TA-14

Department of Energy
Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

September 25, 1997

VIA HAND DELIVERY

Stuart (Stu) Dinwiddie, Ph.D.
Program Manager, RCRA Permits Management Program
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044 Galisteo Street, Building A
P. O. Box 26110
Santa Fe, New Mexico 87505

SEP 26 1997

Dear Dr. Dinwiddie:

SUBJECT: SUBMITTAL OF THE NOTICE OF DEFICIENCY RESPONSE FOR THE TA-14 PERMIT APPLICATION

The purpose of this letter is to submit copies of the Notice of Deficiency (NOD) response for the TA-14 Permit Application and a copy of the Los Alamos National Laboratory (LANL) General Part B. The General Part B is provided to assist you in reviewing the response.

If there are any questions regarding this matter, please feel free to contact me at (505) 665-5042.

Sincerely,

H.L. "Jody" Plum
Office of Environment and Projects

Attachments:
2 copies of the NOD Response
1 copy of the LANL General Part B

3866

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Los Alamos National Laboratory Response to "Notice of Deficiency: Technical Adequacy, Part B Permit Application, Open Burning/ Open Detonation Units, TA-14, EPA I.D. #NM0890010515-$(OB/OD)_{14}$"

Prepared by:

Los Alamos National Laboratory
Hazardous and Solid Waste Group (ESH-19)
Los Alamos, New Mexico 87545

September 1997

ATTACHMENT A

SEP 2 6 1997

NOTICE OF DEFICIENCY:

TECHNICAL ADEQUACY REVIEW OF PART B PERMIT APPLICATION SUBMITTED TO HRMB BY LOS ALAMOS NATIONAL LABORATORY (LANL), NEW MEXICO.

JUNE 10, 1997

A. ***General Description of the Facility*** *as required by 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(1). LANL (The Permit Applicant) must:*

1. *Provide general dimensions and a structural description of the Open Burning/Open Detonation* ***(OB/OD)*** *treatment units located at Technical Area 14* ***(TA-14)****. (This may include an active trench with adjacent buried trenches, a single active trench that is groomed and reused, an open burn containment device, and secondary containment or other design configurations.);*

   Response: The general dimensions and structural description of the OB unit were provided in Section 4.1 of the OB/OD Part B Permit Application submitted to NMED in September 1996. The burn cage sits in a steel tray, which provides secondary containment. The general dimensions and description of the OD unit were also provided in Section 4.1 of the OB/OD Part B. There are no trenches associated with the OD unit. A berm will be constructed downslope of the OB/OD units to prevent runoff from both units and to minimize the erosion potential. The berm will be inspected routinely and maintained, as necessary. A natural drainage just north of the OD unit (along the dirt road) and the paved road just west of the OD unit divert potential run-on away from the unit (see Map 2 in Appendix A of this NOD response for the locations of these roads and the proposed berm).

2. *Submit to the New Mexico Environment Department* ***(NMED)*** *Hazardous and Radioactive Materials Bureau* ***(HRMB)****, engineering drawings that approximate the units' dimensions horizontally and vertically, shows ramps, berms, fencing and any other man-made features used in association with the OB/OD units;*

   Response: An engineering drawing for the OB unit showing approximate dimensions and other pertinent features has been developed and is included in Appendix B of this NOD response. Because the OD unit is simply an area on soil-covered tuff, an engineering drawing cannot be developed for the OD unit. The topography and areal extent of the OD unit were shown on Map 2 of the OB/OD Part A Permit Application, submitted with the Part B in September 1996. The locations of a berm to be constructed for the OB/OD units, an existing natural drainage, and the existing road adjacent to the OD unit are shown on Map 2 in Appendix A of this NOD response.

