1 = first measurement value
C_2 = second measurement value

The % RSD is calculated by the standard deviation of the analytical results of the replicate determinations relative to the average of those results for a given analyte. This method of precision measurement can be expressed by the formula:

$$\% RSD = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100 = \frac{\left[\Sigma(X_i - X_{mean})^2/(n-1)\right]^{1/2}}{(X_1 + X_2 + \ldots X_n)/n} \times 100$$

The % D is calculated by expressing as a percentage, the difference between the original value and new value relative to the original value. This method for precision measurement can be expressed by the formula:

$$\text{Percent Difference (\% D)} = \frac{|C_1 - C_2|}{C_1} \times 100$$

Where:

C_1 = concentration of analyte in the initial aliquot of the sample
C_2 = concentration of analyte in replicate

9.7.2 Accuracy

Accuracy of analysis is represented by the percent recovery (%R) of various analytes added to samples and blanks. Percent recovery is defined as follows:

$$\%R = \frac{(A_T - A_0)}{A_F} \times 100$$

Where:

A_T = Total amount recovered in fortified sample
A_0 = Amount recovered in unfortified sample
A_F = Amount added to sample

QC indicators which provide information relative to analytical accuracy include LCS (or BS), MS, and MSD samples. Results from these measurements are calculated as percent recovery. For metals and inorganic analysis, laboratory control samples are used to demonstrate acceptable method performance, and are used to trigger corrective action when control limits are exceeded. The accuracy of surrogate compound analysis is used similarly in organic analysis.

Spike recoveries on samples (MS/MSD) give an indication of whether a sample's physical or chemical properties interfere with the identification and quantitation of analytes or compounds of interest. Sample homogeneity also becomes a factor in recovery determinations, as variable unspiked analytical results can affect the apparent analyte recovery.

Typically, the amount of spike added to a sample or blank is specified to meet requirements in laboratory operating practices or to meet project requirements. It may also be determined relative to background concentrations observed in the unfortified sample. In the latter case, the spiked concentration should be different enough (e.g., 2 to 5 times above the background concentration) to permit a reliable recovery calculation.

When the LCS recovery exceeds the established acceptance limits, appropriate corrective action is taken (refer to Section 13.0). After the problem has been identified, corrected and system control has been re-established, sample analysis may continue. All data associated with the out-of control situation are evaluated with respect to project DQOs for usability, sample availability for re-analysis, etc. For rejected results, the samples will be re-prepared and/or re-analyzed after control has been re-established or action will be taken in conformance to client specifications. If data are used without re-analysis, the case narrative will address the deviation.

9.7.3 Representativeness and Comparability

Sample handling procedures and analytical techniques are developed and implemented to help ensure that analytical results are representative of the matrix and conditions of the sample being measured. The data are calculated and reported in units consistent with standard reporting conventions to allow comparability with existing data, standards, and regulatory action limits. Project representativeness and comparability are dependent on site conditions and the sampling plan that addresses these conditions. Site conditions and sampling plans are generally the engineering/field contractor's responsibility and are usually prepared on a project specific basis. Therefore, representativeness and comparability are not addressed in this laboratory plan. Assessment of site and collection representativeness and comparability is performed by the field engineer.

9.8 Quality Control Limits and Charts

Control limits and control charts are used in the laboratory to establish method performance of a given analysis and to monitor trends of QC results graphically over time. Once a database of the laboratory's results for a method/matrix/QC analyte combination is established, the acceptability of a given analysis of that QC parameter (and of the analytical batch to which it belongs) can be evaluated in light of the laboratory's normal performance. This is intended to help identify problems before they might affect data. Often, patterns of response that are not at all evident in sets of numbers are very distinct when the same values are viewed as a chronological graph. The laboratory uses historic data for control limits, and evaluates the limits annually through control charts. Control charts are discussed further in OP QA-132.

9.8.1 Establishment of Limits

The purpose of using control limits is to define, for each analyte in a given method/matrix/QC type combination, a range of expected values. This range encompasses the random variation that occurs normally in the laboratory and allows one to evaluate QC indicators in that context, rather than according to an arbitrary or external set of values. Limits for accuracy and precision are defined below:

9.8.1.1 Accuracy

As recoveries of a QC analyte in a given matrix are tabulated over time, a mean value for recovery is established, as is the standard deviation (s) of those recoveries. If the analysis is in statistical control (e.g., if the set of QC recoveries over time show random variation about the mean) approximately 99.7% of all recoveries for that QC will fall within three standard deviations (3s) of the mean. In other words, only 3 results in 1,000 should fall outside the region ± 3s. Thus,

assuming that the mean itself is an acceptable level of recovery, the values corresponding to 3s above and 3s below the mean are defined as the Control Limits. Any single recovery outside these values is assumed to have resulted from some circumstance other than normal variation and shall be investigated.

Roughly 95% of points should fall within 2s of the mean. The values +2s and -2s are the Warning Limits. Any normal result has approximately a 1/20 chance of being between 2s and 3s from the mean, so a result in this region doesn't necessarily warrant corrective action, but attention should be paid to such points.

9.8.1.2 Precision

Precision is used to indicate matrix variability so that appropriate decisions can be made by the client when repeated analyses vary significantly. The coefficient of variation, expressed as a percentage (e.g., the %RSD, refer to section 9.8.1) for the data set used to calculate accuracy control limits defines the control limit for precision. Duplicate analyses of the QC samples, such as duplicates or MS/MSD, should have an RPD less than or equal to this established precision control limit to be considered free of matrix interferences.

Table 9.1

Precision and Accuracy Methods

QC Sample	Purpose	Conc. Level	Method Reference
Matrix Duplicates	Laboratory Precision Sample Homogeneity	Low/Medium	Soil/Water methods for Metals/Wet Chemistry (Optional for Organics)
Matrix Spikes	Laboratory Accuracy Sample Homogeneity Matrix Effects	Low/Medium	All soil and water matrices
Matrix Spike Duplicates	Accuracy/Precision Sample Homogeneity Matrix Effects	Low/Medium	Soil/water methods for Organics (Optional for Metals/Wet Chemistry)
Laboratory Control Samples	Accuracy/Precision	Low/Medium	Soil/water methods for Metals and Wet Chemistry
Blank Spikes and Blank Spike Duplicates	Accuracy/Precision	Low/Medium	Soil/water methods for Organics
Surrogates	Matrix Effects	Low/Medium	Soil/water methods for Organics

10.0 CALIBRATION PROCEDURES AND FREQUENCY

10.1 Standard Receipt and Traceability

Standards are obtained from commercial vendors as neat materials, single or multi-analyte stock solutions, or ready-to-use solutions. Actual preparation requirements vary with each analytical method, and are detailed in the respective analytical OPs. Sources may vary depending on availability of mixes and solutions from vendors. Each production unit is responsible to ensure, when available, that all standards are traceable to EPA, National Institute of Standards and Technology (NIST), American Association for Laboratory Accreditation (A2LA), Standard Analytical Reference Materials (SARMs), or other equivalent certified material sources, or that an alternate source standard is used to verify reference materials.

All standards used throughout the laboratory must have sufficient information to allow traceability of any solution or standard back to the parent vendor and lot number from which the solution originated. Records are maintained that document the dates of receipt, preparation, and expiration of all quality control chemicals and solutions.

The documentation for standards traceability is achieved through the use of books (e.g., standards receipt logbook, a standard preparation logbook) and/or certification statements from vendors. The receipt of each dry chemical, purchased stock solution or reference material to be used as a standard is assigned a unique ID number. The chemical name, manufacturer, lot number, date received, expiration date, date opened and initials of the analyst who opened the chemical are recorded. The expiration dates for ampulated solutions shall not exceed the manufacturer's expiration date. Expiration dates for laboratory-prepared stock and diluted standards shall be no later than the expiration date of the stock solution or material, or one year from the date of preparation, whichever comes first. Expiration dates for pure chemicals shall be established by the laboratory and be based on chemical stability, possibility of contamination, and environmental and storage conditions. Expired standard materials shall be discarded. The laboratory shall label standard and QC materials with expiration dates.

The preparation of all daughter solutions, whether a single or multiple-component stock, intermediate, or working standard solution, is documented in a standard solution preparation log or in a designated section of the analytical logbook. This documentation references the Standard ID of the respective parent solution(s) used in its preparation, providing a solid trail back to the solution or chemical received from the vendor. These records include the standard name, final volume, matrix, final concentration, analyst initials, prep date and expiration date. A daughter solution should not have an expiration date which post-dates any of the parent solutions used in its preparation.

Additional documentation (e.g., the compound/kit, % purity and weight/volume) may also be recorded. Storage conditions, such as shelf life, ambient or chilled, controlled or restricted access, wet or desiccated, etc., are in conformance with the specifications set in the associated method, the program requirements, or the manufacturer's recommendation, as appropriate. Analysis logs provide Standard ID information to provide a link from analysis to standards preparation.

10.1.1 Inorganic Solutions

The preparation of all inorganic stock solutions and intermediate solutions is documented in the Stock Standard Solution Preparation Log or in a designated section of the analytical logbooks. The standard name, final volume, matrix, final concentration, analyst initials, prep date and expiration date are recorded. The prepared stock solution is given a new Source ID number based on the logbook number, page number, and line number in which the solution is recorded in the Stock Standard Prep Log. This Source ID number can be used in the sample preparation/analysis logs to simplify traceability back to the parent chemicals.

The initial calibration verification stock solution is from an alternate stock solution than the stock calibration standard solution. The continuing calibration verification stock solution may be either the same or alternate stock from the stock calibration solution. The two stock solutions, whether purchased or prepared, are from different lot numbered chemicals, preferably from different manufacturers. In rare cases where different lot numbers are not commercially available, the two stock solutions are prepared by different analysts.

10.1.2 Organic Solutions

The preparation of organic standards is similar to the inorganic format with the additional documentation of the compound/kit, % purity and weight/volume. Daily solutions are dilutions of the stock or the intermediate solutions. Procedural SOPs provide instructions for daily solutions. Each laboratory maintains detailed Operating Practices for Standards Traceability.

10.2 Instrument Calibration

All instruments must be calibrated prior to use. Instrument calibration is dependent on the particular type of instrument, the method of analysis, and the intended use of the data. All sample measurements are made within the calibrated range of the instrument and in compliance with method requirements. The calibration data, which includes instrument conditions and standard concentrations, is documented and retained. Instrument conditions and calibration data may reside on electronic raw data when the electronic media is retained and stored as raw data.

Pre-formatted logbooks provide a template to ensure appropriate data are documented in a retrievable format. Preparation of all reference materials used for calibration will be documented in

a standards preparation notebook or in the designated sections of the analytical logbooks. The calibration standards are given a unique identification number based on the standards preparation book number, page number, and line number. This unique ID number is documented in the analytical raw data and/or run logs to trace the standard to a given calibration.

Instrument calibration typically consists of two types: initial calibration and continuing calibration. Initial calibration procedures establish the calibration range of the instrument and determine instrument response over that range. Typically, three to five analyte concentrations are used to establish instrument response over a concentration range. The instrument response over the range is generally absorbance, peak height, etc., which can be expressed as a linear model with a correlation coefficient (e.g., for Atomic Absorption, Inductively Coupled Plasma, UV-Visible-Infrared Spectrophotometry) or as a response factor or amount vs. response plot (e.g., for Ion Chromatography, Gas Chromatography, Gas Chromatography/Mass Spectrometry, High Performance Liquid Chromatography).

Continuing calibration usually includes measurement of the instrument response to fewer calibration standards and requires instrument response to compare within certain limits (e.g., ± 10%) of the initial measured instrument response. Continuing calibration may be used within an analytical sequence to verify stable calibration throughout the sequence, and/or to demonstrate that instrument response did not drift during a period of non-use of the instrument.

Specific instrument calibration procedures for various instruments are summarized further in this section, and detailed in the respective analytical methods. Typically more than one analytical method is available for an analysis. These various methods and other program requirements (e.g., U.S. EPA CLP, AFCEE, NFESC, USACE, NELAC, QAPjPs, contracts, etc.) may specify different calibration requirements. Therefore, calibration details as specified in the respective laboratory SOPs, Technical Profiles, QAPjP, program requirements, and contracts supersede the general instrument calibration procedures described further in this section.

10.2.1 Metals by Atomic Absorption (AA) Spectroscopy: Graphite Furnace (GFAA), and Cold Vapor AA

Atomic absorption spectrophotometers will be calibrated prior to each day of use. Calibration standards will be from appropriate reference materials, and working calibration standards will be prepared fresh daily. Calibration data are recorded and archived with the respective sample data. Lamps and flame/furnace conditions are optimized for maximum response prior to any analytical measurements.

10.2.1.1 AA: Initial Calibration

Initial calibration will include analysis of a calibration blank and a minimum of four (4) calibration standards covering the anticipated range of measurement. Duplicate injections are made for each

concentration. Response readings, e.g., absorbance, are recorded and the resultant standard calibration curve calculated. If the SOP or program-specified criteria are not met, appropriate corrective action must be taken.

An initial calibration verification (ICV) standard will be analyzed immediately after standardization. The ICV must be within SOP-specified criteria (e.g., five percent of the true value for drinking water, and 10% in most other cases), or the initial calibration must be repeated. The ICV must be from a source other than that used for initial calibration.

An initial calibration blank (ICB) will be analyzed after the ICV. The ICB must be free of target analytes at and above a concentration in which sample results are reported, or corrective action must be taken.

10.2.1.2 AA: Continuing Calibration

The initial calibration is verified during the analysis sequence by evaluation of a continuing calibration verification (CCV) standard and a continuing calibration verification blank (CCB), as described in Sections 9.2.3.5 and 9.2.3.6. The CCV value must be within SOP-specified criteria (e.g., ten percent recovery of the true value except for mercury within ± twenty percent recovery of the true value). The CCB must be free of target analytes at and above the concentration reported in samples.

If any initial/continuing calibration verifications or blanks exceed their acceptance criteria, corrective action must be taken.

10.2.2 Metals by Inductively Coupled Argon Plasma (ICP)

Following a period of time sufficient to warm up the instrument, the ICP will be calibrated prior to each analytical run or minimally every 24 hours. Calibration standards will be prepared from reliable reference materials and contain all metals for which analyses are being conducted. Working calibration standards are prepared fresh daily.

10.2.2.1 ICP: Initial Calibration

Quarterly, multi-concentration calibration is performed as described in Section 9.2.3 to document linearity. On a day-to-day basis, 4 calibration standards (blank, high standard, 50% standard, and 20% standard) are analyzed. Prior to an analytical run, the instrument is calibrated using three standards. An initial calibration verification (ICV) standard will be analyzed immediately after standardization, followed by an initial calibration blank (ICB). The ICV must be from a source other than that used for initial calibration and the ICB must be free of target analytes at and above

the value to be reported or appropriate corrective action must be taken. ICP Interference Check Samples (ICSA/ICSAB) will be analyzed at the frequency described in Section 9.2.3.3.

10.2.2.2 ICP: Continuing Calibration

The initial calibration is verified during the analysis sequence by analysis of a continuing calibration verification standard (CCV) and a continuing calibration blank (CCB) as described in Sections 9.2.3.5 and 9.2.3.6. The response of the continuing calibration verification standard must be within OP-specified criteria (e.g., ± ten percent recovery of the true value). The continuing calibration blank must be free of target analytes at or above the value to be reported or appropriate corrective action must be taken. If any initial/continuing calibration verifications or blanks exceed their acceptance criteria, appropriate corrective action must be taken.

10.2.3 Inorganic Colorimetric Methods

10.2.3.1 Colorimetric: Initial Calibration

A full initial standard calibration curve will be prepared for all colorimetric analyses on a daily basis. Working standards to define this curve will include a minimum of five (5) concentrations which cover the anticipated range of measurement, plus a calibration blank. At least one of the calibration standards will be at a concentration which will enable verification of instrument response near the reporting limit as defined in Section 8.6 or a level suitable for meeting specific program requirements. The requirement for an acceptable initial calibration is described in the analytical SOP. If the criteria are not met, appropriate corrective action must be taken. Calibration data, e.g., correlation coefficient, is entered into the laboratory notebook, or associated instrument printouts, and retained with the sample data.

Daily a calibration verification may be analyzed or a full initial calibration standard calibration curve. This daily calibration will at a minimum consist of a blank and a mid-range standard. Results must be within SOP-specified criteria. If not, reanalysis of the standards may be done once to verify the readings; otherwise, a new curve will be developed.

For procedures that require pretreatment steps, a minimum of one standard shall be prepared with the pretreatment. If the pre-treated standard is within SOP-specified criteria, the curve will be used. If the pre-treated sample is not within the criteria, the reason will be determined. If it is determined that the difference between the curves is inherent in the procedure, the curve will be based on the standards prepared and carried through the pretreatment.

An initial calibration verification (ICV) standard will be analyzed immediately after the standardization, followed by an initial calibration blank (ICB). The ICV must be from a source

other than that used for initial calibration. The ICV must be within SOP-specified criteria and the ICB must be free of target analytes or appropriate corrective action must be taken.

10.2.3.2 Colorimetric: Continuing Calibration

The initial calibration is verified during the analysis sequence by analysis of a continuing calibration blank (CCB) and a continuing calibration verification standard (CCV) as described in Sections 9.2.3.5 and 9.2.3.6. If any initial/continuing calibration verifications or blanks exceed their acceptance criteria, analysis is terminated, and the instrument is recalibrated. All samples since the last valid calibration verification are reanalyzed.

10.2.4 Gas Chromatography/Mass Spectrometry (GC/MS)

All GC/MS instrumentation is calibrated to set specifications prior to sample analysis. These specifications vary depending on the requirements of the analytical program and the designated analytical method.

10.2.4.1 Tuning and GC/MS Mass Calibration

Mass spectrometers are calibrated with perfluorotributylamine (FC-43) or perfluorophenanthrene (FC- 5311) as required to ensure correct mass assignment. In addition, at the beginning of the daily work shift, the GC/MS system must be tuned with decafluorotriphenylphosphine (DFTPP) for semivolatiles analysis and 4-bromofluorobenzene (BFB) for volatiles analysis, and calibrated to target compounds, as described in Section 9.2.3.9.

The majority of the laboratory work utilizes U.S. EPA-CLP or SW-846 protocols, which define the work shift as a 12-hour period initiated by the injection of DFTPP, BFB, or the dioxin/furan window mix. For drinking water programs (500 series methods), a 12-hour work shift is specified in the method for calibration frequency. For wastewater programs (600 series methods), the tune expires when the day's analytical sequence is complete; however, no time limit is given for the length of the daily GC/MS work shift. Ion abundances will be within the windows dictated by the specific program requirements.

10.2.4.2 GC/MS: Initial Calibration

After an instrument has been tuned, initial calibration curves (generally 3-5 points) are generated for the compounds of interest. Instrument response to these target compounds are evaluated against SOP-specified criteria. Linearity is verified by evaluating the response factors (RF) for the initial calibration standards against SOP-specified criteria (refer also to Section 9.2.3.9).

Once an acceptable calibration is obtained, samples may be analyzed up until the expiration of the tune. At that time, the instrument must be re-tuned prior to further analysis. After acceptable tuning, a continuing calibration standard may be analyzed in lieu of a full multi-point calibration if the SOP-specified criteria are met.

The majority of compounds analyzed for GC/MS comprise EPA's Target Compound List (TCL) or Priority Pollutant List (PPL). For add-on compounds not on the current TCL or PPL, initial calibration may be performed using a single point calibration of the additional compound(s), unless prior arrangements are made for a full three-to-five point calibration. Calibration data, to include linearity verification, will be maintained in the laboratory's records of instrument calibrations.

10.2.4.3 GC/MS: Continuing Calibration

During each operating shift, a single calibration standard may be analyzed to verify that the instrument responses are still within the initial calibration determinations, as defined in the specific SOPs. If criteria cannot be met, appropriate corrective action must be taken (refer also to Section 9.2.3.9).

10.2.5 Gas Chromatography (GC) and High Performance Liquid Chromatography (HPLC)

Gas chromatographs and high performance liquid chromatographs will be calibrated prior to use as described in analytical OP or program requirements. Calibration standard mixtures will be prepared from appropriate reference materials and will contain analytes appropriate for the method of analysis or program requirements (refer also to Section 9.2.3.10).

10.2.5.1 GC & HPLC: Initial Calibration

Initial calibration will include three to five calibration standards covering the anticipated range of measurement. The low level standard must be at a concentration which will enable verification of instrument response near the reporting limit as defined in Section 8.6 or at a concentration acceptable to meet program requirements. The other standards must extend through the linear working range of the detector. The parameters requiring quantitation must meet SOP or program-specified criteria prior to initiation of sample analysis. Any sample extracts containing parameters of interest which exceed the concentration of the high level standard, must be diluted to bring the parameters within the range of the standards.

10.2.5.2 GC & HPLC: Continuing Calibration

The response of the instrument will be verified for each analysis sequence by evaluation of a daily calibration verification standard at a mid-range concentration. In order to demonstrate that the initial calibration curve is still valid, the calibration check standard must be within SOP or program-

specified acceptance criteria for the compounds of interest or the instrument must be recalibrated. For multi-analyte methods, this check standard may contain a representative number of target analytes rather than the full list of target compounds. Optionally, initial calibration (e.g., the full range of concentration levels) can be performed at the beginning of the analysis sequence.

Within the analysis sequence, instrument drift will be monitored by analysis of a mid-range calibration standard every ten samples or 12 hour sequence (depending on the method protocol), including external QC. If the OP or program-specified calibration criteria are not met for the compounds of interest, appropriate corrective action must be taken.

10.2.6 Ion Chromatography (IC)

10.2.6.1 IC Initial Calibration

The ion chromatograph will either be calibrated daily or a CCV performed prior to analysis (10.2.6.2) . Calibration standards will be prepared from appropriate reference materials and will include a blank and a minimum of three concentrations to cover the anticipated range of measurements. At least one of the calibration standards will be at a concentration which will enable verification of instrument response near the reporting limit as defined in Section 8.6. If SOP-specified calibration criteria cannot be achieved, appropriate corrective action must be taken. Calibration data, e.g., correlation coefficient, will be archived with sample raw data.

10.2.6.2 IC: Continuing Calibration

On a day when initial calibration is not performed, a CCV may be performed before analysis begins. A continuing calibration standard and blank will be analyzed at a frequency of ten percent (10%) and at the end of the analysis shift. The response calculated as a percent recovery of the standard must meet SOP or program-specific criteria. The response of the blank must be less than the concentration to be reported for samples analyzed.

10.3 Balances

At a minimum, laboratory balances are calibrated and serviced annually by a factory representative. In addition, the balances are checked daily (each workday in which the balance is utilized) with a minimum of two masses: both in the gram range for top loading balances, and one each in the gram and milligram range for analytical balances. A record of calibrations and daily checks will be kept in the balance log. Weights used by the analysts for daily balance checks are Class S weights. All class S reference weights are certified and calibrated annually by an independent metrology laboratory. The specific procedures used are detailed in SOP QA-102.

10.4 Pipettes (e.g. Eppendorf, Biohit)

Pipettes are checked daily prior to use against established limits and the results are documented in logbooks. Since the daily checks must pass criteria in order for the pipette to be used, the acceptability is continually demonstrated. Statistics may be used to calculate precision from the daily checks if this information is needed. The specific procedures used are detailed in SOP QA-114.

10.5 Temperature Assurance

Oven and refrigerator/freezer thermometers are calibrated against a reference thermometer that is traceable to a NIST certified thermometer. The NIST thermometer is graduated in at least 0.1°C increments. The specific procedures used for calibrating thermometers for the particular use is detailed in SOP QA-101. The thermometers are labeled with an ID code, correction factor, and calibration date. This same information is documented and stored in the QA office in a Temperature Calibration Logbook. Mercury thermometers are calibrated annually. Digital or dial thermometers which are used to monitor temperature control are calibrated quarterly. New thermometers are calibrated in the range in which they are to be used prior to use. A system for routine monitoring of refrigerators, freezers, and ovens is documented in SOP QA-100.

11.0 DATA REDUCTION AND REPORTING

Analytical data are recorded on pre-formatted bench sheets or analysis run logs in bound laboratory notebooks. These bound notebooks are issued and document controlled by the laboratory's Quality Assurance Section. A unique id is assigned to each bench sheet to assure that record keeping is maintained.

Analytical data is referenced to a unique sample identification number (Batch Number) for internal tracking and reporting. Notebook pages contain the following information, as applicable: analytical method, analyst, date, time, logbook number, sequential page number, associated sample numbers, standard concentrations, instrument settings, and raw data. Entries for instrument logs are in chronological order and maintained so as to enable reconstruction of the analytical sequence.

The laboratory analyst is responsible for recording all appropriate information into analytical logs, and for signing and dating all analytical book entries daily. The notebook pages are reviewed by a supervisor or trained data reviewer. Copies of instrument outputs (chromatograms, strip charts, etc.) are maintained on file with the analyst's signature/initials and date.

11.1 Data Reduction

Data reduction is performed by the analyst and consists of calculating concentrations in samples from the raw data. The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, i.e., Wet Chemistry LOTUS spreadsheets, the data is reduced by the analyst and then transferred to LIMS. The data in LIMS is then verified by the unit leader or alternate analyst. The spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Copies of all raw data and the calculations used to generate the final results, such as bound laboratory notebooks, strip-charts, chromatograms, LOTUS spreadsheets and LIMS record files, are retained on file for a minimum of 6 years.

Calculations and data reduction steps for various methods are summarized in the respective laboratory Standard Operating Practices (SOPs) or program requirements.

Data audits are also performed by regulatory agencies or client representatives. The frequency, level of detail, and the areas of concern during these reviews are dependent on the specific program requirements.

11.3 Data Reporting

Analytical reports comprise final results (uncorrected for blanks and recoveries unless specified), methods of analysis, levels of reporting, surrogate recovery data, and method blank data. In addition, special analytical problems will be noted in the case narratives. The number of significant figures reported are consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two (2) or three (3) significant figures. Data are normally reported in units commonly used for the analyses performed.

Concentrations in liquids are expressed in terms of weight per unit volume (e.g., milligrams per liter, mg/L). Concentrations in solid or semi-solid matrices are expressed in terms of weight per unit weight of sample (e.g., micrograms per gram, µg/g). Reporting limits take into account all appropriate concentration, dilution, and/or extraction factors, unless otherwise specified by program requirements.

A client report is generated according to the Data Management (DM) Series SOPs with various steps of approval prior to printing of the final version. If any analytical anomalies were encountered during the analyses, e.g., an out-of-control matrix duplicate, it is documented in a case narrative. The case narrative is prepared by the respective operating unit and submitted to the Data Management Section to insert in the final report. The final report forms are printed, data packages are organized, a glossary of flags and acronyms is added, and reports are paginated. The Project Manager and/or the Laboratory Manager or designee will review and sign the report prior to delivery.

11.3.1 Report Contents

The final data report provided by the laboratories is a standard client report. The client may contract to upgrade this deliverable to a data documentation package or opt for a separately contracted electronic data deliverable (EDD).

Reported QC results minimally include a method blank and, if applicable to the method, an LCS. Other QC will be specified per client and analysis protocols. Re-analyses will not be required for organics for surrogate or internal standard area outliers unless exceeded criteria are determined to be due to laboratory error, the method specifically requires it, or the client has specifically contracted for this matrix effect contamination.

The standard client report contains a transmittal letter and the following:

- Case Narrative describing: data qualifiers, a description of any technical problems encountered with the analysis, identification of results derived from samples that did not meet LvLI/NELAC sample acceptance policy, and any prior approval for method/contract/client modifications (refer to Sections 4.5.2 and 9.1)

- Sample data summaries to include appropriate QC result summaries, and Five-peak library search report for GC/MS volatiles and semivolatiles.

- Chronology containing sample collection, sample preparation (e.g., extraction or digestion) and analysis dates,

- Chain of Custody documentation

Data for subcontracted samples is provided to LvLI by the subcontractor as their standard report (or in the format requested by the client), under their accreditation number, if applicable. The report is reviewed for compliance to client requirements, and then forwarded on to the client.

11.3.2 Revisions to Reports

After a data report has been issued, the data is set to a status 88 (released) in lims. This prevents data from being changed without proper clearance. Any requests from the client to review previously released data are documented on a data verification request form (DVR). The unit leader can then set the status back so that the data can go through the review cycle again. If a revision is made, depending on the type of revision and how much the report is affected, either a new report is generated or just the revised pages are reprinted. In both cases, the case narrative is marked "REVISION" and contains an explanation of the revision. If additional data is being added to a report (such as data from a re-extraction), the case narrative is marked "SUPPLEMENTAL". The project manager will identify, in the transmittal letter, whether the data is to replace or be added to the current copy.

12.0 PREVENTATIVE MAINTENANCE

12.1 Introduction

The ability to generate valid analytical data requires that all analytical instrumentation be properly and regularly maintained. The responsibility of routine care lies with the analysts using the instruments. Guidance on required routine maintenance, as well as troubleshooting information, is provided in the respective instrument manuals and laboratory Standard Operating Practices (SOPs). For more extensive preventative maintenance or emergency repair service, each analytical laboratory maintains full service contracts on all major instruments or has accounts established with vendors. The elements of the maintenance program are discussed in the following sections.

12.2 Instrument Maintenance Log Books

Each analytical instrument is assigned an instrument maintenance log book. All maintenance activities are recorded in the maintenance log. The information entered in the maintenance log includes:

- Date of service or maintenance,
- Person performing service or maintenance,
- Type of service performed and reason for service,
- Replacement parts installed (if appropriate),
- Documentation of the re-establishment of working order, and
- Miscellaneous information.

If service is performed by the manufacturer, a copy of the service record (when available) is affixed to the notebook page, or cross-referenced in the notebook to a separate maintenance file. The service record should include sufficient detail to describe the service performed (e.g., not just "service call," but "replaced pump motor gear"). If the service record does not spell out this information, it must be written separately into the maintenance log. There must also be a reference to the file number, notebook page, or appropriate cross reference that substantiates re-establishment of working order.

12.3 Instrument Maintenance and Repair

Preventative maintenance and repairs that cannot be performed by laboratory staff are contracted to the manufacturer's service section or to an authorized maintenance vendor. Laboratory service agreements provide for preventative maintenance, emergency service, and emergency shipping of spare parts. Annual service of the laboratory balances is an example of contracted preventative maintenance. The service contracts also provide for overnight delivery of critical spare parts in response to a service request.

Examples of maintenance procedures and suggested frequencies for major analytical instrumentation are summarized in Table 12.1. Actual procedures may vary significantly for specific instruments, depending on the manufacturer, peripherals, and data system. However, this table provides an indication of the level of detail required for maintenance. The frequency of maintenance suggested assumes daily operation of the instrumentation. Laboratory and instrument specific information is provided in the respective instrument manuals, and in the analytical SOPs.

12.4 Spare Parts

The laboratory maintains a supply of routinely required spare parts (e.g., spare sources, vacuum pumps and filaments for GC/MS, spare torches, burner heads for AA-ICP).

The instrument operators have the responsibility, with the appropriate Unit Leaders, to ensure that an acceptable supply of spare parts is maintained.

12.5 Contingency Plans

Properly maintained equipment will provide dependable service; however, emergencies cannot be totally avoided. Major equipment, such as the LIMS and GC/MS instrumentation, is provided with uninterrupted power supplies to provide continuous operation when experiencing electrical power failure or brownouts. Supervisory and building maintenance personnel are notified of power failures during non-working hours, and can be on site or remain on stand-by alert until the emergency is passed or further action is necessary. Additionally, some laboratory personnel from night shift will often already be on site. Service is generally restored within an hour. For prolonged power outages, laboratory personnel on stand-by alert will prepare for an organized, systematic shut-down of major equipment. A decision on the need for auxiliary back-up generators to run storage refrigerators will be made.

With respect to instrument-related downtime, an attempt is made to maintain adequate redundancy in instrumentation to cover short term losses due to repairs. For long-term downtime, arrangements can be made to rent appropriate equipment until necessary repairs can be completed. In either case, with client approval, arrangements may be made to off-load work to another laboratory to enable analysis within prescribed holding times.

Table 12.1
(continued)
Example: Equipment and Maintenance

Instrument	Procedure	Frequency
AA (Graphite Furnace)	Clean lens and furnace head	Daily
	Replace windows	As required
	Check or change cuvette	Daily
	Check & drain compressor drain	Daily
	Clean atomizer cell/furnace hood	Daily
	Nebulizer cleaned/dried	Weekly or as required
	Check/change marble stones	Weekly
	Clean filters	Weekly
	Change graphite tube/platform	As required
	Empty waste container	Daily
	Remove carbon tube and check wear	Daily
	Check sample introduction probe	Daily
Leeman Mercury Analyzer	Check tubing for wear	Daily
	Fill rinse tank with 10% HCl	Daily
	Insert clean drying tube filled with Magnesium Perchlorate	Daily
	Fill reductant bottle with 10% Stannous Chloride	Daily
ICP	Check pump tubing	Daily
	Check liquid argon supply	Daily
	Check fluid level in waste container	Daily
	Check filters	Weekly
	Clean or replace filters	As required
	Check torch	Daily
	Check sample spray chamber for debris	Monthly
	Clean and align nebulizer	Monthly
	Check entrance slit for debris	Monthly
	Change printer ribbon	As required
	Replace pump tubing	As required
UV-Vis Spectrophotometer	Clean ambient flow cell	As required
	Precision check/alignment of flow cell	As required
	Wavelength verification check	Semi-annually

Table 12.1
(continued)
Example: Equipment and Maintenance

Instrument	Procedure	Frequency
Auto Analyzers	Clean sampler	Daily
	Check all tubing	Daily
	Clean inside of colorimeter	Daily
	Record manifold temperature	Daily
	Clean pump well and pump rollers	Quarterly
	Clean wash fluid receptacle	Weekly
	Oil rollers/chains/side rails	Weekly
	Clean optics and cells	Quarterly
IR Spectrophotometer	Clean cell	Annually
	Check/adjust cell alignment	As required
Hewlett Packard GC/MS	Ion gauge tube degassing	As required
	Pump oil-level check	Monthly
	Pump oil changing	Semi-annually
	Analyzer bake-out	As required
	Analyzer cleaning	As required
	Resolution adjustment	As required
	COMPUTER SYSTEM AND PRINTER:	
	Air filter cleaning	As required
	Change data system air filter	As required
	Printer head carriage lubrication	As required
	Paper sprocket cleaning	As required
	Drive belt lubrication	As required
Gas Chromatograph	Compare standard response to previous day or since last initial calibration	Daily
	Check carrier gas flow rate in column	Daily via use of known compound retention
	Check temp. of detector, inlet, column oven	Daily
	Septum replacement	As required
	Glass wool replacement	As required
	Check system for gas leaks with SNOOP	W/cylinder change as required
	Check for loose/fray wires and insulation	Monthly

Table 12.1
(continued)
Example: Equipment and Maintenance

Instrument	Procedure	Frequency
	Bake injector/column	As Required
	Change/remove sections of guard column	As Required
	Replace connectors/liners	As Required
	Change/replace column(s)	As Required
Electron Capture Detector (ECD)	Detector wipe test (Ni-63)	Semi-annually
	Detector cleaning	As required
Flame Ionization Detector (FID)	Detector cleaning	As required
Hall 700A Detector	Electrolyte change	As required by noise
Hall 1000 Detector	Reactor tube/teflon connecting tube change	As required
	Clean detector cell	As required
Photoionization Detector (PID)	Change O-rings	As required
	Clean lamp window	As required
HPLC	Change guard columns	As required
	Change lamps	As required
	Change pump seals	Semi-annually or as required
	Replace tubing	As required
	Change fuses in power supply	As required
	Filter all samples and solvents	Daily
	Change autosampler rotor/stator	As required
Balances	Class "S" traceable weight check	Daily, when used
	Clean pan and check if level	Daily
	Field service	At least Annually
Conductivity Meter	0.01 M KCl calibration	Daily
	Conductivity cell cleaning	As required
Turbidimeter	Check light bulb	Daily, when used

Table 12.1
(continued)
Example: Equipment and Maintenance

Instrument	Procedure	Frequency
Deionized/Distilled Water	Check conductivity	Daily
	Check deionizer light	Daily
	Monitor for VOA's	Daily
	System cleaning	As required
	Replace cartridge & large mixed bed resins	As required
Drying Ovens	Temperature monitoring	Daily
	Temperature adjustments	As required
Refrigerators/ Freezers	Temperature monitoring	Daily
	Warning system checked	Monthly
	Temperature adjustment	As required
	Defrosting/cleaning	As required
Vacuum Pumps/ Air Compressor	Drained	Weekly
	Belts checked	Monthly
	Lubricated	Semi-annually
pH/Specific Ion Meter	Calibration/check slope	Daily
	Clean electrode	As required
BOD Incubator	Temperature monitoring	Daily
	Coil and incubator cleaning	Monthly
Centrifuge	Check brushes and bearings	Every 6 months or as needed
Water baths	Temperature monitoring	Daily
	Water replaced	Monthly or as needed

13.0 CORRECTIVE AND PREVENTIVE ACTION

To consistently achieve technical and regulatory requirements, the data produced by an analytical laboratory must be supported by an effective corrective and preventive action system. The system must be capable of isolating and rectifying both random and systematic errors. Mechanisms used to ensure problem definition include SOPs; internal and external audits and surveillances; and regular laboratory management meetings. When evaluation of performance against established criteria for good laboratory practices shows a condition that could adversely affect the quality of services provided, or when there are departures from documented policies, procedures or NELAC standards, corrective action is initiated. Procedures for corrective action, are summarized in Sections 13.1 - 13.4 and preventive action is addressed in Section 13.5.

All corrective actions, whether immediate or long-term, will comprise the following steps to ensure a closed-loop corrective action process:

- Define the problem,
- Assign responsibility for investigating the problem,
- Determine a corrective action to eliminate the problem,
- Assign, and obtain commitment to, responsibility for implementing the corrective action,
- Implement the correction, and
- Assess the effectiveness of the corrective action and verify that the corrective action has eliminated the problem.

13.1 Immediate Corrective Action

Immediate corrective actions to correct or repair non-conforming equipment and systems are generally initiated in response to adverse conditions identified through quality control (QC) procedures. The individual has relatively quick feedback that a problem exists, e.g., calibration does not meet or QC check samples exceed allowable criteria, and can take immediate action to repair the system.

The initial responsibility to monitor the quality of a function or analytical system lies with the individual performing the task or procedure. Quality indicators are evaluated against laboratory-established or against method- or client-specified QA/QC requirements. If the assessment reveals that any of the QC acceptance criteria are not met, the analyst must immediately assess the analytical system to correct the problem. Types of QC check samples, their frequency, acceptance criteria, and corrective action can be found in the method OPs. Analysts are instructed to be

circumspect in their assessments, as an out-of-control situation may be caused by more than one variable. When the appropriate corrective action measures have been defined and the analytical system is determined to be "in-control" or the measures required to put the system "in-control" have been identified and scheduled, the problem and resolution or planned action is documented in the appropriate notebook. Data generated by an analytical system that is determined to be out-of-control must never be released without approval of the Supervisor, the QA Manager, the Laboratory Manager, and client notification.

When an acceptable resolution cannot be met or data quality is negatively affected, the analyst (or any personnel having QA and/or QC responsibilities) will notify the appropriate supervisor and initiate a Sample Discrepancy Report (SDR) (Refer to Figure 13.1). If an SDR is required, it is routed for proper authorizations and direction. Proper authorization and direction is given by the QA Manager and Project Manager. Based upon the circumstances and judgment of the Project Manager, the client may be notified of the situation.

Data generated concurrently with an out-of-control system will be evaluated for usability in light of the nature of the deficiency. If the deficiency does not impair the usability of the results, data will be reported and the deficiency will be noted in the case narrative. Where sample results may be impaired, the Laboratory Project Manager is notified by a written SDR and appropriate corrective action (e.g., reanalysis) is taken and documented.

If a large number of SDRs are received by the QA Section or further action is required, a Corrective Action (CA) Form (Figure 13.2) is initiated. This CA Form may also be initiated by any laboratory employee for problems not suited to, or broader in scope than, the SDRs.

Any analyst, through their unit leader with the concurrence of the Quality Assurance Manager has the authority to stop the analysis if there is a failure to meet method or project requirements, and to hold all analyses of samples affected by an out-of-control situation. The method cannot be restarted without appropriate documentation leading to the QA Manager's approval and sign-off.

13.2 Long-term Corrective Action

Long-term corrective action is generally initiated due to quality assurance (QA) issues, which are most often identified during internal and external audits (see Section 14.0). Typically, a deeper investigation into the root cause of the nonconformance is warranted, and the problem may take much longer to identify and resolve. Staff training, method revision, replacement of equipment, and LIMS reprogramming, are examples of long-term corrective action.

13.3 Responses to Client Feedback and External On-Site Audits and Performance Samples

Feedback from clients is typically received through their respective project manager. The PM series SOPs describe a closed loop system for timely response and resolution of any issues that arise. When the results from an external on-site audit or performance evaluation study are received by the laboratory, a summary of the results is distributed to appropriate laboratory personnel.

If deficiencies exist, the QA Manager will assign responsibility for investigating the finding ensuring resolution for each deficiency. Upon receipt of all corrective action responses, the QA Manager will forward the information to the respective outside client or agency.

13.4 Responsibility and Closure

The Unit Leaders and Supervisorsare responsible for correcting out-of-control situations, placing highest priority on this endeavor. Associated corrective actions, once verified for effectiveness, are incorporated into standard practices. Ineffective actions will be re-evaluated until acceptable resolution is achieved. Unit Leaders are accountable to the Laboratory Manager to ensure final acceptable resolution is achieved.

Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to Senior Management by the Quality Assurance Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation. This provides laboratory QA personnel non-laboratory management support, if needed, to ensure QA policies and procedures are enforced.

13.5 Preventive Action

The laboratories maintain preventive action programs to define, improve, or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive continuous process improvement activity which can be initiated by clients, employees, business providers, and affiliates. The QA Section has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Preventive action opportunities may be identified from information obtained through activities related to but not limited to the corrective action process, performance evaluation program, internal audits, management review, and/or market trends, industry trends and competitive comparisons. Established standard practices for preventive action are included in SOPs QA-105, Corrective Action; QA-121, Performance Audits; QA-122, System Audits; and SOP QA-005,

Annual Quality System Assessment. These procedures describe the information sources used to detect, analyze, and eliminate potential causes of nonconformities and to ensure effective implementation of solutions.