3. *Provide the best available description of all wastes that have ever been managed or treated at the OB and OD units. Include a summary of historical information on the volume and composition of these wastes;*

Response: The best available descriptions of the wastes managed at the TA-14 OB/OD units were provided in the OB/OD Part B, Table 3-1 and Attachment 3-1. Table 3-1 shows that the wastes treated are both homogeneous (e.g., solid explosives, scrap explosives) and heterogeneous (e.g., explosives-contaminated paper, rags, wood). These wastes have been assigned the following EPA Hazardous Waste Numbers: D001 for ignitability; D003 for reactivity; D005 (for the barium in the HE); and F005 (for spent nonhalogenated solvents, which here include toluene and methyl ethyl ketone on the HE-contaminated rags and wipes). Historically, there have been no significant changes in waste compositions. The wastes are treated to remove the characteristic of reactivity, although other characteristic (ignitability, toxicity for barium) and listed (solvents on the HE-contaminated rags and wipes) hazardous waste may be present in the wastes being treated. Waste treatment capacity was provided in Section 4.1 of the OB/OD Part B; a maximum of 50 pounds may be treated at the OB unit, and a maximum of 20 pounds may be treated at the OD unit. Since RCRA Subtitle C regulations became effective in November 1980, an average of 100 to 150 pounds of waste has been treated at the OB unit annually, and an average of 40 to 80 pounds of waste has been treated annually at the OD unit.

B. ***Topographic Map*** *as required by 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(19). Since the map of TA-14 that HRMB received from LANL was compiled on a scale other than 1 inch to 200, LANL must submit to HRMB, a topographic which:*

1. *Shows the terrain for a distance of 1,000 feet (radius) outside the Open Burning/Open Detonation units, at a map scale of 1 inch equal to not more than 200 feet, with appropriate contour lines shown on the map;*

Response: The note at the end of the requirements of 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(19) states that "For large HWM facilities the Agency will allow the use of other scales on a case-by-case basis." LANL has routinely provided topographic maps at various scales due to the areal extent of the facility. As was stated in Sections 2.1 and 2.1.1 of the OB/OD Part B, the OB/OD units at TA-14 are shown on Map 2 of the OB/OD Part A permit application. This topographic map shows the terrain for a distance exceeding 1,000 feet beyond the units, is at a scale of 1 inch equals 250 feet, and has contour lines to clearly show the pattern of surface water flow in the vicinity of and from each unit.

2. *Contains a wind rose diagram showing prevailing wind directions and velocities;*

Response: As stated in the introduction to Section 2.0 of the OB/OD Part B, a LANL-wide facility description addressing additional regulatory requirements is provided in Section 2.0 of the "General Part B Permit Application Information for Los Alamos National Laboratory" (the General Part B), submitted to NMED in August 1996. The General Part B was developed to consolidate general, LANL-wide facility information, applicable to all of LANL's current and future hazardous waste management units, into

a single document for submittal to NMED to eliminate repetitive information. NMED verbally approved the General Part B strategy in December 1996. LANL is providing a copy of the General Part B with this NOD Response package.

Wind roses were discussed in Section 2.1.4 and were shown on Figures 2-3 and 2-4 of the General Part B. As presented therein, average wind directions at LANL are measured at four sites. TA-6, located approximately 1 mile north of TA-14, is the site closest to TA-14; therefore, its wind rose data are most applicable.

3. *Shows the legal boundaries of the OB/OD units. (The map should also have a title);*

Response: The boundaries of the OB/OD units were shown on Map 2 [titled "Contour Map Showing Hazardous Waste Units at Technical Area (TA) 14"] of the OB/OD Part A. The legal boundary of LANL, the HWM facility, was shown on Map 1 [titled "Contour Map Showing All Technical Areas (TA) at Los Alamos National Laboratory (LANL)"] of the OB/OD Part A.

4. *Contains access control to the OB/OD treatment units; and*

Response: Access control to the OB/OD treatment units was shown on Map 2 of the OB/OD Part A. An industrial fence surrounds the entire area (see map legend), a gate is located at the roadway entrance to the area (see map), and a second gate is located adjacent to TA-14-23 (see map). The gates are locked when operations are not being conducted at TA-14. The fence and site entry gate were also shown on Figure 5-1 of the OB/OD Part B. A revised Map 2 is provided in Appendix A of this NOD response to clarify the map symbols used.