Figure 13A
Example: Sample Discrepancy Report (SDR)

Lionville Laboratory Incorporated Sample Discrepancy Report (SDR) SDR #: _____

Initiator: _____ RFW Batch: _____ Parameter:
Date: _____ Samples: _____ Matrix: _____
Client: _____ Method: SW846/MCAWW/CLP/ _____ Prep Batch: _____

1. Reason for SDR

a. COC Discrepancy
__ Tech Profile Error __ Client Request __ Sampler Error on C-O-C
__ Transcription Error __ Wrong Test Code __ Other _____

b. General Discrepancy
__ Missing Sample/Extract* __ Container Broken __ Wrong Sample Pulled __ Label ID's Illegible
__ Hold Time Exceeded __ Insufficient Sample* __ Preservation Wrong __ Received Past Hold
__ Improper Bottle Type __ Not Amenable to Analysis

Note*: Verified by [Log-In] or [Prep Group] (circle)...signature/date: _____

2. Known or Probable Causes(s)

3. Discussion and Proposed Action Other Description:
__ Re-log
__ Entire Batch
__ Following Samples: _____
__ Re-leach
__ Re-extract
__ Re-digest
__ Revise EDD
__ Change Test Code to _____
__ Place On/Take Off Hold (circle)

4. Project Manager Instructions...signature/date: _____
__ Concur with Proposed Action
__ Disagree with Proposed Action; See Instruction
__ Include in Case Narrative
__ Client Contacted:
Date/Person _____
__ Add
__ Cancel

5. Final Action...signature/date: _____ Other Explanation:
__ Verified re-[log][leach][extract][digest][analysis] (circle)
__ Included in Case Narrative
__ Hard Copy COC Revised
__ Electronic COC Revised
__ EDD Corrections Completed

When Final Action has been recorded, forward original to QA Specialist for distribution and filing.

Route	Distribution of Completed SDR	Route	Distribution of Completed SDR
__	X Initiator	__	__ Metals:
__	X Lab Manager:	__	__ Inorganic:
__	X Project Mgr:	__	__ GC/LC:
__	X Section Mgr:	__	__ MS:
__	X QA (file):	__	__ Log-in:
__	__ Data Management:	__	__ Admin:
__	__ Sample Prep:	__	__ Other: _____

Figure 13B
Example: Corrective Action Form

Lionville Laboratory Incorporated

CORRECTIVE ACTION DOCUMENTATION

AUDIT REPORT #

INSTRUCTIONS: 1) ORIGINATOR complete PERSON RESPONSIBLE FOR RESPONSE and DESCRIPTION OF PROBLEM blocks.
2) Originator forward form to PERSON RESPONSIBLE FOR RESPONSE
3) Develop/plan a SEQUENCE OF CORRECTIVE ACTION and obtain INITIAL CA APPROVAL sign-off from supervisor.
4) Forward original form to QA for sign-off and FOLLOW-UP ACTION. This allows all pertinent action to be documented on the original form. On completion of the corrective action, the form is signed off by QA, distributed, and the original archived with the QA records.

DATE/ORIGINATOR

PAGE __ OF __

PERSON RESPONSIBLE FOR RESPONSE (corrective action plan and implementation of corrective action plan):

DATE RESPONSE DUE: _____

DISTRIBUTION:
__ LABORATORY MANAGER
__ INORGANIC MANAGER
__ GC/MS MANAGER
__ GC/EXTR MANAGER
__ QA MANAGER
__ QA REPORT FILE
__
__

DESCRIPTION OF PROBLEM and when identified:

CAUSE OF PROBLEM if known or suspected:

INITIAL CA APPROVAL: Supervisor signature/date:
QA signature/date:

DESCRIPTION OF QA FOLLOW-UP ACTION (include signature/date):

FINAL CA APPROVED (QA signature/date):

14.0 PERFORMANCE AND SYSTEM AUDITS

Quality assurance audits and surveillances are conducted to assess the performance of laboratory systems in meeting technical, regulatory and client requirements. They provide a means for management to be apprised of, and to respond to, a potential problem before it actually impacts on laboratory operations. They also are a mechanism for ensuring closure of corrective actions resulting from external audits.

Performance audits test the laboratory's ability to assay an unknown sample correctly. They may be single blind or double blind Proficiency Test sample. In a single blind study, the analyst is not provided with the acceptable result for the unknown sample until after the experimental result is reported; however, it is known that the sample is a performance test. In a double blind performance test, the analyst not only has no knowledge of the acceptable result, but the sample is disguised in such a manner as to maintain anonymity as a performance test sample. In some double-blind studies, even laboratory management is unaware that performance test samples are not actual samples.

Systems audits and surveillances are used to evaluate the operational details of the QA program. An audit is a systematic assessment of an area of laboratory operation. It may comprise evaluation of an operational unit, e.g., GC/MS Analysis or Data Reporting; or it may have a more narrow focus, such as an assessment of adherence to chain-of-custody procedures. Audits are conducted by persons other than those who performed or directly supervised the work being inspected. A surveillance consists of inspection or monitoring of a specific targeted area for compliance with requirements, such as an evaluation of a single analytical method to ensure conformance with the written Standard Operating Practices (SOPs). Audits and surveillances can be performed at the request of a client, agency and/or as part of routine internal assessments. External audits and reports may be used as part of the internal audit program, with adherence to the Internal Audit SOP (QA-122) for corrective action and follow-up activity and documentation. If an internal audit finds that data is impacted, an assessment is made, and the client is notified as necessary.

14.1 External Audits

Performance audits, as well as on-site systems audits, by non-LvLI personnel and clients are an on-going, continual occurrence. Whether the audit is scheduled or unannounced, full cooperation with the audit team will be provided by the laboratory staff. A full response to any deficiencies cited as a result of a performance audit or on-site visit will be addressed within the schedule determined by the client. The QA Manager is responsible for scheduling and coordinating all external audits and any resultant corrective actions.

On-site evaluation by agencies, clients, or designated third-party auditors (both government and non-government) are routinely conducted to assure program compliance. These audits are preferentially pre-scheduled with the client to ensure that appropriate personnel are available to answer questions. However, audits may also be unannounced. In either instance, full cooperation with the audit team by the laboratory staff during the on-site visit will be provided.

Program compliance may be defined as adherence to requirements for a specific certification or licensing program, e.g., state certifications, NELAC, or adherence to specific project requirements. Government program clients include State Regulatory Agencies, U.S. EPA, the Nuclear Regulatory Commission (NRC), the Department of Defense, the Department of Energy, and the Department of Agriculture. Non-government clients include industrial clients and engineering firms utilizing the laboratory services for drinking water, groundwater, wastewater, hazardous waste, and mixed wastewater, soil, air, tissue, and miscellaneous waste matrices. A list of all state and agency accreditations is maintained by QA.

14.2 Performance Audits

Internal performance audits conducted at the bench level provide the analyst with a tool to evaluate the acceptability of a specific data set. This is accomplished through analysis of laboratory control samples or spiked blanks of known concentration to the analyst which must meet minimum performance standards. When these QC checks are performed in duplicate, method accuracy and precision information can be generated to demonstrate the proper functioning of the total measurement system.

Single blind performance audits (e.g., Performance Evaluation Studies: PES) are routinely analyzed at least semiannually as Water Supply (WS), Water Pollution (WP) and soil matrix studies. DMRQA studies are performed annually in conjunction with WP studies. Other water/wastewater PES are received quarterly from confidential clients for full TCL/TAL plus selected wastewater parameters,

As an additional feature of the laboratory's internal QA Program, double blind performance evaluation samples are submitted to the laboratory periodically for analysis. These samples originate both internally and externally, and are scheduled through the laboratory's project management system to ensure anonymity. Externally originated samples are purchased from a commercial vendor in a constituted form. The laboratory initiates these external double-blind samples using the same procedures utilized for routine clients through a designated project manager, to include, for example, assigning of work order numbers, forward scheduling the

analyses, generation of sample container orders so that samples arrive in standard containers, etc. This system effectively gets samples in the laboratory for unbiased analysis. All deficiencies are investigated by the quality assurance department and a corrective action plan is implemented.

Internally generated samples are handled in the same manner as the externally purchased double blinds, except that they are prepared by the laboratory, unknown to the analysts, using NIST or commercially available reference materials.

14.3 Systems Audits and Surveillances

The laboratory QA Manager has overall responsibility for monitoring the internal Quality Assurance/Quality Control program. The QA Manager has a staff to provide in-house audits and to review analytical data packages.

Internal auditors/assessors will either have formal training or documented experience performing these functions. They will have the responsibility and authority to prepare for and carry out the audit, as well as be accountable for developing a formal corrective action plan for any deficiencies found.

Internal laboratory systems audits and surveillances will be conducted and documented such that all laboratory sections receive an annual QA audit either independently or in conjunction with an external audit. Unique client audit procedures and data requirements will be complied with as specified contractually. The internal audit consists of a review of laboratory systems, procedures, and documentation. Internal systems audits include specific attention to issues noted in external audits. Any deficiencies and/or deviations are documented and a summary report is prepared.
The following items may be included for focus in routine laboratory audits and surveillances:

- Life of reagents
- Holding times
- Interferences (if any)
- Maintenance logs
- Standards traceability
- Preparation of glassware
- Sample preservation
- Equipment/instrumentation
- Computer spreadsheets
- Calculations
- Standard deliverables
- Lab book documentation
- Safety
- Method reporting limits
- Current operating procedure

An audit report is prepared and distributed to the responsible party, including the appropriate supervisor. A maximum of one calendar month is given to address any recommended corrective actions. The original copy of the completed responses is kept on file in the QA Section. QA also conducts follow-up audits to ensure closure of items noted in the respective original systems audits.

14.4 Raw Data Audits and Surveillances

All laboratory notebooks containing quality records are routinely reviewed by the analyst and a second reviewer to assure correctness of sample and quality control calculations. In addition, all active laboratory data books and QC files are subject to periodic audits/surveillances by QA personnel and/or Unit Leaders.

Raw data evaluations will be based on the following completed information, as applicable:

- Parameter and method
- Instrument ID and settings
- Date and full signature of analyst
- Valid standard curve
- Frequency of QC
- QC calculations and recoveries
- Sample calculations
- Neatness and ease of data interpretation

Reviewed data will be documented as "reviewed by" and signed (initials or full signature) and dated by the reviewer.

15.0 QUALITY ASSURANCE REPORTS

Quality assurance reports communicate quality status and needs to upper management. By providing summaries of quality data and analysis of relevant situations, these reports provide management a feedback loop to monitor the effectiveness of laboratory improvement activities. Quality assurance reports distinguish between major and minor issues, while minimizing false alarms. The reports emphasize objective quality measurements, but when subjective elements are reviewed, these are reported without blame.

For day-to-day problems, a Sample Discrepancy Report (SDR) and/or Corrective Action Report (CAR) are used. These forms are typically used for process related circumstances requiring immediate attention (Refer to Section 13.0). Distribution of these corrective action documents includes the appropriate Project Manager and/or Section Manager that must acknowledge and approve the corrective actions in order to remedy project related out-of-control situations.

In addition, regular QA meetings are held with management (operations and technical), during which the items listed in Sections 15.1 – 15.4 are discussed. An outgrowth of these activities are various informal "reports", which are written documents or summaries to track and resolve both new and long term objectives and issues.

15.1 Performance Evaluation Studies (PES)

Results of both external and internal performance audits are distributed to laboratory line management for review and action, as appropriate. Any required response to deficiencies must be submitted to QA for review. After acceptable corrective action responses are received for all noted deficiencies, a summary of the results with attached responses is distributed.

15.2 Agency and Client On-Site Audits

On-site evaluations of laboratory facilities and procedures are conducted by external auditors to ensure conformance to the requirements of their respective programs. These are scheduled and coordinated through the QA Section. All audits and review findings are documented as follows. The summary evaluation received from the client reporting findings and/or recommendations and observations are distributed through the QA Section to laboratory line management for review and action, as appropriate. Any required response to deficiencies must be submitted to QA for review. After acceptable corrective action responses are received for all noted deficiencies, a summary of the results with attached responses is distributed.

15.3 Management Systems Reviews

The laboratory manager reviews the quality system at least annually (SOP QA-005 and QA-121) to ensure its continuing suitability and effectiveness in satisfying client requirements. At a minimum, this review is performed through the evaluation and revision of this Quality Assurance Manual (QAM) and a memo, letter, or e-mail acknowledging review and discussion of the Quality Assurance Manager's Annual Quality System Assessment report and associated goals and objectives.

Management reviews of specific quality system elements may be performed through continuous improvement activities, monthly QA reports, process changes, standard practice revisions, and/or audit reports/responses. Documentation of these reviews are not required unless it is inherent in the review mechanism (e.g., approval signatures on standard operating practice revisions).

15.4 Employee Orientation and Training Activities

Orientation to laboratory policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. The Quality Assurance Section in conjunction with the Human Resources Section are responsible for maintaining documentation of these activities. The QA section maintains this information and makes it available to managers and staff for planning and evaluation.

16.0 WASTE MANAGEMENT

Wastes generated in the laboratory can be divided into four types: hazardous, non-hazardous, radioactive, and mixed wastes. The EPA defines wastes as hazardous if they exhibit the characteristics of ignitability, corrosivity, reactivity, or toxicity as identified in 40 CFR 261, Subpart C, or are listed in 40CFR 261, Subpart D. For the intents and purposes of laboratory waste management procedures, substances that may be disposed of as hazardous wastes include, but are not limited to:

- Environmental samples.
  (Disposed 30 days after the data report is submitted to the client unless longer specific contract/program requirements were established. Disposal may include return of the samples to the client.)

- By-products of sample preparation or analysis.

- Standards or reagent solutions.

- End products of sample preparation or analysis.

- Used chemicals, or chemicals that have exceeded their shelf life.

- Waste products generated from spill cleanup.

- The laboratory maintains detailed SOPs for Waste Management in the OP Manual, WM series OPs.

17.0 HEALTH AND SAFETY

It is the policy of Lionville Laboratory Incorporated to assure that its employees are provided a work environment in which they are secure from recognized health and safety hazards. In addition, LVLI is committed to protecting the public and the environment from potential hazards that may result from laboratory activities. To accomplish these objectives, all reasonable precautions are taken to ensure that exposures to potentially hazardous materials are maintained as low as possible for employees and members of the public. Employees conduct work activities in accordance with all applicable health and safety regulations, and corporate guidelines.

LvLI adheres to the health and safety policies as presented in SOP HS-005 "Chemical Hygiene Plan" and related supplements, as well as in the HS series of SOPs in the Standard Procedures Manual.

APPENDIX A
SOP Master Listing

LIONVILLE LABORATORY INC.

OPMAST Query Report

GROUP	OP_NUM/METHOD	REV_	MOD	OP_TITLE	EFF_DATE	comments
DM						
	DM-001	00	A	Data Reporting	05/15/2002	
	DM-002	01	B	Quality/Non Quality Records	07/24/2002	
	DM-003	00	A	Facilities Descriptions	09/05/2001	
	DM-004	00	B	Transmittals, Retrievals, and Return of Archive Boxes	05/15/2002	
	DM-006	00	A	Data Assembly/Document Control	09/05/2001	
	DM-009	00	0	Purging Data	08/21/2001	
	DM-014	00	0	Review of Subcontract Laboratory Data	08/27/2001	renamed from SR-014
	DM-015	00	A	CCS, Data Reduction, Review, and Reporting for Inorganics	09/05/2001	renamed from 21-13-015
	DM-018	00	0	Data Review Checklists	08/29/2001	
	DM-600	00	A	EDD Generation and Transfer (client and program specific transfers	05/15/2002	
GE						
	GE-0002.1	00	0	GC Preventive Maintenance Procedures	06/26/2001	
	GE-0015	00	0	Alternate Sample ID Labeling	06/26/2001	
	GE-004.2	01	0	CLP Analysis of PESTICIDES/PCBS by EPA SOW OLMO4.2 (May	03/15/2002	
	GE-0504	00	A	1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-Chloropropane (DBC	12/01/1932	
	GE-0505	00	0	Anal. of Organohalide Pest/PCBs in water by Microextr/GC	08/21/2001	
	GE-0507	00	A	Determination of N and P containing Pests in water by GC NPD	12/31/2002	
	GE-0508	00	A	Determination of Chlorinated Pesticides in Water by GC ECD	12/31/2002	
	GE-0515.1	00	A	Determination of Chlorinated Acids in Water by GC ECD	12/31/2002	
	GE-8015	00	0	Total Petroleum Hydrocarbons, (Extractable) by GC	08/27/2001	renamed from 21-16-8015
	GE-8081	00	A	Organo-Chlorine Pesticides/PCB by SW846 method 8081 & 8082	12/21/2001	

GROUP	OP_NUM/METHOD	REV_	MOD	OP_TITLE	EFF_DATE	comments
	GE-8082			GC Analysis of PCBs by SW846 Method 8082		draft
	GE-8141	00	0	Determination of N and P Containing Pesticides	07/12/2001	renamed from 21-16-8141
	GE-8151	00	A	Chlorinated Herbicides by SW846 method 8151A	05/20/2002	
GV						
	GV-0502.2	00	0	Volatile Org Compds in Water by Purge & Trap Cap Column GC	07/30/2001	
	GV-8015	00	A	Total Petroleum Hydrocarbons, (Purgeable) by GC	05/15/2002	
	GV-8021	00	0	Purgeable Halocarbons & Aromatics by Purge & Trap GC	08/27/2001	
	GV-RSK175	00	0	Non-Halogenated VOA (C1-C3) in water by GC/FID		draft
HS						
	HS-003	00	0	Non-LvLI Personnel Instructions	06/26/2001	
	HS-004	00	0	Hood Airflow Survey Procedure	07/10/2001	
	HS-005	01	0	Chemical Hygiene Plan (Laboratory Health and Safety Manual)	02/05/2002	
	HS-007	00	0	Right-to-Know Training	05/09/2001	
	HS-010	00	0	Chemical Materials Handling: Glossary of Terms	08/27/2001	
	HS-014	00	0	Laboratory Spill Response Plan	08/27/2001	
	HS-016	01	A	Preparedness, Prevention, and Contingency (PPC) Plan	01/23/2002	
	L-HS-015	00	0	Hearing Conservation Program	06/04/2001	
IS						
	IS-001	00	0	Information Systems	07/19/2001	renamed from L-IS-005
	IS-002	00	0	Computer Backup	07/19/2001	renamed from L-IS-003 a
	IS-003	00	0	QA Requirements for Software	07/19/2001	renamed from 21-11A-001
	IS-004	00	0	LIMS Routine Maintenance	07/19/2001	
	IS-005	00	0	Site Administration Manual	08/27/2001	RESTRICTED DISTRIBU

GROUP	OP_NUM/METHOD	REV_	MOD	OP_TITLE	EFF_DATE	comments
LC						
	LC-0022	00	0	Standards Documentation for HPLC	08/24/2001	
	LC-0023	00	0	Determination of Benzoic Acid, Chlorobenzoic Acids and Chlorendic		draft
	LC-0025	00	A	NG & PETN by HPLC	01/23/2002	
	LC-8310	00	0	PAH by HPLC	08/01/2001	
	LC-8330	00	0	Nitroaromatic and Nitroamines by HPLC	08/24/2001	
MB						
	MB-0002	00	0	GC/MS Preventive Maintenance	08/24/2001	
	MB-004.2	02	0	GC/MS Analysis of Semivolatile compounds Based on SOW OLMO	04/05/2002	
	MB-0525.2	00	A	Determination of Organic Compounds In Drinking Water by Liquid-S	11/27/2001	
	MB-0625	00	0	Semivolatile Organic Compounds by Cap Column GC/MS	05/15/2002	
	MB-8270C	00	A	GC/MS/BNA: Capillary Column	11/27/2001	
	MB-8280	00	A	Analysis of Polychlorinated Dibenzo-p-dioxins and Polychlorinated D	06/27/2001	
	MB-8280A	00	A	Analysis of Polychlorinated Dibenzo-p-dioxins and Polychlorinated D	06/27/2001	
ME						
	ME-0002.1	00	0	Instrument Maintenance: AA/ICP/Hg	08/07/2001	
	ME-0003.1	00	0	Instrument Calibration: AA, ICP	08/07/2001	
	ME-0007	00	0	ICP Interelement Correction (IEC) Determination	07/02/2001	
	ME-0008	00	0	Updating and Archiving ICP Data Files	08/27/2001	
	ME-0009	00	0	Determination of Quarterly Linear Ranges for the ICP	08/07/2001	
	ME-0010	00	0	Determination of Instrument Detection Limits (IDLs) for ICP/GFAA/C	08/27/2001	
	ME-0012	00	0	Verification of Metals Standard Solutions	08/27/2001	
	ME-0013	00	0	Metals Sample/Digestate Disposal	08/27/2001	
	ME-0025	00	0	Speciation of Arsenic in Natural Waters and Sediments	08/27/2001	

GROUP	OP_NUM/METHOD	REV_	MOD	OP_TITLE	EFF_DATE	comments
	ME-0200.2	00	0	Metals by Graphite Furnace Atomic Absorption	08/27/2001	
	ME-0200.3	00	0	Drinking Water Metals by Graphite Furnace AA	08/27/2001	
	ME-6000.3	00	0	TJA Polyscan 61E ICP Operation	08/27/2001	
	ME-6000.4	00	0	TJA ICAP 61E Trace Vacuum Spectrometer Operation.	08/07/2001	
	ME-7000.2	00	0	Metals PE 5100 Operation	08/27/2001	
	ME-HgCVAA	01	A	Mercury Prep/Analysis by Leeman Cold Vapor	04/05/2002	renamed from ME-7470 a
	ME-ICP	00	0	Metals by ICP	03/15/2002	renamed from ME-6010B.
MV						
	MV-003.2	00	0	GC/MS Anal. of VOA Based on EPA SOW OLM OLMO3.2 (May 99)	11/27/2001	
	MV-004.2	01	B	GC/MS Anal. of VOA Based on EPA SOW OLM OLMO4.2 (May 99)	05/16/2002	
	MV-0524.2	00	A	Volatile Organic Compounds by method 524.2	11/27/2001	
	MV-0624	01	0	Volatile Organic Compounds by EPA Method 624	05/20/2002	
	MV-8260B	01	0	GC/MS VOA by Capillary Column	05/20/2002	
PM						
	L-PM-002	00	0	Technical Profile: Dioxins/Furans Supplement	06/20/2001	renamed from 21-18L-002
	PM-001	00	B	Technical Profile	08/14/2002	renamed from L-PM-001
	PM-003	00	0	Contract Review	08/27/2001	
	PM-004	00	0	Fermco Non-Conformances/Deviations: Client Notification	08/27/2001	
	PM-005	00	0	Project Management Process	08/24/2001	
	PM-006	00	0	Quotes	08/24/2001	
	PM-007	00	0	Project Planning	08/24/2001	
	PM-008	00	0	Financial Tracking	08/24/2001	
	PM-009	00	0	Production Tracking	06/26/2001	
	PM-010	00	0	Data Submission	08/24/2001	
	PM-011	00	0	Client Follow-up	08/24/2001	

GROUP	OP_NUM/METHOD	REV_	MOD	OP_TITLE	EFF_DATE	comments
	PM-012	00	0	Production Meeting	08/24/2001	
	PM-014	00	0	Sample Subcontracting Procedure and Checklist	08/24/2001	
	PM-017	00	0	Requirements for Third Party Data Validation (Review)	08/27/2001	renamed from L-SR-017
QA						
	L-QA-005	00	0	Annual Quality Assessment Process	05/08/2001	
	L-QA-010	00	0	Duties and Responsibilities of the QA Section Manager	05/08/2001	
	QA-001	01	0	Laboratory Quality Assurance Manual	10/16/2002	
	QA-004	00	0	Standard Operating procedure (SOP) Change Protocol	08/09/2001	
	QA-006	00	0	Procurement Quality Assurance	08/27/2001	
	QA-007	00	A	Laboratory Reagent Water	03/22/2002	renamed from L-WC-0004
	QA-008	00	0	Subcontract Laboratory On-Site Audit	08/27/2001	
	QA-009	00	A	Laboratory Analyst Signature List	01/11/2002	
	QA-011	00	0	Subcontract Laboratory Qualification and Experience	08/23/2001	renamed from SR-011
	QA-100	00	A	Routine Temperature Checks	12/20/2001	
	QA-101	01	A	Thermometer Calibration, Use, and Care	12/05/2001	
	QA-102	00	A	Daily Balance Check	12/18/2001	
	QA-103	00	0	Solvent Approval	08/23/2001	
	QA-105	01	0	Corrective Action	08/14/2002	
	QA-106	00	0	Document Control	08/23/2001	
	QA-107	00	A	Laboratory Analytical Notebooks/Logbooks	08/14/2002	
	QA-112	00	0	QC Sample Storage and Ordering	08/27/2001	
	QA-114	00	0	Micropipette Calibration	09/20/2001	
	QA-115	00	A	Employee Training Procedure	01/31/2002	
	QA-118	00	0	Reqts and Prep of Bound Lab Notebks/Benchshts and Anal. Logs	08/27/2001	
	QA-121	00	0	PBA: Proficiency Tests and Management Reviews	08/27/2001	

GROUP	OP_NUM/METHOD	REV_	MOD	OP_TITLE	EFF_DATE	comments
	QA-122	01	0	Internal Audits	07/24/2002	
	QA-123	00	0	Preparation of WQAC Refrigerator Blank Samples	08/27/2001	
	QA-125	00	0	Manual Integration	08/21/2001	
	QA-126	00	0	Control of Restricted Analytical Standards	08/23/2001	
	QA-130	00	0	Laboratory Security	07/19/2001	
	QA-131	00	0	Criteria for Data Rev and Summary of Internal QC/Accept Crit	08/24/2001	
	QA-132	00	0	Laboratory Quality Control Limits and Control Charts	08/20/2001	
	QA-134	00	0	Reagent, Solution and Standard Traceability	08/23/2001	
	QA-136	00	0	Mitigation of Sample and Laboratory Contamination	09/10/2001	
	QA-139	00	A	Sample Discrepancy Report (SDR)	08/14/2002	
	QA-140	00	0	Method Validation Studies (MDL, IDL, P&A)	08/27/2001	
	QA-141	00	0	Instrument/Equipment Tag-out	08/27/2001	
	QA-147	00	0	Laboratory SOP Life Cycle	08/21/2001	
RA						
	RA-001	00	0	Determination of Gross Alpha and Gross Bets Radioactivity		DRAFT
	RA-002	00	0	Determination of Tritium in Watrt by Liquid Scintillation Counting		DRAFT
	RA-003	00	0	Planchet Cleaning	10/16/2002	
RS						
	RS-001	01	A	Radiation Safety Training Manual	08/19/2002	
	RS-101	00	A	Radioactive Sample Receipt and Log-in Procedure	01/23/2002	
	RS-102	00	0	Radiological Sample Screening Methods	08/27/2001	
	RS-104	00	0	Radioactive Materials Shipping Procedure	08/16/2001	
	RS-106	00	0	Sample Handling Protocol For Chem Anal of Rad Samples	08/14/2001	
	RS-109	00	0	Radioactive Sample Intermediate Handling and Labeling	08/14/2001	
	RS-110	00	0	Operation of the Tennelec LB5100-W	08/14/2001	

GROUP	OP_NUM/METHOD	REV_	MOD	OP_TITLE	EFF_DATE	comments
	RS-111	00	0	Radioactive Material Inventory Control	08/27/2001	
	RS-201	00	0	Radiological Survey Documentation	08/21/2001	
	RS-204	00	0	Laboratory Radioactive Waste Screening	08/14/2001	
	RS-205	00	0	Low Level Rad and Mixed Waste Handling	08/27/2001	
	RS-206	00	0	Radioactive Sample Residual Handling	08/21/2001	
	RS-301	00	0	Personal Contamination Monitoring	08/21/2001	
	RS-302	00	0	Spill Cleanup and Decontamination	08/14/2001	
	RS-303	00	0	Personal Air Samplers: Particulate Sampling and Analysis	08/14/2001	
	RS-305	00	0	Dosimetry Monitoring Program	08/27/2001	
	RS-404	00	A	a/ß Efficiency Determination for Ludlum Model 1000 Scaler	08/19/2002	
	RS-405	00	0	Source Checks for Radiation Detection Instrumentation	08/14/2001	
	RS-406	00	0	Operating Procedure for the Ludlum Model 3 Survey Meter	08/14/2001	
	RS-407	00	0	Operating Procedure for the Ludlum Model 19 Micro-R Meter	08/14/2001	
SPI						
	L-SPI-0001	00	0	Inorganic Glassware Cleaning	05/21/2001	renamed from L-WC-0001
	L-SPI-200.7	00	0	Metal Digestion: Drinking Water by GFAA/ICP/AA	05/14/2001	renamed from 21-15L-302
	L-SPI-3020	00	0	Metal Digestion for Aqueous Samples by GFAA/ICP/FLAA using CL	06/05/2001	renamed from 21-15L-302
	L-SPO-0001	00	0	Organic Glassware Cleaning (includes VOA Vessels)	05/21/2001	renamed from L-SP-0001
	SPI-1311.1	01	0	TCLP Non-Volatile	08/20/2002	
	SPI-1311.2	01	0	TCLP ZHE for Volatiles	08/20/2002	
	SPI-3000.4	00	0	Metals Digestion: Spiking Protocol	08/21/2001	
	SPI-3050	00	0	Metals Digestion: Soil Samples	07/27/2001	renamed from 21-15L-305
SPO						
	SPO-0006	00	A	Spike and Surrogate Preparation and Criterion Check	12/07/2001	renamed from 21-16L-000
	SPO-0011	00	0	Tuning of the Extraction Sonicators	07/02/2001	

GROUP	OP_NUM/METHOD	REV_	MOD	OP_TITLE	EFF_DATE	comments
	SPO-3510C	00	A	Separatory Funnel Extraction: Method 3510C	10/22/2001	
	SPO-3520C	00	B	Continuous Liquid-Liquid Extraction Method 3520C	03/25/2002	
	SPO-3540	00	0	Soxhelet Extraction by SW846 Method 3540C	07/30/2001	
	SPO-3550	00	0	Sonication Extraction for Extractables	07/02/2001	
	SPO-3580	00	0	Waste Dilution for Semivolatiles (BNA)	08/21/2001	
	SPO-3620	00	0	Florisil Clean-up Method 3620B	07/19/2001	
	SPO-3640	01	0	GPC Cleanup	03/15/2002	renamed from 21-16-3640
	SPO-3660	00	0	Sulfur Cleanup	03/15/2002	
	SPO-3665	00	0	Sulfuric Acid/Permanganate Cleanup	07/30/2001	
	SPO-5035	00	0	VOA soil prep by SW846 method 5035	08/21/2001	
	SPO-8151	00	A	Chlorinated Herbicide Extraction by SW846 method 8151A	05/16/2002	
	SPO-8280	00	A	Polychlorinated Dibenzo-p-dioxin and Polychlorinated Dibenzofuran	06/27/2001	renamed from 21-16L350
	SPO-8280A	00	A	PCDD and PCDF Extraction and Cleanup by 8280A	06/27/2001	
SR						
	SR-001	00	0	Bottle Orders: Preparation/Shipping	08/27/2001	
	SR-001.1	00	0	Preparing Solution for Preserving Sample Bottles	09/10/2001	
	SR-002	00	A	Sample Receipt & Log In	04/15/2002	
	SR-002.1	00	A	Verification of pH Preservation Upon Sample Receipt	05/14/2002	
	SR-002.2	00	0	Residual Chlorine in Drinking Water Samples	09/23/2002	
	SR-004	00	0	Custody Transfer Record/Lab Work Request Instructions	08/28/2001	
	SR-006	00	0	Trip Blank Preparation & Approval	09/10/2001	
	SR-009	00	A	Internal Tracking of Env. Samples,Extracts, and Digestates	12/12/2001	
	SR-010	00	0	Use and Care of the Infrared Thermometer	08/23/2001	
WC						
	L-WC-0375.4	00	0	Sulfate (Turbidimetric)	05/11/2001	renamed from 21-15-0375

GROUP	OP_NUM/METHOD	REV_	MOD	OP_TITLE	EFF_DATE	comments
	WC-0002	00	0	Instrument Maintenance: Wet Chemistry	08/14/2001	
	WC-0016	00	0	Wet Chemistry Standards Preparation Frequency	09/10/2001	
	WC-0017	00	0	Use Maintenance and Calibration of Dissolved Oxygen Meter	08/27/2001	
	WC-0021	00	0	Hydrazine Analysis	08/27/2001	
	WC-0051	00	0	Heat of Combustion, BTU (Bomb Method)	08/27/2001	renamed from 21-15-0051
	WC-0054	00	0	Chlorine in Solids: Oxygen Bomb Method	08/27/2001	renamed from 21-15-0054
	WC-0055	00	0	Formate and Acetate by Ion Chromatography	08/27/2001	
	WC-0120.1	00	0	Specific Conductance	07/31/2001	
	WC-0130.2	00	0	Hardness (EDTA Titrimetric Method)	08/27/2001	renamed from 21-15L-013
	WC-0150.1	00	0	pH by Electrometric Measurement (Aqueous Matrix)	08/27/2001	
	WC-0160.1	00	0	Total Dissolved Solids	07/10/2001	renamed from 21-15L-016
	WC-0160.2	00	A	Total Suspended Solids	05/16/2002	renamed from 21-15-0160
	WC-0160.3	00	0	Total Solids	08/20/2001	renamed from 21-15-0160
	WC-0160.4	00	0	Volatile and Fixed Solids	08/16/2001	renamed from 21-15-0160
	WC-0160.5	00	0	Setteable Solids by Imhoff Cone	08/20/2001	
	WC-0160.6	00	0	% Solids, % Moisture, % Ash, & % Volatile Solid Detemination	08/24/2001	
	WC-0300.0	00	A	Inorganic Anions in Water by Ion Chromatography	12/12/2001	
	WC-0305.1	00	0	Acidity (Titrimetric)	08/20/2001	renamed from 21-15-305.
	WC-0310.1	00	0	Total, Hydroxide, Carbonate, and Bicarbonate Alkalinity	07/10/2001	
	WC-0325.2	00	0	Chloride by Automated Ferricyanide using the Lachat QuikChem AE	07/12/2001	renamed from 21-15L-032
	WC-0330.5	00	0	Total Chlorine Residual (Colorimetric)	07/31/2001	renamed from 21-15L-330
	WC-0335.2	00	A	Cyanide, Total and Amenable	10/04/2001	
	WC-0340.2	00	0	Fluoride by ISE (ION-Specific Electrode)	08/27/2001	renamed from 21-15L-034
	WC-0350.3	00	0	Nitrogen, Ammonia (Potentiometric, ISE)	08/27/2001	renamed from 21-15-0350
	WC-0351.4	00	A	Total Kjeldahl Nitrogen (TKN)	02/25/2002	

GROUP	OP_NUM/METHOD	REV_	MOD	OP_TITLE	EFF_DATE	comments
	WC-0353.2D	00	0	Nitrate-Nitrite by Automated Cadmium Reduction in Drinking Water		DRAFT
	WC-0353.2M	00	0	NO3-NO2 Auto Cd Reduct using the Lachat QuikChem AE Anal	07/27/2001	renamed from L-WC-0353
	WC-0365.2	00	0	Phosphate-Phosphorus	08/24/2001	
	WC-0370.1	00	0	Silica, Dissolved	08/21/2001	renamed from 21-15-0370
	WC-0377.1	00	0	Sulfite (Titrimetric Iodine)	08/16/2001	renamed from 21-16-0377
	WC-0405.1	00	0	Biochemical Oxygen Demand, 5-Day	08/28/2001	renamed from 21-15-0405
	WC-0410.5	00	0	Chemical Oxygen Demand (Titrimetric) (410.2 or 410.5?)	08/24/2001	
	WC-0413.1	00	0	Oil & Grease (Gravimetric)	07/10/2001	
	WC-0413.2	00	0	Oil & Grease, Total Recoverable for Water Samples (Spectrophotom	08/20/2001	renamed from 21-15-0413
	WC-0415.1	00	0	TC, TOC, DOC, and TIC in Water by Dohrmand D-80 Total Carbon	07/10/2001	renamed from 21-15L-041
	WC-0415.2	00	0	Total Organic/Inorganic Carbon in Soil Sludge and Sediment	08/24/2001	
	WC-0418.1	00	0	Total Recoverable Petroleum Hydrocarbons and Oil/Grease by Infrar	08/24/2001	
	WC-0420.2	00	0	Automated Determination of Phenolics by 4-AAP (Lachat Quikchem	09/10/2001	rename from 21-15L-0420
	WC-0425.1	00	0	MBAS (Colorimetric)	08/27/2001	changed from 21-15-0425
	WC-1010.1	00	0	Flash Point (Pensky-Martens Closed Cup)	08/24/2001	
	WC-1110.1	00	0	Corrosivity by Coupon	08/27/2001	renamed from 21-15-1110
	WC-1664	00	0	N-Hexane Extractable Material (HEM and SGT-HEM); Oil and Greas	04/19/2002	
	WC-7.3.3.2	00	0	Test Method for Determination of Reactive Cyanide	07/30/2001	renamed from 21-15-9010
	WC-7.3.4.2	00	0	Test Method for Determination of Reacting Sulfide	07/31/2001	renamed from 21-15L-903
	WC-7196	00	0	Hexavalent Chromium (Colorimetric)	08/09/2001	
	WC-9020B	01	0	Total Organic Halides (TOX)	06/24/2002	renamed from WC-9020.2
	WC-9030.1	00	A	Sulfide (Titrimetric)	12/13/2001	renamed from 21-15L-903
	WC-9041	00	0	pH (pH Paper Method)	08/24/2001	
	WC-9045	00	0	Corrosivity by pH (Solids)	07/31/2001	
	WC-9071	00	0	TRPH and Oil/Grease by IR: Preparation for Solid Samples	07/31/2001	

GROUP	OP_NUM/METHOD	REV_	MOD	OP_TITLE	EFF_DATE	comments
	WC-9095A	00	0	Paint Filter Test for Determination of Free Liquid	08/24/2001	
WM						
	WM-001	00	0	Hazardous Waste Management	06/26/2001	
	WM-002	00	0	Hazardous Waste Segregation	07/10/2001	
	WM-003	00	0	Hazardous Waste Personnel Training	08/14/2001	
	WM-006	00	0	Waste Analysis Plan	08/22/2001	
	WM-008	00	0	Waste Management Tracking	07/10/2001	
	WM-009	01	A	Container Disposal	02/11/2002	
	WM-011	00	A	Satellite Accumulation Area Requirements	12/12/2001	

APPENDIX B
Instrument List

LIONVILLE LABORATORY INC.

LIONVILLE LABORATORY INCORPORATED
LABORATORY ANALYTICAL INSTRUMENTATION AVAILABILITY

Type and Model	Quantity
Gas Chromatograph/Mass Spectrophotometers/Data Systems	8
• Hewlett-Packard MSD/5970: Mass Selective Detector; Model 5890 gas chromatograph; equipped with capillary column; with DOS Chem Station Data System - Purchased in 1996	1
Instrument ID: K; S/N 2960A12031 (EPA 524)	
Instrument ID: X; S/N 2923A12171 (EPA 524)	
• Hewlett-Packard MSD/5971: Mass Selective Detector; Model 5890 gas chromatograph; DOS ChemStation G1034C version C.01.05 data system, Enviroquan Software; capillary column injector; H.P. Model 7673 autosampler; 75K NBS library - Purchased 1991	1
Instrument ID: A; S/N 3118A02692 (EPA 525)	
• Hewlett-Packard MSD/5972: Mass Selective Detector; Model 5890 gas chromatograph; DOS ChemStation G1034C version C.01.05 data system, Enviroquan Software; capillary column injector; H.P. Model 7673 autosampler; 75K NBS library - Purchased 1993, 1994	4
Instrument ID: C; S/N 3307A00293 (EPA 524) Instrument ID: H; S/N 3329A00557 (EPA 524)	
Instrument ID: D; S/N 3329A00689 (EPA 525)	
• Hewlett-Packard MSD/5972: Mass Selective Detector; Model 6890 gas chromatograph; DOS ChemStation G1034C version C.01.05 data system, capillary column injector; H.P. Model 7673 autosampler; 75K NBS library - Purchased 1995, 1996	2
Instrument ID: E; S/N 3524A03060 (EPA 524)	
Instrument ID: N; S/N 3524A03032 (EPA 524)	
• Hewlett-Packard MSD/5973N: Mass Selective Detector; Model 6890 gas chromatograph; DOS ChemStation G1034C version C.01.05 data system, capillary column injector; H.P. Model 7673 autosampler; 75K NBS library - Purchased 2001	5
Instrument ID: G; S/N US10461225 (EPA 524)	
Instrument ID: J; S/N US10461239 (EPA 524)	
Tekmar Purge and Trap (located in GC/MS):	1
	4
• LSC 2000 concentrator, with ALS 2016 autosampler; S/N 91317005	2
• LSC 3000 concentrator, with ALS 2016 autosampler; S/N 95272009 (ID# N); 94057004 (ID # X); 9530214 (ID# H); 93209002 (ID# C)	
• Varian Archon Purge & Trap Autosampler; S/N 122516; 12253	2
Gas Chromatographs and Detectors	
GC instrument descriptions listed below list specific instrument/detector information.	16
• Hewlett-Packard Model 5890A: ID = GC H, configured for VOA- Purchased in 1983;	1
• Hewlett-Packard Model 5890 Series II: ID = GC 14/GC 15 - Purchased in 1991;	6
ID = GC13/GC17/GC20 - Purchased in 1989; ID = GC J. configured for VOA - Obtained from Field Lab 1993	
Instrument ID: GC13; S/N 2413A05621 (EPA 504, 505) Instrument ID: GC17; S/N 2750A17875 (EPA 508)	
Instrument ID: GC14; S/N 3203A40316 Instrument ID: GC20; S/N 2750A18142 (EPA 508)	
Instrument ID: GC18: S/N 2950A27675	
• Hewlett-Packard Model 5890 Series II: ID = GC F. configured for VOA: Purchased rental	1
• Hewlett-Packard Model 5890A: ID = GC 22 - Purchased in 1991 (acquired from Stockton, CA Lab in 1995)	1
• Hewlett-Packard Model 5890A: - (acquired from STL in 1999) NPD & FPD detectors	

LIONVILLE LABORATORY INCORPORATED
LABORATORY ANALYTICAL INSTRUMENTATION AVAILABILITY

Type and Model	Quantity
Instrument ID: S/N2643A11022	
• Varian 3400: ID = GC E, configured for VOA - Obtained from Field Lab 1993 (used); ID = GCD, configured for VOA - Obtained from Field Lab 1994 (used)	2
• Varian 6000: ID = GC G, configured for VOA - Obtained September 1992 (acquired from Stockton, CA Lab); ID = none - Obtained from Field Lab 1993	2
• Carlo-Erba Model 5300 Mega Series, temperature programmed, with autosampler - Purchased in 1986 S/N 205346	1
• Fisons GC 8000, with autosampler: ID = none - Leased in 1993. S/N 269934 (EPA 507)	1
The autosamplers listed below are available to be connected to one of the above GC instruments.	9
• Model 7673A/B autosampler for continuous sample analysis	9
The GC laboratory is equipped with one or more of the following detectors, installed as indicated above or as backup spares:	34
• Electron Capture Detector (ECD)	16
• Flame Ionization Detector (FID)	5
• Nitrogen/Phosphorous Detector (NPD)	3
• Photoionization Detector (PID)	6
• Hall, Electrolytic Conductivity Detector (HECD)	5
Purge and Traps (located in GC	7
• Tekmar LSC 2 concentrator, with ALS 10 autosampler	2
• Tekmar LSC 2000 concentrator, with ALS 2016 autosampler	2
• Tekmar LSC 2000 concentrator, with ALS 2016 autosampler and heater	1
• Tekmar LSC 3000 concentrator, with ALS 2016 autosampler and heater	1
• O.I. 4560 concentrator, with DPM-16 multisampler and heater	1
• O.I. 4560 concentrator, with DPM-16 multisampler and heater	
• O.I. 4560 concentrator, with DPM-16 multisampler and heater	
High Pressure Liquid Chromatograph	3
• Hewlett Packard 1050 HPLC equipped with HP autosampler and HP UV detector and HP fluorescence detector. Purchased in 1991	1
• Hewlett Packard 1050 HPLC equipped with HP autosampler and HP photodiode array UV detector. Purchased in 1994	1
• Hewlett Packard 1050 HPLC equipped with HP autosampler and HP UV detector and HP fluorescence detector. Obtained from STL 1999.	1
S/Ns: 3141A01115 (autosampler); 3405A02694 (pump); 3114A00267 (heater)	
Registration Number for HPLCs: G2180AA, G2170AA, G2171AA	
Atomic Absorption/Mercury Apparatus	4
• Perkin-Elmer Model 5100 graphite furnace AA and Zeeman background correction, autosampler - Purchased in 1990. S/N 140425 (SM 3113B, EPA 200.9)	1
• Perkin-Elmer Model 5100ZL graphite furnace AA with Zeeman background correction, autosampler - Purchased in 1992 (in storage) (N/A)	
• Leeman Labs Model PS200 Mercury Analyzer with autosampler - Instrument ID: HG1; S/N 1014A Purchased in 1991. Instrument ID: HG2; S/N 4016 Purchased 1994 (EPA 245.1)	2