Access is controlled administratively through implementation of SOPs (e.g., DX-4:SOP 1.0, DX-4:SOP 3, DX-4:SOP 4, and DX-4:SOP 27). Copies of these SOPs are included in Appendix C of this NOD response.

5. *Shows the SWMUs, on-site or off-site wells, buildings, and drainage and flood control barriers at, and in the vicinity of TA-14.*

Response: The locations of SWMUs in the vicinity of the OB/OD units at TA-14 were shown on Figure 10-1 of the OB/OD Part B. All existing water supply wells, monitoring wells, test wells, springs, and surface water sampling stations within the LANL boundary (i.e., on-site) and surrounding LANL (i.e., off-site) were shown on Map 6 of the OB/OD Part A. Buildings in the vicinity of the OB/OD units were shown on Map 2 of the OB/OD Part A, and buildings at the LANL facility were shown on Map 1 of the OB/OD Part A. The locations of a proposed berm downslope of the OB/OD units and of the existing natural drainage upslope of and the road adjacent to the units to provide drainage control are shown on Map 2 in Appendix A of this NOD response.

C. ***Description of the OB/OD Treatment Units*** *as required by 20 NMAC 4.1.900 incorporating 40 CFR §270.23. The Permit Applicant must:*

1. *Provide detailed plans and engineering drawings of the OB container device in addition to the description that was provided in the Permit Application of September 1996. Include a description of the lining material within and below the OB container device, and the secondary containment that will be located around it.*

   Response: A detailed engineering drawing of the OB unit (container device) is provided in Appendix B of this NOD response. The OB unit is constructed of 1/4-inch-thick steel, and measures 3 feet high by 2 feet in diameter; the device is not lined. A wire mesh and steel door, measuring 2 feet 10 inches high and 1 foot 7 inches wide, is attached to the front of the unit; this door closes with a latch. A steel mesh screen is located inside the unit one foot above the containment tray. HE-contaminated wastes to be burned are placed on this screen. A wire mesh screen also covers the top of the OB unit. Secondary containment for the OB unit is provided by a steel tray with 3-inch raised edges, as shown on the engineering drawing in Appendix B of this NOD response.

2. *Describe how the OB/OD treatment units will be designed, constructed, operated and maintained to minimize run-off of hazardous constituents during the active life of the units, in compliance with 20 NMAC 4.1.500 incorporating 40 CFR §264.273(b).*

   Response: The OB unit is designed with secondary containment and is covered with a tarp when not in use to prevent accumulation of precipitation in the unit that could potentially result in run-off to the environment. Ash resulting from OB operations is removed from the secondary containment tray within approximately 24 hours after each burn; it is not allowed to accumulate. The ash is placed in a 55-gallon drum and stored in a satellite accumulation area near TA-14-23. The OB unit is covered with a tarp once the ash is removed. Operations at the OD unit require post-detonation visual surveys for materials not consumed by the detonation. This practice minimizes the potential for precipitation contacting untreated hazardous waste, if any. In addition, a berm will be constructed downslope of the OB/OD units to prevent run-off of hazardous constituents. The proposed location of the berm is shown on Map 2 in Appendix A of this NOD response.

3. *Explain how a run-on control system will be designed, constructed, operated, and maintained to prevent flow onto the OB/OD units during peak discharge from at least a 24-hour, 25-year storm, as required by 20 NMAC 4.1.500 incorporating 40 CFR §264.273(c). Include a description of how ditches, berms or other diversion structures may need to be designed and constructed to prevent vertical and horizontal migration of waste constituents into the environmental media at and around TA-14.*

   Response: The OB unit is designed with a secondary containment tray, which prevents run-on into the burn cage. This unit is also covered with a tarp when not in use to prevent accumulation of precipitation within the containment tray. The natural drainage upslope of the OB/OD units and the road just west of the OD unit prevent run-on at both units. In addition, the parking lot adjacent to the control building (TA-14-23) is

upgradient of the OB/OD units and slopes to the east, which further prevent potential run-on to the OB/OD units.