LIONVILLE LABORATORY INCORPORATED
LABORATORY ANALYTICAL INSTRUMENTATION AVAILABILITY

Type and Model	Quantity
Inductively Coupled Plasma - Analyzers	2
• Thermo Jarrell Ash Enviro II Polyscan ICAP with host computer and auto sampler - Purchased in 1991	1
S/N: 67190 (EPA 200.7)	
• Thermo Jarrell Ash ICAP 61E Trace Analyzer with data system and random access autosampler - purchased 10/94 (EPA 200.7)	1
S/N: 325490	
Automatic Analyzer	1
• LACHAT QUIKCHEM AE - With auto diluter, autosampler, PC and printer - Purchased March 1992	1
S/N: 2000-D411 (EPA 353.2)	
Ion Chromatograph	2
• Dionex Model 2020i - Purchased in 1984, upgraded with 1989 interface, 286 computer and software	1
S/N: 842032 (EPA 300.0)	
• Waters ActION Analyzer with Model 431 detector and Model 717 autosampler with 386 computer/printer - Purchased 1992 (In storage)	1
Organic, Inorganic and Total Carbon Analyzers	2
• Dohrmann Envirotech Analyzer Model DC-80 - Purchased in 1984, 1988 (1 model with combustion furnace)	2
Total Organic Halide Analyzer	3
• Mitsubishi TOX 10E - Purchased in June 1992	
Spectrophotometers	3
• Perkin Elmer Lambda 3 - Purchased in 1983, 1991 (SM 4500CN-E)	2
• Leeman Labs Automated Cyanide Analyzer - Purchased 06/94 (In storage)	1
pH/ Ion Analyzer - Purchased in 1978	2
• Orion Model 901 pH/ion meter with Model 658 switch and various specific ion electrodes. S/N 98627	2
• Orion Model 520A pH/ion meter. S/N 008443 (SM 4500F-C)	
• Corning Model 425 pH/ion meter. S/N 07760 (SM 4500F-C) purchased 2002	1
Balances	22
• Analytical Balance, various makes, purchased various time	11
• Top-loader Balance, various makes	11
TCLP Tumblers and Zero Headspace Extractors	4 and 18
• Lars Lande, 10 compartments with Dayton split phase gear motor. Purchased January 1990 (Tumbler #1 & #2) and October 1990 (Tumbler #3 & #4	4
• Zero Headspace Extractors (ZHE) - Environmental Express. Purchased October 1990.	18
Distillation Apparatus	2
• Andrews 10 station midi distillation. Purchased 1993 (In storage)	1
• Leeman cyanide midi distillation AP1214. Purchased 1994 (In storage)	1
Liquid Scintillation Counter: Tritium	1
• Wallac Model 1414 low level liquid scintillation counter with alpha/beta separation. Purchased 1996 (Serial No. 4140087)	1
Gas Flow Proportional Counter (Gross Alpha/Beta)	
• Tennelec LB 5100W	1

LIONVILLE LABORATORY INCORPORATED
LABORATORY ANALYTICAL INSTRUMENTATION AVAILABILITY

Type and Model	Quantity
Radiation Detection Instrumentation	32
• Ludlum Model 3 with Model 44-9 Pancake GM Probe	17
• Ludlum Model 19 Micro-R meter	3
• Ludlum Model 177 with Model 44-9 Pancake GM Probe	7
• Ludlum Model 1000 Scaler with 44-9 miscellaneous probes: 1 Alpha 43-2, 1 Alpha 43-9; 1Beta 44-1	2
• Ludlum Model 3 Personnel Contamination Meter with Model 43-5 Alpha Scintillation Probe	3
• Tennelec LB 5100W	
Gel-Permeation Cleanup Apparatus	3
• Waters Model #s717/600/486/610 with Enviro gel cleanup columns. ID: GPC#4. Purchased 1995. S/N MX5HM8022M	1
• ABC Model 1002B. ID: GPC #3. Purchased 1991.	1
• ABC Model AS2000. ID: GPC #5.	1
Sonicators	6
• Tekmar Sonic Disruptors with appropriate and various horns and tips purchased at various times from 1988 to the present.	6
Blowdown Apparatus	1
• N-EVAP Organomation Analytical Evaporator. Model 115; ID: L234. Purchased 1994. S/N 8395	1

BALANCE MANUFACTURER AND LOCATION
A = Analytical Balance T= Topload Balance
Annual Calibration Certification due in August

ID #	MANUFACTURER	SERIAL #	MODEL #	TYPE	LOCATION	LOG BOOK #
B-1	Mettler	B85696	AE163	A	GC VOA	8848
B-2	Sartorius	40050015	LC520D	A	HPLC	8833
B-4	Mettler	G01878	AE200	A	Rad Screen	8834
B-5	Mettler	H78476	PM460	T	Wet Lab	8835
B-6	Mettler	F78009	PM460	T	Wet Lab	8836
B-7	Mettler	P37496	PB302	T	Log-In (not in use)	8837
B-8	Mettler	G29234	AE200	A	OSPU	8838
B-9	Mettler	J19245	PJ360	T	OSPU	8839
B-14	Mettler	H31127	AE240	A	Metals	8840
B-15	Mettler	J48724	BB300	T	Rad Screen	8841
B-20	Mettler	L81199	AE260	A	Met Dig/Hg Room	8842
B-23	Mettler	H07844	PJ3000	T	OSPU	8843
B-29	Mettler	N36951	AE260	A	Hg Room	8844
B-30	Mettler	N71508	PB302	T	MS VOA	8845
B-31	Sartorius	50509217	BP210D	A	Wet Chem	8846
B-32	Mettler	K27359	AE100	A	TOC & TOX Room	8847
B-33	Mettler	**Tagged out**	PM4000	T	TCLP	N/A

S CLASS WEIGHT SET ID #	MANUFACTURER	LOCATION / ANNUAL CALIBRATION DATE	
WQAC-9805-WT100	Troemner	OSPU	9/10
WQAC-9606-WT101	Troemner	GC/MS VOA	October
WQAC-9606-WT102	Troemner	Wet Chemistry	October
WQAC-9805-WT103	Troemner	GC VOA	9/10
WQAC-9606-WT104	Troemner	HPLC	October
WQAC-9606-WT105	Troemner	Wet Chemistry	October
WQAC-9606-WT106	Troemner	Rad Screen	October
WQAC-9805-WT107	Troemner	Met Dig/Hg Room	9/10
WQAC-9805-WT108	Troemner	Hg Room	9/10
WQAC-9806-WT110	Troemner	QA (full set, not in use)	
WQAC-31147	Troemner	QA (full set, not in use)	

APPENDIX C
NELAC Accredited Methods and Analytes

VLI
LIONVILLE LABORATORY INC.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

OFFICE OF MANAGEMENT AND TECHNICAL SERVICES

BUREAU OF LABORATORIES

Certifies that

LIONVILLE LABORATORIES INC
208 WELSH POOL RD
LIONVILLE, PA 19341-1313
15-009

Having duly met the requirements of
Chapter 109, Subchapter H: Safe Drinking Water Rules and Regulations
Issued under the Pennsylvania Safe Drinking Water Act of May 1, 1984
(P.L. 206, No. 43), (35 P.S. §§ 721.1 - 721.17) and the National Environmental
Laboratory Accreditation Conference Standards
is hereby approved as an

Accredited Laboratory

As more fully described in the attached Scope of Accreditation

Expiration Date: January 24, 2003

Roger H. Carlson, PhD, Director
Bureau of Laboratories

1500-FM-LA80007 1/2001

Certificate not transferable
Surrender upon revocation
To Be Conspicuously Displayed at the Laboratory
Not valid unless accompanied by a valid Scope of Accreditation
Shall not be used to imply endorsement by the Commonwealth of Pennsylvania

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

LabID	Organization	Phone	City	State
9	Lionville Laboratory Incorporated	(610)280-3000	Lionville	PA

SDWA Certification

Method Code	Method	Analyte	Status	Type	AA
1061	EPA 150.1	pH	Accredited	NELAP	PA
1066	EPA 200.7	ARSENIC	Accredited	NELAP	PA
1066	EPA 200.7	BARIUM	Accredited	NELAP	PA
1066	EPA 200.7	BERYLLIUM	Accredited	NELAP	PA
1066	EPA 200.7	CADMIUM	Accredited	NELAP	PA
1066	EPA 200.7	CALCIUM	Accredited	NELAP	PA
1066	EPA 200.7	CHROMIUM	Accredited	NELAP	PA
1066	EPA 200.7	COPPER	Accredited	NELAP	PA
1066	EPA 200.7	NICKEL	Accredited	NELAP	PA
1066	EPA 200.7	SILVER	Accredited	NELAP	PA
1066	EPA 200.7	SODIUM	Accredited	NELAP	PA
1068	EPA 200.9	THALLIUM	Accredited	NELAP	PA
1078	EPA 245.1	MERCURY	Accredited	NELAP	PA
1084	EPA 300.0	SULFATE	Accredited	NELAP	PA
1094	EPA 353.2	NITRATE calc.	Accredited	NELAP	PA
1094	EPA 353.2	NITRITE	Accredited	NELAP	PA
1106	EPA 502.2	1,1,1,2-TETRACHLOROETHANE	Accredited	NELAP	PA
1106	EPA 502.2	1,1,1-TRICHLOROETHANE	Accredited	NELAP	PA
1106	EPA 502.2	1,1,2,2-TETRACHLOROETHANE	Accredited	NELAP	PA
1106	EPA 502.2	1,1,2-TRICHLOROETHANE	Accredited	NELAP	PA
1106	EPA 502.2	1,1-DICHLOROETHANE	Accredited	NELAP	PA
1106	EPA 502.2	1,1-DICHLOROETHENE	Accredited	NELAP	PA
1106	EPA 502.2	1,1-DICHLOROPROPENE	Accredited	NELAP	PA
1106	EPA 502.2	1,2,3-TRICHLOROPROPANE	Accredited	NELAP	PA
1106	EPA 502.2	1,2,4-TRICHLOROEENZENE	Accredited	NELAP	PA
1106	EPA 502.2	1,2-DICHLOROBENZENE	Accredited	NELAP	PA
1106	EPA 502.2	1,2-DICHLOROETHANE	Accredited	NELAP	PA
1106	EPA 502.2	1,2-DICHLOROPROPANE	Accredited	NELAP	PA
1106	EPA 502.2	1,3-DICHLOROBENZENE	Accredited	NELAP	PA
1106	EPA 502.2	1,3-DICHLOROPROPANE	Accredited	NELAP	PA
1106	EPA 502.2	1,4-DICHLOROBENZENE	Accredited	NELAP	PA
1106	EPA 502.2	2,2-DICHLOROPROPANE	Accredited	NELAP	PA
1106	EPA 502.2	2-CHLOROTOLUENE	Accredited	NELAP	PA
1106	EPA 502.2	4-CHLOROTOLUENE	Accredited	NELAP	PA
1106	EPA 502.2	BENZENE	Accredited	NELAP	PA
1106	EPA 502.2	BROMOBENZENE	Accredited	NELAP	PA
1106	EPA 502.2	BROMODICHLOROMETHANE	Accredited	NELAP	PA
1106	EPA 502.2	BROMOFORM	Accredited	NELAP	PA
1106	EPA 502.2	BROMOMETHANE	Accredited	NELAP	PA
1106	EPA 502.2	CARBON TETRACHLORIDE	Accredited	NELAP	PA
1106	EPA 502.2	CHLOROBENZENE	Accredited	NELAP	PA
1106	EPA 502.2	CHLOROETHANE	Accredited	NELAP	PA
1106	EPA 502.2	CHLOROFORM	Accredited	NELAP	PA
1106	EPA 502.2	CHLOROMETHANE	Accredited	NELAP	PA
1106	EPA 502.2	cis-1,2-DICHLOROETHENE	Accredited	NELAP	PA
1106	EPA 502.2	cis-1,3-DICHLOROPROPENE	Accredited	NELAP	PA
1106	EPA 502.2	DIBROMOCHLOROMETHANE	Accredited	NELAP	PA
1106	EPA 502.2	DIBROMOMETHANE	Accredited	NELAP	PA
1106	EPA 502.2	DICHLOROMETHANE	Accredited	NELAP	PA
1106	EPA 502.2	ETHYLBENZENE	Accredited	NELAP	PA

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LabID	Organization	Phone	City	State
9	Lionville Laboratory Incorporated	(610)280-3000	Lionville	PA

SDWA Certification

Method Code	Method	Analyte	Status	Type	AA
1106	EPA 502.2	STYRENE	Accredited	NELAP	PA
1106	EPA 502.2	TETRACHLOROETHENE	Accredited	NELAP	PA
1106	EPA 502.2	TOLUENE	Accredited	NELAP	PA
1106	EPA 502.2	TOTAL TRIHALOMETHANES	Accredited	NELAP	PA
1106	EPA 502.2	TOTAL XYLENES	Accredited	NELAP	PA
1106	EPA 502.2	trans-1,2-DICHLOROETHENE	Accredited	NELAP	PA
1106	EPA 502.2	trans-1,3-DICHLOROPROPENE	Accredited	NELAP	PA
1106	EPA 502.2	TRICHLOROETHENE	Accredited	NELAP	PA
1106	EPA 502.2	VINYL CHLORIDE	Accredited	NELAP	PA
1108	EPA 504.1	1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	Accredited	NELAP	PA
1108	EPA 504.1	1,2-DIBROMOETHANE (EDB)	Accredited	NELAP	PA
1111	EPA 507	ALACHLOR	Accredited	NELAP	PA
1111	EPA 507	ATRAZINE	Accredited	NELAP	PA
1111	EPA 507	BUTACHLOR	Accredited	NELAP	PA
1111	EPA 507	METOLACHLOR	Accredited	NELAP	PA
1111	EPA 507	METRIBUZIN	Accredited	NELAP	PA
1111	EPA 507	SIMAZINE	Accredited	NELAP	PA
1112	EPA 508	ALDRIN	Accredited	NELAP	PA
1112	EPA 508	CHLORDANE (alpha & gamma)	Accredited	NELAP	PA
1112	EPA 508	DIELDRIN	Accredited	NELAP	PA
1112	EPA 508	ENDRIN	Accredited	NELAP	PA
1112	EPA 508	HEPTACHLOR	Accredited	NELAP	PA
1112	EPA 508	HEPTACHLOR EPOXIDE	Accredited	NELAP	PA
1112	EPA 508	HEXACHLOROBENZENE	Accredited	NELAP	PA
1112	EPA 508	HEXACHLOROCYCLOPENTADIENE	Accredited	NELAP	PA
1112	EPA 508	LINDANE	Accredited	NELAP	PA
1112	EPA 508	METHOXYCHLOR	Accredited	NELAP	PA
1112	EPA 508	PROPACHLOR	Accredited	NELAP	PA
1112	EPA 508	TOXAPHENE	Accredited	NELAP	PA
1116	EPA 515.1	2,4,5-TP (SILVEX)	Accredited	NELAP	PA
1116	EPA 515.1	2,4-D	Accredited	NELAP	PA
1116	EPA 515.1	DALAPON	Accredited	NELAP	PA
1116	EPA 515.1	DICAMBA	Accredited	NELAP	PA
1116	EPA 515.1	DINOSEB	Accredited	NELAP	PA
1116	EPA 515.1	PENTACHLOROPHENOL	Accredited	NELAP	PA
1116	EPA 515.1	PICLORAM	Accredited	NELAP	PA
1119	EPA 524.2	1,1,1,2-TETRACHLOROETHANE	Accredited	NELAP	PA
1119	EPA 524.2	1,1,1-TRICHLOROETHANE	Accredited	NELAP	PA
1119	EPA 524.2	1,1,2,2-TETRACHLOROETHANE	Accredited	NELAP	PA
1119	EPA 524.2	1,1,2-TRICHLOROETHANE	Accredited	NELAP	PA
1119	EPA 524.2	1,1-DICHLOROETHANE	Accredited	NELAP	PA
1119	EPA 524.2	1,1-DICHLOROETHENE	Accredited	NELAP	PA
1119	EPA 524.2	1,1-DICHLOROPROPENE	Accredited	NELAP	PA
1119	EPA 524.2	1,2,3-TRICHLOROPROPANE	Accredited	NELAP	PA
1119	EPA 524.2	1,2,4-TRICHLOROBENZENE	Accredited	NELAP	PA
1119	EPA 524.2	1,2-DICHLOROBENZENE	Accredited	NELAP	PA
1119	EPA 524.2	1,2-DICHLOROETHANE	Accredited	NELAP	PA
1119	EPA 524.2	1,2-DICHLOROPROPANE	Accredited	NELAP	PA
1119	EPA 524.2	1,3-DICHLOROBENZENE	Accredited	NELAP	PA
1119	EPA 524.2	1,3-DICHLOROPROPANE	Accredited	NELAP	PA

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Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

LabID	Organization	Phone	City	State
9	Lionville Laboratory Incorporated	(610)280-3000	Lionville	PA

SDWA Certification

Method Code	Method	Analyte	Status	Type	AA
1119	EPA 524.2	1,4-DICHLOROBENZENE	Accredited	NELAP	PA
1119	EPA 524.2	2,2-DICHLOROPROPANE	Accredited	NELAP	PA
1119	EPA 524.2	2-CHLOROTOLUENE	Accredited	NELAP	PA
1119	EPA 524.2	4-CHLOROTOLUENE	Accredited	NELAP	PA
1119	EPA 524.2	BENZENE	Accredited	NELAP	PA
1119	EPA 524.2	BROMOBENZENE	Accredited	NELAP	PA
1119	EPA 524.2	BROMODICHLOROMETHANE	Accredited	NELAP	PA
1119	EPA 524.2	BROMOFORM	Accredited	NELAP	PA
1119	EPA 524.2	BROMOMETHANE	Accredited	NELAP	PA
1119	EPA 524.2	CARBON TETRACHLORIDE	Accredited	NELAP	PA
1119	EPA 524.2	CHLOROBENZENE	Accredited	NELAP	PA
1119	EPA 524.2	CHLOROETHANE	Accredited	NELAP	PA
1119	EPA 524.2	CHLOROFORM	Accredited	NELAP	PA
1119	EPA 524.2	CHLOROMETHANE	Accredited	NELAP	PA
1119	EPA 524.2	cis-1,2-DICHLOROETHENE	Accredited	NELAP	PA
1119	EPA 524.2	cis-1,3-DICHLOROPROPENE	Accredited	NELAP	PA
1119	EPA 524.2	DIBROMOCHLOROMETHANE	Accredited	NELAP	PA
1119	EPA 524.2	DIBROMOMETHANE	Accredited	NELAP	PA
1119	EPA 524.2	DICHLOROMETHANE	Accredited	NELAP	PA
1119	EPA 524.2	ETHYLBENZENE	Accredited	NELAP	PA
1119	EPA 524.2	STYRENE	Accredited	NELAP	PA
1119	EPA 524.2	TETRACHLOROETHENE	Accredited	NELAP	PA
1119	EPA 524.2	TOLUENE	Accredited	NELAP	PA
1119	EPA 524.2	TOTAL TRIHALOMETHANES	Accredited	NELAP	PA
1119	EPA 524.2	TOTAL XYLENES	Accredited	NELAP	PA
1119	EPA 524.2	trans-1,2-DICHLOROETHENE	Accredited	NELAP	PA
1119	EPA 524.2	trans-1,3-DICHLOROPROPENE	Accredited	NELAP	PA
1119	EPA 524.2	TRICHLOROETHENE	Accredited	NELAP	PA
1119	EPA 524.2	VINYL CHLORIDE	Accredited	NELAP	PA
1121	EPA 525.2	BENZO(a)PYRENE	Accredited	NELAP	PA
1121	EPA 525.2	BIS(2-ETHYLHEXYL) ADIPATE	Accredited	NELAP	PA
1121	EPA 525.2	BIS(2-ETHYLHEXYL) PHTHALATE	Accredited	NELAP	PA
1202	SM2320B	ALKALINITY	Accredited	NELAP	PA
1207	SM2540C	TOTAL DISSOLVED SOLIDS	Accredited	NELAP	PA
1212	SM3113B	ANTIMONY	Accredited	NELAP	PA
1212	SM3113B	LEAD	Accredited	NELAP	PA
1212	SM3113B	SELENIUM	Accredited	NELAP	PA
1233	SM4500CN- E	TOTAL CYANIDE	Accredited	NELAP	PA
1237	SM4500F- C	FLUORIDE	Accredited	NELAP	PA

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FLORIDA DEPARTMENT OF HEALTH

State of Florida
Department of Health, Bureau of Laboratories
This is to certify that

E87813
Lionville Laboratory Inc.
208 Welsh Pool Road
Lionville, PA 19341

has complied with Florida Administrative Code 64E-1, for the examination of Environmental samples in the following categories:

SDWA - Group I Unregulated Contaminants,Group II Unregulated Contaminants,Other Regulated Contaminants,Primary Inorganic Contaminants,Secondary Inorganic Contaminants,Synthetic Organic Contaminants
CWA - Extractable Organics,General Chemistry,Metals,Pesticides-Herbicides-PCB's,Volatile Organics
RCRA/CERCLA - Extractable Organics,General Chemistry,Metals,Pesticides-Herbicides-PCB's,Volatile Organics

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are on file at the Bureau of Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

EFFECTIVE JULY 1, 2002 THROUGH JUNE 30, 2003

Ming S. Chan, Ph.D.
Bureau Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1697, 3/98

NON-TRANSFERABLE N6143E87813

Jeb Bush
Governor

FLORIDA DEPARTMENT OF HEALTH

John O. Agwunobi, M.D., M.B.A.
Secretary

Laboratory Scope of Accreditation

THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE

State Laboratory ID: E87813 EPA Lab Code: PA00023 610-280-3000

E87813
Lionville Laboratory Inc.
208 Welsh Pool Road
Lionville, PA 19341

Program SDWA

Analyte	Method	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,1,1,2-Tetrachloroethane	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
1,1,1-Trichloroethane	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
1,1,1-Trichloroethane	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
1,1,2,2-Tetrachloroethane	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,1,2,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,1,2-Trichloroethane	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
1,1,2-Trichloroethane	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
1,1-Dichloroethane	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,1-Dichloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,1-Dichloroethylene	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
1,1-Dichloroethylene	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
1,1-Dichloropropene	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,1-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,2,3-Trichloropropane	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,2,3-Trichloropropane	EPA 504.1	Group II Unregulated Contaminants	NELAP	5/23/02
1,2,3-Trichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,2,4-Trichlorobenzene	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,2,4-Trichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1	Synthetic Organic Contaminants	NELAP	4/1/02
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504.1	Synthetic Organic Contaminants	NELAP	4/1/02
1,2-Dichlorobenzene	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
1,2-Dichlorobenzene	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
1,2-Dichloroethane	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
1,2-Dichloroethane	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
1,2-Dichloropropane	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
1,2-Dichloropropane	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
1,3-Dichlorobenzene	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,3-Dichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,3-Dichloropropane	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,3-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
1,4-Dichlorobenzene	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
1,4-Dichlorobenzene	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
2,2-Dichloropropane	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02

"STATE" indicates certification for the analyte by the method specified. "NELAP" further indicates certification compliant with the NELAC Standards.

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Jeb Bush
Governor

FLORIDA DEPARTMENT OF HEALTH

John O. Agwunobi, M.D., M.B.A.
Secretary

Laboratory Scope of Accreditation

THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE

State Laboratory ID: E87813 EPA Lab Code: PA00023 610-280-3000

E87813
Lionville Laboratory Inc.
208 Welsh Pool Road
Lionville, PA 19341

Program SDWA

Analyte	Method	Category	Certification Type	Effective Date
2,2-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
2,4-D	EPA 515.1	Synthetic Organic Contaminants	NELAP	4/1/02
2-Chlorotoluene	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
2-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
4-Chlorotoluene	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
4-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
Alachlor	EPA 507	Synthetic Organic Contaminants	NELAP	4/1/02
Aldrin	EPA 508	Group I Unregulated Contaminants	NELAP	4/1/02
Alkalinity as CaCO3	SM 2320 B	Primary Inorganic Contaminants	NELAP	4/1/02
Aluminum	EPA 200.7	Secondary Inorganic Contaminants	NELAP	5/23/02
Antimony	SM 3113 B	Primary Inorganic Contaminants	NELAP	4/1/02
Arsenic	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/02
Atrazine	EPA 507	Synthetic Organic Contaminants	NELAP	4/1/02
Barium	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/02
Benzene	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
Benzene	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
Benzo(a)pyrene	EPA 525.2	Synthetic Organic Contaminants	NELAP	4/1/02
Beryllium	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/02
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 525.2	Synthetic Organic Contaminants	NELAP	4/1/02
Bromide	EPA 300.0	Primary Inorganic Contaminants	NELAP	5/23/02
Bromobenzene	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
Bromobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
Bromochloromethane	EPA 502.2	Group II Unregulated Contaminants	NELAP	5/23/02
Bromochloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	5/23/02
Bromodichloromethane	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
Bromodichloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
Bromoform	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
Bromoform	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
Butachlor	EPA 507	Group I Unregulated Contaminants	NELAP	4/1/02
Cadmium	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/02
Calcium	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/02
Calcium	SM 3500-Ca D	Primary Inorganic Contaminants	NELAP	5/23/02
Carbon tetrachloride	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
Carbon tetrachloride	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02

"STATE" indicates certification for the analyte by the method specified. "NELAP" further indicates certification compliant with the NELAC Standards.

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Secretary

Laboratory Scope of Accreditation

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State Laboratory ID: E87813 EPA Lab Code: PA00023 610-280-3000

E87813
Lionville Laboratory Inc.
208 Welsh Pool Road
Lionville, PA 19341

Program SDWA

Analyte	Method	Category	Certification Type	Effective Date
Chlordane (tech.)	EPA 508	Synthetic Organic Contaminants	NELAP	4/1/02
Chloride	EPA 300.0	Secondary Inorganic Contaminants	NELAP	5/23/02
Chlorobenzene	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
Chlorobenzene	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
Chloroethane	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
Chloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
Chloroform	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
Chloroform	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
Chromium	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/02
cis-1,2-Dichloroethylene	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
cis-1,2-Dichloroethylene	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
cis-1,3-Dichloropropene	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
cis-1,3-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
Conductivity	SM 2510 B	Primary Inorganic Contaminants	NELAP	5/23/02
Copper	EPA 200.7	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	4/1/02
Cyanide	SM 4500CN-E	Primary Inorganic Contaminants	NELAP	4/1/02
Dalapon	EPA 515.1	Synthetic Organic Contaminants	NELAP	4/1/02
Di(2-ethylhexyl)adipate	EPA 525.2	Synthetic Organic Contaminants	NELAP	4/1/02
Dibromochloromethane	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
Dibromochloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
Dibromomethane	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
Dibromomethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
Dicamba	EPA 515.1	Group I Unregulated Contaminants	NELAP	4/1/02
Dichloromethane (DCM, Methylene chloride)	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
Dichloromethane (DCM, Methylene chloride)	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
Dieldrin	EPA 508	Group I Unregulated Contaminants	NELAP	4/1/02
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 515.1	Synthetic Organic Contaminants	NELAP	4/1/02
Endrin	EPA 508	Synthetic Organic Contaminants	NELAP	4/1/02
Ethylbenzene	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
Ethylbenzene	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
Fluoride	SM 4500 F-C	Primary Inorganic Contaminants	NELAP	4/1/02
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 508	Synthetic Organic Contaminants	NELAP	4/1/02
Heptachlor	EPA 508	Synthetic Organic Contaminants	NELAP	4/1/02

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State Laboratory ID: E87813 EPA Lab Code: PA00023 610-280-3000

E87813
Lionville Laboratory Inc.
208 Welsh Pool Road
Lionville, PA 19341

Program SDWA

Analyte	Method	Category	Certification Type	Effective Date
Heptachlor epoxide	EPA 508	Synthetic Organic Contaminants	NELAP	4/1/02
Hexachlorocyclopentadiene	EPA 508	Synthetic Organic Contaminants	NELAP	4/1/02
Iron	EPA 200.7	Secondary Inorganic Contaminants	NELAP	5/23/02
Lead	SM 3113 B	Primary Inorganic Contaminants	NELAP	4/1/02
Magnesium	EPA 200.7	Primary Inorganic Contaminants	NELAP	5/23/02
Manganese	EPA 200.7	Secondary Inorganic Contaminants	NELAP	5/23/02
Mercury	EPA 245.1	Primary Inorganic Contaminants	NELAP	4/1/02
Methoxychlor	EPA 508	Synthetic Organic Contaminants	NELAP	4/1/02
Methyl bromide (Bromomethane)	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
Methyl bromide (Bromomethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
Methyl chloride (Chloromethane)	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
Methyl chloride (Chloromethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
Methyl tert-butyl ether (MTBE)	EPA 524.2	Group II Unregulated Contaminants	NELAP	5/23/02
Metolachlor	EPA 507	Group I Unregulated Contaminants	NELAP	4/1/02
Metribuzin	EPA 507	Group I Unregulated Contaminants	NELAP	4/1/02
Nickel	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/02
Nitrate as N	EPA 353.2	Primary Inorganic Contaminants	NELAP	4/1/02
Nitrite as N	EPA 353.2	Primary Inorganic Contaminants	NELAP	4/1/02
Nitrobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	5/23/02
Orthophosphate as P	EPA 300.0	Primary Inorganic Contaminants	NELAP	5/23/02
Orthophosphate as P	SM 4500-P E	Primary Inorganic Contaminants	NELAP	5/23/02
PCBs	EPA 508	Synthetic Organic Contaminants	NELAP	5/23/02
Pentachlorophenol	EPA 515.1	Synthetic Organic Contaminants	NELAP	4/1/02
pH	EPA 150.1	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	4/1/02
Picloram	EPA 515.1	Synthetic Organic Contaminants	NELAP	4/1/02
Propachlor (Ramrod)	EPA 508	Group I Unregulated Contaminants	NELAP	4/1/02
Selenium	SM 3113 B	Primary Inorganic Contaminants	NELAP	4/1/02
Silica as SiO2	EPA 200.7	Primary Inorganic Contaminants	NELAP	5/23/02
Silver	EPA 200.7	Secondary Inorganic Contaminants	NELAP	4/1/02
Silvex (2,4,5-TP)	EPA 515.1	Synthetic Organic Contaminants	NELAP	4/1/02
Simazine	EPA 507	Synthetic Organic Contaminants	NELAP	4/1/02
Sodium	EPA 200.7	Primary Inorganic Contaminants	NELAP	4/1/02
Styrene	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02

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State Laboratory ID: E87813 EPA Lab Code: PA00023 610-280-3000

E87813
Lionville Laboratory Inc.
208 Welsh Pool Road
Lionville, PA 19341

Program SDWA

Analyte	Method	Category	Certification Type	Effective Date
Styrene	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
Sulfate	EPA 300.0	Primary Inorganic Contaminants	NELAP	4/1/02
Tetrachloroethylene (Perchloroethylene)	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
Tetrachloroethylene (Perchloroethylene)	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
Thallium	EPA 200.9	Primary Inorganic Contaminants	NELAP	4/1/02
Toluene	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
Toluene	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
Total dissolved solids	SM 2540 C	Secondary Inorganic Contaminants	NELAP	4/1/02
Total nitrate-nitrite	EPA 353.2	Primary Inorganic Contaminants	NELAP	5/23/02
Total organic carbon	SM 5310C	Primary Inorganic Contaminants	NELAP	5/23/02
Total trihalomethanes	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
Total trihalomethanes	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
Toxaphene (Chlorinated camphene)	EPA 508	Synthetic Organic Contaminants	NELAP	4/1/02
trans-1,2-Dichloroethylene	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
trans-1,2-Dichloroethylene	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
trans-1,3-Dichloropropylene	EPA 502.2	Group II Unregulated Contaminants	NELAP	4/1/02
trans-1,3-Dichloropropylene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/02
Trichloroethene (Trichloroethylene)	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
Trichloroethene (Trichloroethylene)	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
Vinyl chloride	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
Vinyl chloride	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
Xylene (total)	EPA 502.2	Other regulated Contaminants	NELAP	4/1/02
Xylene (total)	EPA 524.2	Other regulated Contaminants	NELAP	4/1/02
Zinc	EPA 200.7	Secondary Inorganic Contaminants	NELAP	5/23/02

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Program CWA

Analyte	Method	Category	Certification Type	Effective Date
1,1,1-Trichloroethane	EPA 601	Volatile Organics	NELAP	5/23/02
1,1,1-Trichloroethane	EPA 624	Volatile Organics	NELAP	5/23/02
1,1,2,2-Tetrachloroethane	EPA 601	Volatile Organics	NELAP	5/23/02
1,1,2,2-Tetrachloroethane	EPA 624	Volatile Organics	NELAP	5/23/02
1,1,2-Trichloroethane	EPA 601	Volatile Organics	NELAP	5/23/02
1,1,2-Trichloroethane	EPA 624	Volatile Organics	NELAP	5/23/02
1,1-Dichloroethane	EPA 601	Volatile Organics	NELAP	5/23/02
1,1-Dichloroethane	EPA 624	Volatile Organics	NELAP	5/23/02
1,1-Dichloroethylene	EPA 601	Volatile Organics	NELAP	5/23/02
1,1-Dichloroethylene	EPA 624	Volatile Organics	NELAP	5/23/02
1,2,4-Trichlorobenzene	EPA 625	Extractable Organics	NELAP	5/23/02
1,2-Dichlorobenzene	EPA 602	Volatile Organics	NELAP	5/23/02
1,2-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	5/23/02
1,2-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	5/23/02
1,2-Dichloroethane	EPA 601	Volatile Organics	NELAP	5/23/02
1,2-Dichloroethane	EPA 624	Volatile Organics	NELAP	5/23/02
1,2-Dichloropropane	EPA 601	Volatile Organics	NELAP	5/23/02
1,2-Dichloropropane	EPA 624	Volatile Organics	NELAP	5/23/02
1,3-Dichlorobenzene	EPA 602	Volatile Organics	NELAP	5/23/02
1,3-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	5/23/02
1,3-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	5/23/02
1,4-Dichlorobenzene	EPA 601	Volatile Organics	NELAP	5/23/02
1,4-Dichlorobenzene	EPA 602	Volatile Organics	NELAP	5/23/02
1,4-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	5/23/02
1,4-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	5/23/02
2,4,6-Trichlorophenol	EPA 625	Extractable Organics	NELAP	5/23/02
2,4-Dichlorophenol	EPA 625	Extractable Organics	NELAP	5/23/02
2,4-Dimethylphenol	EPA 625	Extractable Organics	NELAP	5/23/02
2,4-Dinitrophenol	EPA 625	Extractable Organics	NELAP	5/23/02
2,4-Dinitrotoluene (2,4-DNT)	EPA 625	Extractable Organics	NELAP	5/23/02
2,6-Dinitrotoluene (2,6-DNT)	EPA 625	Extractable Organics	NELAP	5/23/02
2-Chloroethyl vinyl ether	EPA 601	Volatile Organics	NELAP	5/23/02
2-Chloroethyl vinyl ether	EPA 624	Volatile Organics	NELAP	5/23/02
2-Chloronaphthalene	EPA 625	Extractable Organics	NELAP	5/23/02

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2-Chlorophenol	EPA 625	Extractable Organics	NELAP	5/23/02
2-Methyl-4,6-dinitrophenol	EPA 625	Extractable Organics	NELAP	5/23/02
2-Nitrophenol	EPA 625	Extractable Organics	NELAP	5/23/02
3,3'-Dichlorobenzidine	EPA 625	Extractable Organics	NELAP	5/23/02
4,4'-DDD	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
4,4'-DDE	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
4,4'-DDT	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
4-Bromophenyl phenyl ether	EPA 625	Extractable Organics	NELAP	5/23/02
4-Chloro-3-methylphenol	EPA 625	Extractable Organics	NELAP	5/23/02
4-Chlorophenyl phenylether	EPA 625	Extractable Organics	NELAP	5/23/02
4-Nitrophenol	EPA 625	Extractable Organics	NELAP	5/23/02
Acenaphthene	EPA 625	Extractable Organics	NELAP	5/23/02
Acenaphthylene	EPA 625	Extractable Organics	NELAP	5/23/02
Acidity, as CaCO3	EPA 305.1	General Chemistry	NELAP	5/23/02
Acidity, as CaCO3	SM 2310 B (4A)	General Chemistry	NELAP	5/23/02
Aldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Alkalinity as CaCO3	EPA 310.1	General Chemistry	NELAP	5/23/02
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	5/23/02
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aluminum	EPA 200.7	Metals	NELAP	5/23/02
Ammonia as N	EPA 350.3	General Chemistry	NELAP	5/23/02
Anthracene	EPA 625	Extractable Organics	NELAP	5/23/02
Antimony	EPA 200.7	Metals	NELAP	5/23/02
Aroclor-1016 (PCB-1016)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1221 (PCB-1221)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1232 (PCB-1232)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1242 (PCB-1242)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1248 (PCB-1248)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1254 (PCB-1254)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1260 (PCB-1260)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Arsenic	EPA 200.7	Metals	NELAP	5/23/02
Arsenic	EPA 6010	Metals	NELAP	5/23/02
Barium	EPA 200.7	Metals	NELAP	5/23/02
Benzene	EPA 624	Volatile Organics	NELAP	5/23/02

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Benzidine	EPA 625	Extractable Organics	NELAP	5/23/02
Benzo(a)anthracene	EPA 625	Extractable Organics	NELAP	5/23/02
Benzo(a)pyrene	EPA 625	Extractable Organics	NELAP	5/23/02
Benzo(b)fluoranthene	EPA 625	Extractable Organics	NELAP	5/23/02
Benzo(g,h,i)perylene	EPA 625	Extractable Organics	NELAP	5/23/02
Benzo(k)fluoranthene	EPA 625	Extractable Organics	NELAP	5/23/02
Beryllium	EPA 200.7	Metals	NELAP	5/23/02
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Biochemical oxygen demand	EPA 405.1	General Chemistry	NELAP	5/23/02
bis(2-Chloroethoxy)methane	EPA 625	Extractable Organics	NELAP	5/23/02
bis(2-Chloroethyl) ether	EPA 625	Extractable Organics	NELAP	5/23/02
bis(2-Chloroisopropyl) ether	EPA 625	Extractable Organics	NELAP	5/23/02
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 625	Extractable Organics	NELAP	5/23/02
Boron	EPA 200.7	Metals	NELAP	5/23/02
Bromide	EPA 300.0	General Chemistry	NELAP	5/23/02
Bromide	EPA 320.1	General Chemistry	NELAP	5/23/02
Bromodichloromethane	EPA 601	Volatile Organics	NELAP	5/23/02
Bromodichloromethane	EPA 624	Volatile Organics	NELAP	5/23/02
Bromoform	EPA 601	Volatile Organics	NELAP	5/23/02
Bromoform	EPA 624	Volatile Organics	NELAP	5/23/02
Butyl benzyl phthalate	EPA 625	Extractable Organics	NELAP	5/23/02
Cadmium	EPA 200.7	Metals	NELAP	5/23/02
Cadmium	EPA 6010	Metals	NELAP	5/23/02
Calcium	EPA 200.7	Metals	NELAP	5/23/02
Carbon tetrachloride	EPA 601	Volatile Organics	NELAP	5/23/02
Carbon tetrachloride	EPA 624	Volatile Organics	NELAP	5/23/02
Carbonaceous BOD (CBOD)	SM 5210 B	General Chemistry	NELAP	5/23/02
Chemical oxygen demand	EPA 410.2	General Chemistry	NELAP	5/23/02
Chlordane (tech.)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Chloride	EPA 300.0	General Chemistry	NELAP	5/23/02
Chloride	EPA 325.1	General Chemistry	NELAP	5/23/02
Chloride	EPA 325.2	General Chemistry	NELAP	5/23/02
Chlorobenzene	EPA 601	Volatile Organics	NELAP	5/23/02
Chlorobenzene	EPA 602	Volatile Organics	NELAP	5/23/02

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Chlorobenzene	EPA 624	Volatile Organics	NELAP	5/23/02
Chloroethane	EPA 601	Volatile Organics	NELAP	5/23/02
Chloroethane	EPA 624	Volatile Organics	NELAP	5/23/02
Chloroform	EPA 601	Volatile Organics	NELAP	5/23/02
Chloroform	EPA 624	Volatile Organics	NELAP	5/23/02
Chromium	EPA 200.7	Metals	NELAP	5/23/02
Chromium	EPA 6010	Metals	NELAP	5/23/02
Chrysene	EPA 625	Extractable Organics	NELAP	5/23/02
cis-1,3-Dichloropropene	EPA 601	Volatile Organics	NELAP	5/23/02
cis-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	5/23/02
Cobalt	EPA 200.7	Metals	NELAP	5/23/02
Color	EPA 110.2	General Chemistry	NELAP	5/23/02
Conductivity	EPA 120.1	General Chemistry	NELAP	5/23/02
Conductivity	SM 2510 B	General Chemistry	NELAP	5/23/02
Copper	EPA 200.7	Metals	NELAP	5/23/02
Copper	EPA 6010	Metals	NELAP	5/23/02
delta-BHC	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Dibenz(a,h) anthracene	EPA 625	Extractable Organics	NELAP	5/23/02
Dibromochloromethane	EPA 601	Volatile Organics	NELAP	5/23/02
Dibromochloromethane	EPA 624	Volatile Organics	NELAP	5/23/02
Dichlorodifluoromethane	EPA 601	Volatile Organics	NELAP	5/23/02
Dichlorodifluoromethane	EPA 624	Volatile Organics	NELAP	5/23/02
Dieldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Diethyl phthalate	EPA 625	Extractable Organics	NELAP	5/23/02
Dimethyl phthalate	EPA 625	Extractable Organics	NELAP	5/23/02
Di-n-butyl phthalate	EPA 625	Extractable Organics	NELAP	5/23/02
Di-n-octyl phthalate	EPA 625	Extractable Organics	NELAP	5/23/02
Endosulfan I	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endosulfan II	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endosulfan sulfate	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endrin aldehyde	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Ethylbenzene	EPA 624	Volatile Organics	NELAP	5/23/02
Fluoranthene	EPA 625	Extractable Organics	NELAP	5/23/02