4. *Explain how the OB/OD units will be managed to control the releases of propellants, explosives, pyrotechnics as well as wind dispersal of ash and particulate matter to the environment, in order to meet standards required by 20 NMAC 4.1.500 incorporating 40 CFR §264.601(a) and 20 NMAC 4.1.900 incorporating §270.23(c).*

   Response: Releases of propellants, explosives, or pyrotechnics are minimized by following the procedures in DX-4:SOP 3, DX-4:SOP 4, and DX-4:SOP 27 (see Appendix C of this NOD response) to ensure maximum burns or detonations and to minimize misfires. Materials that are not consumed during a burn or detonation are collected and treated until consumed. During OB treatment operations, the heavy gauge wire mesh door and screen control dispersion of materials. Materials not consumed during a burn are collected after the cooling period (i.e., after 24 hours); ash that has collected in the containment tray is removed and managed appropriately. Materials not consumed during a detonation are collected after the Firing Leader ensures that the area is safe. Treatment operations are not conducted during adverse conditions (see response to Comment J.1) in order to minimize wind dispersal of ash and particulate matter to the environment.

5. *Provide a description of methods to control the deterioration of the open burning devices, and the installation of a cover to prevent the accumulation of precipitation in the OB device during periods of inactivity. Explain how accumulation of precipitation in the OB container device will be handled.*

   Response: The OB unit is covered with a tarp when not in use to minimize the potential for deterioration of the unit and prevent the accumulation of precipitation. Accumulation of precipitation would only occur while the OB unit is not covered during the cooling period after a burn; in such a case, the wet residual ash would be removed from the containment tray, placed in appropriate containers, and stored temporarily in a nearby satellite accumulation area.

D. ***Contingency Plan*** *as required by 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(7) and 20 NMAC 4.1.500 incorporating 40 CFR §264.53. The Permit Applicant must submit information that:*

1. *Identifies where copies of the Contingency Plan will be located; and*

   Response: As stated in Section 7.1 of the General Part B, a current copy of the contingency plan will be retained by the appropriate facility operators. A copy of the General Part B contingency plan and the OB/OD Part B contingency plan will be located at TA-14-23, Room 101. In addition, copies will be maintained at DOE/LAAO, ESH-19, and the DX Facility Management Office.

2. *Describes a schedule of remedial action.*

Response: There is no regulatory requirement in 20 NMAC 4.1.500 incorporating 40 CFR Part 264 Subpart D to provide a schedule of remedial action for contingency or emergency measures. By definition, these events are unanticipated "fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste ..." for which a schedule of remedial actions cannot be reasonably ascertained. Any remedial actions carried out under the provisions of the contingency plan will be performed as soon as possible to ensure protection of human health and the environment, as was described in Section 7.0 of the OB/OD Part B and in Section 7.0 of the General Part B. As stated in the General Part B, these remedial actions include site cleanup; proper handling of recovered waste, contaminated soil, or contaminated surface water; decontaminating equipment, as needed; replacing or repairing equipment, as needed; and testing to verify successful cleanup.

E. ***Traffic Patterns*** *in accordance with 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(10). Submit to HRMB additional information as follows:*

1. *Provide an estimate of the number and types of vehicles at and around the TA-14 OB/OD units;*

Response: LANL has typically provided traffic pattern and volume information for the HWM facility (LANL); this facility information was provided in Section 2.3 of the General Part B.

Due to the nature of operations at TA-14 and because the TA is in a secured area, traffic volume in the area of the OB/OD units is minimal (typically about 10 vehicles per month). Vehicle types are generally cars and light- and medium-duty trucks and vans. Vehicles are usually parked in the parking area adjacent to TA-14-23; occasionally, a truck or van may drive on the gravel road adjacent to the OB/OD units.

2. *Provide information about hazardous waste transfer or pick-up stations and the loading/unloading procedures;*

Response: Information on the hazardous waste transfer/pick-up stations and loading/ unloading procedures was introduced in Section 4.5 of the OB/OD Part B. Detailed information was provided in the SOPs (e.g., DX-16:SOP 1.9) referenced in Section 4.5 and included in Appendix A of the OB/OD Part B. In summary, wastes to be treated are picked up from various nearby buildings. When loading, the cargo compartment is checked to ensure that it is clean and contains no loose items such as tools or pieces of metal. For transport, the wastes are placed in an enclosed compartment or secured with tie-downs. A visual examination is conducted after unloading to ensure that no explosive material remains. Preparation room operations and HE charge handling and assembly are addressed in DX-4:SOP 3; packaging and transportation procedures are presented in DX/DO:SOP 3. Additional and/or updated SOPs are included in Appendix C of this NOD response.

3. *Include a description of the quantity of waste moved per movement per vehicle; and*

Response: A brief description of the waste management practices at the OB/OD units was presented in Section 4.5 of the OB/OD Part B. Detailed waste management information, including information on the quantity of waste moved per movement per vehicle, was contained in SOPs (e.g., DX-16:SOP 1.9) referenced in Section 4.5 and included in Appendix A of the OB/OD Part B. As stated in DX-16:SOP 1.9, the load limit for transporting explosives is 55 pounds, and as stated in Section 4.5 of the OB/OD Part B, waste is transported to the treatment units on the day of planned treatment. As noted in the response to Comment A.3, the OB unit treatment capacity is 50 pounds, and the OD unit treatment capacity is 20 pounds.

4. *Present a description of the route surface composition and load bearing capacity.*

Response: As was noted in Section 2.3.6 of the General Part B, roads within TAs are generally two-lane roads with asphaltic concrete surfaces. Load-bearing capacity for these roads is 32,000 pounds per axle. They are typically constructed with a 6-inch-thick base overlain with a 6- to 8-inch asphaltic concrete surface and are designed and constructed to meet American Association of State Highway Transportation Officials standards.

F. ***Soil and Vadose Zone Monitoring*** *in accordance with 20 NMAC 4.1.500 incorporating 40 CFR §264.278; §264.601(b) and §264.13(b).*

Provide the following additional information on soil and vadose zone monitoring program:

1. *Describe sample collection, sample preservation, shipment, sampling and analysis procedures, and chain of custody control;*

Response: LANL proposes the following Soil Monitoring Program as the preferred approach to meet the monitoring and analysis requirements of 20 NMAC 4.1.500 incorporating 40 CFR 264.602. Vadose zone monitoring is discussed in the response to Comment F.6. Details of the proposed Soil Monitoring Program are presented below.

Annual Soil Sampling/Risk Assessment Approach. This approach for a Soil Monitoring Program will require one soil sampling event during the first year of the program, and using the data collected as additional input to the baseline risk assessment conducted for the response to Item K (Risk Analysis) of this NOD. The baseline risk assessment concludes that, after 40 years of operations at TA-14, the current level of contaminants for both surface soil and surface water does not pose a potential significant risk to human health. In addition, the overall ecological risks at the site are expected to be low. The annual soil sampling/risk assessment approach will meet the monitoring and analysis requirements of 20 NMAC 4.1.500 incorporating 40 CFR 264.602 and ensure protection of human health and the environment. After the samples have been analyzed and the additional risk assessment is conducted, LANL proposes to meet with NMED to determine a reasonable schedule for potential additional activities using the risk assessment approach for the Soil Monitoring Program.