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Fluorene	EPA 625	Extractable Organics	NELAP	5/23/02
Fluoride	EPA 300.0	General Chemistry	NELAP	5/23/02
Fluoride	EPA 340.2	General Chemistry	NELAP	5/23/02
Fluoride	SM 4500 F-C	General Chemistry	NELAP	5/23/02
gamma-BHC (Lindane, gauuna-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Hardness	EPA 130.2	General Chemistry	NELAP	5/23/02
Hardness	SM 2340 B	General Chemistry	NELAP	5/23/02
Hardness (calc.)	EPA 200.7	Metals	NELAP	5/23/02
Heptachlor	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Heptachlor epoxide	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Hexachlorobenzene	EPA 625	Extractable Organics	NELAP	5/23/02
Hexachlorobutadiene	EPA 625	Extractable Organics	NELAP	5/23/02
Hexachlorocyclopentadiene	EPA 625	Extractable Organics	NELAP	5/23/02
Hexachloroethane	EPA 625	Extractable Organics	NELAP	5/23/02
Indeno(1,2,3-cd)pyrene	EPA 625	Extractable Organics	NELAP	5/23/02
Iron	EPA 200.7	Metals	NELAP	5/23/02
Isophorone	EPA 625	Extractable Organics	NELAP	5/23/02
Kjeldahl nitrogen - total	EPA 351.1	General Chemistry	NELAP	5/23/02
Kjeldahl nitrogen - total	EPA 351.3	General Chemistry	NELAP	5/23/02
Lead	EPA 200.7	Metals	NELAP	5/23/02
Lead	EPA 6010	Metals	NELAP	5/23/02
Magnesium	EPA 200.7	Metals	NELAP	5/23/02
Manganese	EPA 200.7	Metals	NELAP	5/23/02
Mercury	EPA 245.1	Metals	NELAP	5/23/02
Mercury	EPA 6010	Metals	NELAP	5/23/02
Methoxychlor	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Methyl bromide (Bromomethane)	EPA 601	Volatile Organics	NELAP	5/23/02
Methyl bromide (Bromomethane)	EPA 624	Volatile Organics	NELAP	5/23/02
Methylene chloride	EPA 601	Volatile Organics	NELAP	5/23/02
Methylene chloride	EPA 624	Volatile Organics	NELAP	5/23/02
Molybdenum	EPA 200.7	Metals	NELAP	5/23/02
Molybdenum	EPA 6010	Metals	NELAP	5/23/02
Naphthalene	EPA 625	Extractable Organics	NELAP	5/23/02
Nickel	EPA 200.7	Metals	NELAP	5/23/02

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Nickel	EPA 6010	Metals	NELAP	5/23/02
Nitrate	EPA 300.0	General Chemistry	NELAP	5/23/02
Nitrate as N	EPA 353.2	General Chemistry	NELAP	5/23/02
Nitrate-nitrite	EPA 300.0	General Chemistry	NELAP	5/23/02
Nitrite	EPA 300.0	General Chemistry	NELAP	5/23/02
Nitrite as N	EPA 353.2	General Chemistry	NELAP	5/23/02
Nitrite as N	EPA 354.1	General Chemistry	NELAP	5/23/02
Nitrobenzene	EPA 625	Extractable Organics	NELAP	5/23/02
n-Nitrosodimethylamine	EPA 625	Extractable Organics	NELAP	5/23/02
n-Nitrosodi-n-propylamine	EPA 625	Extractable Organics	NELAP	5/23/02
n-Nitrosodiphenylamine	EPA 625	Extractable Organics	NELAP	5/23/02
Oil & Grease	EPA 1664	General Chemistry	NELAP	5/23/02
Oil & Grease	EPA 413.1	General Chemistry	NELAP	5/23/02
Orthophosphate as P	EPA 300.0	General Chemistry	NELAP	5/23/02
Orthophosphate as P	EPA 365.2	General Chemistry	NELAP	5/23/02
Pentachlorophenol	EPA 625	Extractable Organics	NELAP	5/23/02
pH	EPA 150.1	General Chemistry	NELAP	5/23/02
Phenanthrene	EPA 625	Extractable Organics	NELAP	5/23/02
Phenol	EPA 625	Extractable Organics	NELAP	5/23/02
Phosphorus, total	EPA 365.2	General Chemistry	NELAP	5/23/02
Phosphorus, total	EPA 365.3	General Chemistry	NELAP	5/23/02
Potassium	EPA 200.7	Metals	NELAP	5/23/02
Pyrene	EPA 625	Extractable Organics	NELAP	5/23/02
Residue-filterable (TDS)	EPA 160.1	General Chemistry	NELAP	5/23/02
Residue-nonfilterable (TSS)	EPA 160.2	General Chemistry	NELAP	5/23/02
Residue-nonfilterable (TSS)	SM 2540 D	General Chemistry	NELAP	5/23/02
Residue-settleable	EPA 160.5	General Chemistry	NELAP	5/23/02
Residue-total	EPA 160.3	General Chemistry	NELAP	5/23/02
Residue-volatile	EPA 160.4	General Chemistry	NELAP	5/23/02
Selenium	EPA 200.7	Metals	NELAP	5/23/02
Selenium	EPA 6010	Metals	NELAP	5/23/02
Silica as SiO2	EPA 200.7	Metals	NELAP	5/23/02
Silver	EPA 200.7	Metals	NELAP	5/23/02
Sodium	EPA 200.7	Metals	NELAP	5/23/02

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Sulfate	EPA 300.0	General Chemistry	NELAP	5/23/02
Sulfate	EPA 375.4	General Chemistry	NELAP	5/23/02
Sulfide	EPA 376.1	General Chemistry	NELAP	5/23/02
Sulfide	EPA 376.2	General Chemistry	NELAP	5/23/02
Surfactants - MBAS	EPA 425.1	General Chemistry	NELAP	5/23/02
Tetrachloroethylene (Perchloroethylene)	EPA 601	Volatile Organics	NELAP	5/23/02
Tetrachloroethylene (Perchloroethylene)	EPA 624	Volatile Organics	NELAP	5/23/02
Thallium	EPA 200.7	Metals	NELAP	5/23/02
Tin	EPA 200.7	Metals	NELAP	5/23/02
Titanium	EPA 200.7	Metals	NELAP	5/23/02
Toluene	EPA 624	Volatile Organics	NELAP	5/23/02
Total cyanide	EPA 335.2	General Chemistry	NELAP	5/23/02
Total dissolved solids	SM 2540 C	General Chemistry	NELAP	5/23/02
Total nitrate-nitrite	EPA 353.1	General Chemistry	NELAP	5/23/02
Total nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	5/23/02
Total organic carbon	EPA 415.1	General Chemistry	NELAP	5/23/02
Total Petroleum Hydrocarbons (TPH)	EPA 1664	General Chemistry	NELAP	5/23/02
Total phenolics	EPA 420.1	General Chemistry	NELAP	5/23/02
Total phenolics	EPA 420.2	General Chemistry	NELAP	5/23/02
Total recoverable petroleum hydrocarbons (TRPH)	EPA 418.1	General Chemistry	NELAP	5/23/02
Toxaphene (Chlorinated camphene)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/23/02
trans-1,3-Dichloropropylene	EPA 601	Volatile Organics	NELAP	5/23/02
trans-1,3-Dichloropropylene	EPA 624	Volatile Organics	NELAP	5/23/02
Trichloroethene (Trichloroethylene)	EPA 601	Volatile Organics	NELAP	5/23/02
Trichloroethene (Trichloroethylene)	EPA 624	Volatile Organics	NELAP	5/23/02
Trichlorofluoromethane	EPA 601	Volatile Organics	NELAP	5/23/02
Trichlorofluoromethane	EPA 624	Volatile Organics	NELAP	5/23/02
Turbidity	EPA 180.1	General Chemistry	NELAP	5/23/02
Vanadium	EPA 200.7	Metals	NELAP	5/23/02
Vinyl chloride	EPA 601	Volatile Organics	NELAP	5/23/02
Vinyl chloride	EPA 624	Volatile Organics	NELAP	5/23/02
Xylene (total)	EPA 624	Volatile Organics	NELAP	5/23/02
Zinc	EPA 200.7	Metals	NELAP	5/23/02
Zinc	EPA 6010	Metals	NELAP	5/23/02

"STATE" indicates certification for the analyte by the method specified. "NELAP" further indicates certification compliant with the NELAC Standards.

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Jeb Bush
Governor

FLORIDA DEPARTMENT OF HEALTH

John O. Agwunobi, M.D., M.B.A.
Secretary

Laboratory Scope of Accreditation

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State Laboratory ID: E87813 EPA Lab Code: PA00023 610-280-3000

E87813
Lionville Laboratory Inc.
208 Welsh Pool Road
Lionville, PA 19341

Program RCRA/CERCLA

Analyte	Method	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8021	Volatile Organics	NELAP	5/23/02
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	5/23/02
1,1,1-Trichloroethane	EPA 8021	Volatile Organics	NELAP	5/23/02
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	5/23/02
1,1,1-Trichloroethane	OLM04.2	Volatile Organics	NELAP	5/23/02
1,1,2,2-Tetrachloroethane	EPA 8021	Volatile Organics	NELAP	5/23/02
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	5/23/02
1,1,2,2-Tetrachloroethane	OLM04.2	Volatile Organics	NELAP	5/23/02
1,1,2-Trichloroethane	EPA 8021	Volatile Organics	NELAP	5/23/02
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	5/23/02
1,1,2-Trichloroethane	OLM04.2	Volatile Organics	NELAP	5/23/02
1,1-Dichloroethane	EPA 8021	Volatile Organics	NELAP	5/23/02
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	5/23/02
1,1-Dichloroethane	OLM04.2	Volatile Organics	NELAP	5/23/02
1,1-Dichloroethylene	EPA 8021	Volatile Organics	NELAP	5/23/02
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	5/23/02
1,1-Dichloroethylene	OLM04.2	Volatile Organics	NELAP	5/23/02
1,1-Dichloropropene	EPA 8021	Volatile Organics	NELAP	5/23/02
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	5/23/02
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3,4,7,8-Hxcdd	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3,4,7,8-Hxcdf	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3,6,7,8-Hxcdd	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3,6,7,8-Hxcdf	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3,7,8,9-Hxcdd	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3,7,8,9-Hxcdf	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3,7,8-Pecdd	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3,7,8-Pecdf	EPA 8280	Extractable Organics	NELAP	5/23/02
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	5/23/02

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State Laboratory ID: E87813 EPA Lab Code: PA00023 610-280-3000

E87813
Lionville Laboratory Inc.
208 Welsh Pool Road
Lionville, PA 19341

Program RCRA/CERCLA

Analyte	Method	Category	Certification Type	Effective Date
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	5/23/02
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	5/23/02
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	5/23/02
1,2,4-Trichlorobenzene	OLM04.2	Volatile Organics	NELAP	5/23/02
1,2,4-Trimethylbenzene	EPA 8021	Volatile Organics	NELAP	5/23/02
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8021	Volatile Organics	NELAP	5/23/02
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	5/23/02
1,2-Dibromo-3-chloropropane (DBCP)	OLM04.2	Volatile Organics	NELAP	5/23/02
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8021	Volatile Organics	NELAP	5/23/02
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	5/23/02
1,2-Dibromoethane (EDB, Ethylene dibromide)	OLM04.2	Volatile Organics	NELAP	5/23/02
1,2-Dichlorobenzene	EPA 8021	Volatile Organics	NELAP	5/23/02
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	5/23/02
1,2-Dichlorobenzene	OLM04.2	Volatile Organics	NELAP	5/23/02
1,2-Dichloroethane	EPA 8021	Volatile Organics	NELAP	5/23/02
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	5/23/02
1,2-Dichloroethane	OLM04.2	Volatile Organics	NELAP	5/23/02
1,2-Dichloropropane	EPA 8021	Volatile Organics	NELAP	5/23/02
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	5/23/02
1,2-Dichloropropane	OLM04.2	Volatile Organics	NELAP	5/23/02
1,2-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	5/23/02
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	5/23/02
1,3,5-Trimethylbenzene	EPA 8021	Volatile Organics	NELAP	5/23/02
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	5/23/02
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	5/23/02
1,3-Dichlorobenzene	EPA 8021	Volatile Organics	NELAP	5/23/02
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	5/23/02
1,3-Dichlorobenzene	OLM04.2	Volatile Organics	NELAP	5/23/02
1,3-Dichloropropane	EPA 8021	Volatile Organics	NELAP	5/23/02

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1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	5/23/02
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	5/23/02
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	5/23/02
1,4-Dichlorobenzene	EPA 8021	Volatile Organics	NELAP	5/23/02
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	5/23/02
1,4-Dichlorobenzene	OLM04.2	Volatile Organics	NELAP	5/23/02
1,4-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	5/23/02
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	5/23/02
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	5/23/02
1-Chlorobutane	EPA 8260	Volatile Organics	NELAP	5/23/02
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	5/23/02
2,2-Dichloropropane	EPA 8021	Volatile Organics	NELAP	5/23/02
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	5/23/02
2,3,4,6,7,8-Hxcdf	EPA 8280	Extractable Organics	NELAP	5/23/02
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	5/23/02
2,3,4,7,8-Pecdf	EPA 8280	Extractable Organics	NELAP	5/23/02
2,3,7,8-TCDD	EPA 8280	Extractable Organics	NELAP	5/23/02
2,3,7,8-TCDF	EPA 8280	Extractable Organics	NELAP	5/23/02
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/23/02
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	5/23/02
2,4,5-Trichlorophenol	OLM04.2	Extractable Organics	NELAP	5/23/02
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	5/23/02
2,4,6-Trichlorophenol	OLM04.2	Extractable Organics	NELAP	5/23/02
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	5/23/02
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/23/02
2,4-D, Butoxyethanol ester	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/23/02
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/23/02
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	5/23/02
2,4-Dichlorophenol	OLM04.2	Extractable Organics	NELAP	5/23/02
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	5/23/02
2,4-Dimethylphenol	OLM04.2	Extractable Organics	NELAP	5/23/02
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	5/23/02
2,4-Dinitrophenol	OLM04.2	Extractable Organics	NELAP	5/23/02

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Analyte	Method	Category	Certification Type	Effective Date
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	5/23/02
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	5/23/02
2,4-Dinitrotoluene (2,4-DNT)	OLM04.2	Extractable Organics	NELAP	5/23/02
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	5/23/02
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	5/23/02
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	5/23/02
2,6-Dinitrotoluene (2,6-DNT)	OLM04.2	Extractable Organics	NELAP	5/23/02
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	5/23/02
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	5/23/02
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	5/23/02
2-Butanone (Methyl ethyl ketone, MEK)	OLM04.2	Volatile Organics	NELAP	5/23/02
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	5/23/02
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	5/23/02
2-Chloronaphthalene	OLM04.2	Extractable Organics	NELAP	5/23/02
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	5/23/02
2-Chlorophenol	OLM04.2	Extractable Organics	NELAP	5/23/02
2-Chlorotoluene	EPA 8021	Volatile Organics	NELAP	5/23/02
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	5/23/02
2-Hexanone	EPA 8260	Volatile Organics	NELAP	5/23/02
2-Hexanone	OLM04.2	Volatile Organics	NELAP	5/23/02
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	5/23/02
2-Methyl-4,6-dinitrophenol	OLM04.2	Extractable Organics	NELAP	5/23/02
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	5/23/02
2-Methylnaphthalene	OLM04.2	Extractable Organics	NELAP	5/23/02
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	5/23/02
2-Methylphenol (o-Cresol)	OLM04.2	Extractable Organics	NELAP	5/23/02
2-Naphthylamine	EPA 8270	Extractable Organics	NELAP	5/23/02
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	5/23/02
2-Nitroaniline	OLM04.2	Extractable Organics	NELAP	5/23/02
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	5/23/02
2-Nitrophenol	OLM04.2	Extractable Organics	NELAP	5/23/02
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	5/23/02
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	5/23/02
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	5/23/02

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Analyte	Method	Category	Certification Type	Effective Date
3,3'-Dichlorobenzidine	OLM04.2	Extractable Organics	NELAP	5/23/02
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	5/23/02
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	5/23/02
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	5/23/02
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	5/23/02
3-Nitroaniline	OLM04.2	Extractable Organics	NELAP	5/23/02
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	5/23/02
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
4,4'-DDD	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
4,4'-DDE	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
4,4'-DDT	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
4,4'-Methylenebis(2-chloroaniline)	EPA 8270	Extractable Organics	NELAP	5/23/02
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	5/23/02
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	5/23/02
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	5/23/02
4-Bromophenyl phenyl ether	OLM04.2	Extractable Organics	NELAP	5/23/02
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	5/23/02
4-Chloro-3-methylphenol	OLM04.2	Extractable Organics	NELAP	5/23/02
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	5/23/02
4-Chloroaniline	OLM04.2	Extractable Organics	NELAP	5/23/02
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	5/23/02
4-Chlorophenyl phenylether	OLM04.2	Extractable Organics	NELAP	5/23/02
4-Chlorotoluene	EPA 8021	Volatile Organics	NELAP	5/23/02
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	5/23/02
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	5/23/02
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	5/23/02
4-Methyl-2-pentanone (MIBK)	OLM04.2	Volatile Organics	NELAP	5/23/02
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	5/23/02
4-Methylphenol (p-Cresol)	OLM04.2	Extractable Organics	NELAP	5/23/02
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	5/23/02
4-Nitroaniline	OLM04.2	Extractable Organics	NELAP	5/23/02
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	5/23/02

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Analyte	Method	Category	Certification Type	Effective Date
4-Nitrophenol	OLM04.2	Extractable Organics	NELAP	5/23/02
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	5/23/02
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	5/23/02
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	5/23/02
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	5/23/02
Acenaphthene	EPA 8270	Extractable Organics	NELAP	5/23/02
Acenaphthene	EPA 8310	Extractable Organics	NELAP	5/23/02
Acenaphthene	OLM04.2	Extractable Organics	NELAP	5/23/02
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	5/23/02
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	5/23/02
Acenaphthylene	OLM04.2	Extractable Organics	NELAP	5/23/02
Acetone	EPA 8260	Volatile Organics	NELAP	5/23/02
Acetone	OLM04.2	Volatile Organics	NELAP	5/23/02
Acetonitrile	EPA 8260	Volatile Organics	NELAP	5/23/02
Acetophenone	EPA 8270	Extractable Organics	NELAP	5/23/02
Acetophenone	OLM04.2	Extractable Organics	NELAP	5/23/02
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	5/23/02
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	5/23/02
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aldrin	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Allyl alcohol	EPA 8015	Volatile Organics	NELAP	5/23/02
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	5/23/02
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
alpha-BHC (alpha-Hexachlorocyclohexane)	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
alpha-Chlordane	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aluminum	EPA 6010	Metals	NELAP	5/23/02
Aluminum	ILM04.1	Metals	NELAP	5/23/02
Amenable cyanide	EPA 9014	General Chemistry	NELAP	5/23/02
Aniline	EPA 8270	Extractable Organics	NELAP	5/23/02
Anthracene	EPA 8270	Extractable Organics	NELAP	5/23/02
Anthracene	EPA 8310	Extractable Organics	NELAP	5/23/02
Anthracene	OLM04.2	Extractable Organics	NELAP	5/23/02
Antimony	EPA 6010	Metals	NELAP	5/23/02

"STATE" indicates certification for the analyte by the method specified. "NELAP" further indicates certification compliant with the NELAC Standards.

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State Laboratory ID: E87813 EPA Lab Code: PA00023 610-280-3000

E87813
Lionville Laboratory Inc.
208 Welsh Pool Road
Lionville, PA 19341

Program RCRA/CERCLA

Analyte	Method	Category	Certification Type	Effective Date
Antimony	ILM04.1	Metals	NELAP	5/23/02
Aramite	EPA 8270	Extractable Organics	NELAP	5/23/02
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1016 (PCB-1016)	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1221 (PCB-1221)	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1232 (PCB-1232)	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1242 (PCB-1242)	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1248 (PCB-1248)	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1254 (PCB-1254)	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Aroclor-1260 (PCB-1260)	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Arsenic	EPA 6010	Metals	NELAP	5/23/02
Arsenic	ILM04.1	Metals	NELAP	5/23/02
Atrazine	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Azinphos-methyl (Guthion)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Barium	EPA 6010	Metals	NELAP	5/23/02
Barium	ILM04.1	Metals	NELAP	5/23/02
Benzene	EPA 8021	Volatile Organics	NELAP	5/23/02
Benzene	EPA 8260	Volatile Organics	NELAP	5/23/02
Benzene	OLM04.2	Volatile Organics	NELAP	5/23/02
Benzidine	EPA 8270	Extractable Organics	NELAP	5/23/02
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	5/23/02
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	5/23/02
Benzo(a)anthracene	OLM04.2	Extractable Organics	NELAP	5/23/02
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	5/23/02
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	5/23/02
Benzo(a)pyrene	OLM04.2	Extractable Organics	NELAP	5/23/02
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	5/23/02
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	5/23/02

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Analyte	Method	Category	Certification Type	Effective Date
Benzo(b)fluoranthene	OLM04.2	Extractable Organics	NELAP	5/23/02
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	5/23/02
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	5/23/02
Benzo(g,h,i)perylene	OLM04.2	Extractable Organics	NELAP	5/23/02
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	5/23/02
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	5/23/02
Benzoic acid	EPA 8270	Extractable Organics	NELAP	5/23/02
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	5/23/02
Beryllium	EPA 6010	Metals	NELAP	5/23/02
Beryllium	ILM04.1	Metals	NELAP	5/23/02
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
beta-BHC (beta-Hexachlorocyclohexane)	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	5/23/02
bis(2-Chloroethoxy)methane	OLM04.2	Extractable Organics	NELAP	5/23/02
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	5/23/02
bis(2-Chloroethyl) ether	OLM04.2	Extractable Organics	NELAP	5/23/02
bis(2-Chloroisopropyl) ether	EPA 8270	Extractable Organics	NELAP	5/23/02
bis(2-Chloroisopropyl) ether	OLM04.2	Extractable Organics	NELAP	5/23/02
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	5/23/02
bis(2-Ethylhexyl) phthalate (DEHP)	OLM04.2	Extractable Organics	NELAP	5/23/02
Boron	EPA 6010	Metals	NELAP	5/23/02
Bromide	EPA 9056	General Chemistry	NELAP	5/23/02
Bromobenzene	EPA 8021	Volatile Organics	NELAP	5/23/02
Bromobenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
Bromochloromethane	EPA 8021	Volatile Organics	NELAP	5/23/02
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	5/23/02
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	5/23/02
Bromodichloromethane	OLM04.2	Volatile Organics	NELAP	5/23/02
Bromoform	EPA 8021	Volatile Organics	NELAP	5/23/02
Bromoform	EPA 8260	Volatile Organics	NELAP	5/23/02
Bromoform	OLM04.2	Volatile Organics	NELAP	5/23/02
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	5/23/02
Butyl benzyl phthalate	OLM04.2	Extractable Organics	NELAP	5/23/02
Cadmium	EPA 6010	Metals	NELAP	5/23/02

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Analyte	Method	Category	Certification Type	Effective Date
Cadmium	ILM04.1	Metals	NELAP	5/23/02
Calcium	EPA 6010	Metals	NELAP	5/23/02
Calcium	ILM04.1	Metals	NELAP	5/23/02
Carbazole	EPA 8270	Extractable Organics	NELAP	5/23/02
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	5/23/02
Carbon disulfide	OLM04.2	Volatile Organics	NELAP	5/23/02
Carbon tetrachloride	EPA 8021	Volatile Organics	NELAP	5/23/02
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	5/23/02
Carbon tetrachloride	OLM04.2	Volatile Organics	NELAP	5/23/02
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Chloride	EPA 9056	General Chemistry	NELAP	5/23/02
Chloroacetonitrile	EPA 8260	Volatile Organics	NELAP	5/23/02
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
Chlorobenzene	OLM04.2	Volatile Organics	NELAP	5/23/02
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Chloroethane	EPA 8021	Volatile Organics	NELAP	5/23/02
Chloroethane	EPA 8260	Volatile Organics	NELAP	5/23/02
Chloroethane	OLM04.2	Volatile Organics	NELAP	5/23/02
Chloroform	EPA 8021	Volatile Organics	NELAP	5/23/02
Chloroform	EPA 8260	Volatile Organics	NELAP	5/23/02
Chloroform	OLM04.2	Volatile Organics	NELAP	5/23/02
Chloroprene	EPA 8021	Volatile Organics	NELAP	5/23/02
Chloroprene	EPA 8260	Volatile Organics	NELAP	5/23/02
Chromium	EPA 6010	Metals	NELAP	5/23/02
Chromium	ILM04.1	Metals	NELAP	5/23/02
Chromium VI	EPA 7196	General Chemistry	NELAP	5/23/02
Chrysene	EPA 8270	Extractable Organics	NELAP	5/23/02
Chrysene	EPA 8310	Extractable Organics	NELAP	5/23/02
Chrysene	OLM04.2	Extractable Organics	NELAP	5/23/02
cis-1,2-Dichloroethylene	EPA 8021	Volatile Organics	NELAP	5/23/02
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	5/23/02
cis-1,2-Dichloroethylene	OLM04.2	Volatile Organics	NELAP	5/23/02
cis-1,3-Dichloropropene	EPA 8021	Volatile Organics	NELAP	5/23/02
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	5/23/02

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Analyte	Method	Category	Certification Type	Effective Date
cis-1,3-Dichloropropene	OLM04.2	Volatile Organics	NELAP	5/23/02
cis-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	5/23/02
Cobalt	EPA 6010	Metals	NELAP	5/23/02
Cobalt	ILM04.1	Metals	NELAP	5/23/02
Copper	EPA 6010	Metals	NELAP	5/23/02
Copper	ILM04.1	Metals	NELAP	5/23/02
Corrosivity	EPA 1110	General Chemistry	NELAP	5/23/02
Corrosivity (pH)	EPA 9040	General Chemistry	NELAP	5/23/02
Coumaphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Cyanide	EPA 9014	General Chemistry	NELAP	5/23/02
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/23/02
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
delta-BHC	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Demeton-o	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Demeton-s	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Diazinon	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Dibenz(a,h) anthracene	EPA 8270	Extractable Organics	NELAP	5/23/02
Dibenz(a,h) anthracene	EPA 8310	Extractable Organics	NELAP	5/23/02
Dibenz(a,h) anthracene	OLM04.2	Extractable Organics	NELAP	5/23/02
Dibenzo(a,e) pyrene	EPA 8270	Extractable Organics	NELAP	5/23/02
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	5/23/02
Dibenzofuran	OLM04.2	Extractable Organics	NELAP	5/23/02
Dibromochloromethane	EPA 8021	Volatile Organics	NELAP	5/23/02
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	5/23/02
Dibromochloromethane	OLM04.2	Volatile Organics	NELAP	5/23/02
Dibromofluoromethane	EPA 8021	Volatile Organics	NELAP	5/23/02
Dibromofluoromethane	EPA 8260	Volatile Organics	NELAP	5/23/02
Dibromomethane	EPA 8021	Volatile Organics	NELAP	5/23/02
Dibromomethane	EPA 8260	Volatile Organics	NELAP	5/23/02
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Dichlorodifluoromethane	EPA 8021	Volatile Organics	NELAP	5/23/02
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	5/23/02
Dichlorodifluoromethane	OLM04.2	Volatile Organics	NELAP	5/23/02

Laboratory Scope of Accreditation

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Lionville, PA 19341

Program RCRA/CERCLA

Analyte	Method	Category	Certification Type	Effective Date
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Dieldrin	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	5/23/02
Diesel range organics (DRO)	WA-EPH	Extractable Organics	NELAP	5/23/02
Diethyl ether	EPA 8015	Volatile Organics	NELAP	5/23/02
Diethyl ether	EPA 8260	Volatile Organics	NELAP	5/23/02
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	5/23/02
Diethyl phthalate	OLM04.2	Extractable Organics	NELAP	5/23/02
Dimethoate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	5/23/02
Dimethyl phthalate	OLM04.2	Extractable Organics	NELAP	5/23/02
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	5/23/02
Di-n-butyl phthalate	OLM04.2	Extractable Organics	NELAP	5/23/02
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	5/23/02
Di-n-octyl phthalate	OLM04.2	Extractable Organics	NELAP	5/23/02
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Extractable Organics	NELAP	5/23/02
Diphenylamine	EPA 8270	Extractable Organics	NELAP	5/23/02
Disulfoton	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endosulfan I	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endosulfan II	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endosulfan sulfate	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endrin	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endrin aldehyde	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Endrin ketone	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02

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Analyte	Method	Category	Certification Type	Effective Date
Ethane	RSK-175	Volatile Organics	NELAP	5/23/02
Ethanol	EPA 8015	Volatile Organics	NELAP	5/23/02
Ethion	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Ethyl acetate	EPA 8260	Volatile Organics	NELAP	5/23/02
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	5/23/02
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	5/23/02
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	5/23/02
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
Ethylbenzene	OLM04.2	Volatile Organics	NELAP	5/23/02
Ethylene	RSK-175	Volatile Organics	NELAP	5/23/02
Ethylene glycol	EPA 8015	Volatile Organics	NELAP	5/23/02
Ethylene oxide	EPA 8015	Volatile Organics	NELAP	5/23/02
Extractable organics halides (EOX)	EPA 9023	General Chemistry	NELAP	5/23/02
Famphur	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Fluoranthene	EPA 8270	Extractable Organics	NELAP	5/23/02
Fluoranthene	EPA 8310	Extractable Organics	NELAP	5/23/02
Fluoranthene	OLM04.2	Extractable Organics	NELAP	5/23/02
Fluorene	EPA 8270	Extractable Organics	NELAP	5/23/02
Fluorene	EPA 8310	Extractable Organics	NELAP	5/23/02
Fluorene	OLM04.2	Extractable Organics	NELAP	5/23/02
Fluoride	EPA 9056	General Chemistry	NELAP	5/23/02
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
gamma-Chlordane	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	5/23/02
Gasoline range organics (GRO)	WA-VPH	Extractable Organics	NELAP	5/23/02
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Heptachlor	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Heptachlor epoxide	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	5/23/02
Hexachlorobenzene	OLM04.2	Extractable Organics	NELAP	5/23/02
Hexachlorobutadiene	EPA 8021	Volatile Organics	NELAP	5/23/02

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Analyte	Method	Category	Certification Type	Effective Date
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	5/23/02
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	5/23/02
Hexachlorobutadiene	OLM04.2	Extractable Organics	NELAP	5/23/02
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	5/23/02
Hexachlorocyclopentadiene	OLM04.2	Extractable Organics	NELAP	5/23/02
Hexachloroethane	EPA 8260	Volatile Organics	NELAP	5/23/02
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	5/23/02
Hexachloroethane	OLM04.2	Extractable Organics	NELAP	5/23/02
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	5/23/02
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	5/23/02
Ignitability	EPA 1010	General Chemistry	NELAP	5/23/02
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	5/23/02
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	5/23/02
Indeno(1,2,3-cd)pyrene	OLM04.2	Extractable Organics	NELAP	5/23/02
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	5/23/02
Iron	EPA 6010	Metals	NELAP	5/23/02
Iron	ILM04.1	Metals	NELAP	5/23/02
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8015	Volatile Organics	NELAP	5/23/02
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	5/23/02
Isodrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Isophorone	EPA 8270	Extractable Organics	NELAP	5/23/02
Isophorone	OLM04.2	Extractable Organics	NELAP	5/23/02
Isopropyl alcohol (2-Propanol)	EPA 8015	Volatile Organics	NELAP	5/23/02
Isopropylbenzene	EPA 8021	Volatile Organics	NELAP	5/23/02
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
Isopropylbenzene	OLM04.2	Volatile Organics	NELAP	5/23/02
Isosafrole	EPA 8270	Extractable Organics	NELAP	5/23/02
Kepone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Lead	EPA 6010	Metals	NELAP	5/23/02
Lead	ILM04.1	Metals	NELAP	5/23/02
Lithium	EPA 6010	Metals	NELAP	5/23/02
Magnesium	EPA 6010	Metals	NELAP	5/23/02

Laboratory Scope of Accreditation

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State Laboratory ID: E87813 EPA Lab Code: PA00023 610-280-3000

E87813
Lionville Laboratory Inc.
208 Welsh Pool Road
Lionville, PA 19341

Program RCRA/CERCLA

Analyte	Method	Category	Certification Type	Effective Date
Magnesium	ILM04.1	Metals	NELAP	5/23/02
Malathion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Manganese	EPA 6010	Metals	NELAP	5/23/02
Manganese	ILM04.1	Metals	NELAP	5/23/02
Mercury	EPA 7470	Metals	NELAP	5/23/02
Mercury	EPA 7471	Metals	NELAP	5/23/02
Mercury	ILM04.1	Metals	NELAP	5/23/02
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	5/23/02
Methane	RSK-175	Volatile Organics	NELAP	5/23/02
Methanol	EPA 8015	Volatile Organics	NELAP	5/23/02
Methapyrilene	EPA 8270	Extractable Organics	NELAP	5/23/02
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Methoxychlor	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Methyl acrylate	EPA 8260	Volatile Organics	NELAP	5/23/02
Methyl bromide (Bromomethane)	EPA 8021	Volatile Organics	NELAP	5/23/02
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	5/23/02
Methyl bromide (Bromomethane)	OLM04.2	Volatile Organics	NELAP	5/23/02
Methyl chloride (Chloromethane)	EPA 8021	Volatile Organics	NELAP	5/23/02
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	5/23/02
Methyl chloride (Chloromethane)	OLM04.2	Volatile Organics	NELAP	5/23/02
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	5/23/02
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	5/23/02
Methyl parathion (Parathion, methyl)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Methyl tert-butyl ether (MTBE)	EPA 8021	Volatile Organics	NELAP	5/23/02
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	5/23/02
Methyl tert-butyl ether (MTBE)	OLM04.2	Volatile Organics	NELAP	5/23/02
Methylene chloride	EPA 8021	Volatile Organics	NELAP	5/23/02
Methylene chloride	EPA 8260	Volatile Organics	NELAP	5/23/02
Methylene chloride	OLM04.2	Volatile Organics	NELAP	5/23/02
Molybdenum	EPA 6010	Metals	NELAP	5/23/02
Molybdenum	ILM04.1	Metals	NELAP	5/23/02
m-Xylene	EPA 8021	Volatile Organics	NELAP	5/23/02
m-Xylene	EPA 8260	Volatile Organics	NELAP	5/23/02

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Naphthalene	EPA 8021	Volatile Organics	NELAP	5/23/02
Naphthalene	EPA 8260	Volatile Organics	NELAP	5/23/02
Naphthalene	EPA 8270	Extractable Organics	NELAP	5/23/02
Naphthalene	EPA 8310	Extractable Organics	NELAP	5/23/02
Naphthalene	OLM04.2	Extractable Organics	NELAP	5/23/02
n-Butyl alcohol	EPA 8015	Volatile Organics	NELAP	5/23/02
n-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	5/23/02
n-Butylbenzene	EPA 8021	Volatile Organics	NELAP	5/23/02
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
Nickel	EPA 6010	Metals	NELAP	5/23/02
Nickel	ILM04.1	Metals	NELAP	5/23/02
Nitrate	EPA 9056	General Chemistry	NELAP	5/23/02
Nitrite	EPA 9056	General Chemistry	NELAP	5/23/02
Nitrobenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	5/23/02
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	5/23/02
Nitrobenzene	OLM04.2	Extractable Organics	NELAP	5/23/02
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	5/23/02
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	5/23/02
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	5/23/02
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	5/23/02
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	5/23/02
n-Nitrosodi-n-propylamine	OLM04.2	Extractable Organics	NELAP	5/23/02
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	5/23/02
n-Nitrosodiphenylamine	OLM04.2	Extractable Organics	NELAP	5/23/02
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	5/23/02
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	5/23/02
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	5/23/02
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	5/23/02
n-Propanol	EPA 8015	Volatile Organics	NELAP	5/23/02
n-Propylbenzene	EPA 8021	Volatile Organics	NELAP	5/23/02
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	5/23/02

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FLORIDA DEPARTMENT OF HEALTH

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Analyte	Method	Category	Certification Type	Effective Date
Oil & Grease	EPA 9071	General Chemistry	NELAP	5/23/02
Orthophosphate as P	EPA 9056	General Chemistry	NELAP	5/23/02
o-Toluidine	EPA 8270	Extractable Organics	NELAP	5/23/02
o-Xylene	EPA 8021	Volatile Organics	NELAP	5/23/02
o-Xylene	EPA 8260	Volatile Organics	NELAP	5/23/02
Paint Filter Liquids Test	EPA 9095	General Chemistry	NELAP	5/23/02
Parathion, ethyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	5/23/02
Pentachloroethane	EPA 8260	Volatile Organics	NELAP	5/23/02
Pentachloronitrobenzene	EPA 8270	Extractable Organics	NELAP	5/23/02
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	5/23/02
Pentachlorophenol	OLM04.2	Extractable Organics	NELAP	5/23/02
pH	EPA 9040	General Chemistry	NELAP	5/23/02
pH	EPA 9045	General Chemistry	NELAP	5/23/02
Phenacetin	EPA 8270	Extractable Organics	NELAP	5/23/02
Phenanthrene	EPA 8270	Extractable Organics	NELAP	5/23/02
Phenanthrene	EPA 8310	Extractable Organics	NELAP	5/23/02
Phenanthrene	OLM04.2	Extractable Organics	NELAP	5/23/02
Phenol	EPA 8270	Extractable Organics	NELAP	5/23/02
Phenol	OLM04.2	Extractable Organics	NELAP	5/23/02
Phorate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Phosphorus, total	EPA 6010	Metals	NELAP	5/23/02
Phthalic anhydride	EPA 8270	Extractable Organics	NELAP	5/23/02
p-Isopropyltoluene	EPA 8021	Volatile Organics	NELAP	5/23/02
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	5/23/02
Potassium	EPA 6010	Metals	NELAP	5/23/02
Potassium	ILM04.1	Metals	NELAP	5/23/02
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	5/23/02
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	5/23/02
p-Xylene	EPA 8021	Volatile Organics	NELAP	5/23/02
p-Xylene	EPA 8260	Volatile Organics	NELAP	5/23/02
Pyrene	EPA 8270	Extractable Organics	NELAP	5/23/02

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Analyte	Method	Category	Certification Type	Effective Date
Pyrene	EPA 8310	Extractable Organics	NELAP	5/23/02
Pyrene	OLM04.2	Extractable Organics	NELAP	5/23/02
Pyridine	EPA 8270	Extractable Organics	NELAP	5/23/02
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	5/23/02
Reactive cyanide	EPA 7.3.3.2	General Chemistry	NELAP	5/23/02
Reactive sulfide	EPA 7.3.4.2	General Chemistry	NELAP	5/23/02
Safrole	EPA 8270	Extractable Organics	NELAP	5/23/02
sec-Butylbenzene	EPA 8021	Volatile Organics	NELAP	5/23/02
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
Selenium	EPA 6010	Metals	NELAP	5/23/02
Selenium	ILM04.1	Metals	NELAP	5/23/02
Silica as SiO2	EPA 6010	Metals	NELAP	5/23/02
Silver	EPA 6010	Metals	NELAP	5/23/02
Silver	ILM04.1	Metals	NELAP	5/23/02
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Sodium	EPA 6010	Metals	NELAP	5/23/02
Strontium	EPA 6010	Metals	NELAP	5/23/02
Styrene	EPA 8021	Volatile Organics	NELAP	5/23/02
Styrene	EPA 8260	Volatile Organics	NELAP	5/23/02
Styrene	OLM04.2	Volatile Organics	NELAP	5/23/02
Sulfate	EPA 9056	General Chemistry	NELAP	5/23/02
Sulfide	EPA 9030/9034	General Chemistry	NELAP	5/23/02
Sulfotepp	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Sulfotepp	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
tert-Butyl alcohol	EPA 8015	Volatile Organics	NELAP	5/23/02
tert-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	5/23/02
tert-Butylbenzene	EPA 8021	Volatile Organics	NELAP	5/23/02
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	5/23/02
Tetrachloroethylene (Perchloroethylene)	EPA 8021	Volatile Organics	NELAP	5/23/02
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	5/23/02
Tetrachloroethylene (Perchloroethylene)	OLM04.2	Volatile Organics	NELAP	5/23/02
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	5/23/02
Thallium	EPA 6010	Metals	NELAP	5/23/02
Thallium	ILM04.1	Metals	NELAP	5/23/02

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Thionazin (Zinophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Tin	EPA 6010	Metals	NELAP	5/23/02
Titanium	EPA 6010	Metals	NELAP	5/23/02
Toluene	EPA 8021	Volatile Organics	NELAP	5/23/02
Toluene	EPA 8260	Volatile Organics	NELAP	5/23/02
Toluene	OLM04.2	Volatile Organics	NELAP	5/23/02
Total cyanide	EPA 9014	General Chemistry	NELAP	5/23/02
Total Heptachlorodibenzofuran	EPA 8280	Extractable Organics	NELAP	5/23/02
Total Heptachlorodibenzo-p-dioxin	EPA 8280	Extractable Organics	NELAP	5/23/02
Total Hexachlorodibenzofuran	EPA 8280	Extractable Organics	NELAP	5/23/02
Total Hexachlorodibenzo-p-dioxin	EPA 8280	Extractable Organics	NELAP	5/23/02
Total nitrate-nitrite	EPA 9056	General Chemistry	NELAP	5/23/02
Total organic carbon	EPA 9060	General Chemistry	NELAP	5/23/02
Total organic halides (TOX)	EPA 9020	General Chemistry	NELAP	5/23/02
Total Pentachlorodibenzofuran	EPA 8280	Extractable Organics	NELAP	5/23/02
Total Pentachlorodibenzo-p-dioxin	EPA 8280	Extractable Organics	NELAP	5/23/02
Total phenolics	EPA 9066	General Chemistry	NELAP	5/23/02
Total Tetrachlorodibenzofuran	EPA 8280	Extractable Organics	NELAP	5/23/02
Total Tetrachlorodibenzo-p-dioxin	EPA 8280	Extractable Organics	NELAP	5/23/02
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Toxaphene (Chlorinated camphene)	OLM04.2	Pesticides-Herbicides-PCB's	NELAP	5/23/02
Toxicity Characteristic Leaching Procedure	EPA 1311	General Chemistry	NELAP	5/23/02
trans-1,2-Dichloroethylene	EPA 8021	Volatile Organics	NELAP	5/23/02
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	5/23/02
trans-1,2-Dichloroethylene	OLM04.2	Volatile Organics	NELAP	5/23/02
trans-1,3-Dichloropropylene	EPA 8021	Volatile Organics	NELAP	5/23/02
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	5/23/02
trans-1,3-Dichloropropylene	OLM04.2	Volatile Organics	NELAP	5/23/02
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	5/23/02
Trichloroethene (Trichloroethylene)	EPA 8021	Volatile Organics	NELAP	5/23/02
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	5/23/02
Trichloroethene (Trichloroethylene)	OLM04.2	Volatile Organics	NELAP	5/23/02
Trichlorofluoromethane	EPA 8021	Volatile Organics	NELAP	5/23/02

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