For the annual soil sampling/risk assessment approach, 10 soil samples will be collected from the area of the OB/OD treatment units during a single sampling event the first year of the Soil Monitoring Program. For the combined OB/OD area, LANL personnel will collect 10 discrete (non-composited) samples. One sample will be collected from approximately the center of the OD area and 5 equally spaced samples will be collected along a circle with a radius of approximately 100 feet from the center of the OD area (for a total of 6 samples for the OD area). Four discrete samples equally spaced along a circle with a radius of approximately 15 feet will also be collected in the OB area.

Sample collection, preservation, shipment, and chain-of-custody procedures and sampling and analysis procedures are discussed below.

LANL and NMED have discussed a Soil Monitoring Program based on a quarterly sampling approach; as an alternative, however, LANL evaluated the two approaches described herein. The evaluation concludes that, while both approaches will meet the monitoring and analysis requirements of 20 NMAC 4.1.500 incorporating 40 CFR 264.602 and ensure protection of human health and the environment, the annual soil sampling/risk assessment approach is LANL's preferred approach because it also allows technical prudence and, most importantly, is a fiscally responsible alternative approach. LANL estimates that the expense of implementing this cost-effective alternative approach (including sampling, analysis, surveying, and the additional risk assessment) will be approximately one third the amount of implementing the quarterly sampling approach, described below.

Quarterly Sampling Approach. This approach for a Soil Monitoring Program will require that soil samples be collected within 30 days following each OB/OD treatment operation, with a maximum sampling frequency of once every three months (i.e., quarterly). Data collected would be evaluated as presented in the response to Comment F.4 below. The quarterly sampling approach will meet the monitoring and analysis requirements of 20 NMAC 4.1.500 incorporating 40 CFR 264.602 and will ensure protection of human health and the environment; however, the estimated cost may exceed 3 times the cost of the risk assessment approach. After 1 year of quarterly sampling, LANL proposes to meet with NMED to evaluate the quarterly sampling approach to the Soil Monitoring Program to determine if the quarterly sampling frequency may be justifiably decreased (e.g., if the sampling data indicate no significant adverse effects to human health and the environment as a result of treatment activities).

For the OD area, LANL personnel will collect 5 discrete samples. One sample will be collected from approximately the center of the OD area and 4 equally spaced samples will be collected along a circle with a radius of approximately 100 feet from the center of the OD area. For the OB area, LANL personnel will collect 4 discrete samples equally spaced along a circle with a radius of approximately 15 feet from the OB unit.

Procedures. Each discrete sample will be placed in a labeled glass sample container. To ensure that representative discrete soil samples are collected, all soil sampling activities will be conducted in accordance with the LANL Hazardous and Solid Waste Group (ESH-19) Sampling and Analysis Plan (SAP).

Protective gloves will be worn during soil sampling activities and the spade and scoop method will be used by LANL personnel collecting samples. Sample containers will be labeled with the date, time, exact sampling location, and the name of the individual collecting the sample. For any sampling event, a field duplicate soil sample will be collected from one of the sample locations and analyzed to assess laboratory quality control. The field duplicate will be collected and handled in the same manner as the field samples. In addition, a trip blank and a field blank will be collected for each sampling event, as appropriate. Following the collection of each sample, the disposable scoops used will be containerized and stored appropriately, pending receipt of analytical results. Therefore, equipment rinsate blanks will not need to be collected.

Following each soil sampling event, LANL personnel will transport the field and QC samples to LANL's High Explosives Science and Technology Group (DX-2) for HE analysis, to LANL's Organic Analysis Group (CST-12) for organics analysis, and to LANL's Inorganic Trace Analysis Group (CST-9) for metals analysis, or will arrange for transport to LANL-approved off-site analytical laboratories. Samples will be transported to the respective analytical laboratories in a timely manner to ensure that sample holding times specified in the U.S. Environmental Protection Agency (EPA) "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (*SW-846*) are met. In addition, samples will be preserved, as appropriate, as specified in *SW-846*. At the time of sample collection, sample collection personnel will complete chain-of-custody forms and will place custody tape on all sample containers to ensure that sample custody is maintained. Sample collection personnel will maintain physical custody of the samples until the samples are relinquished to laboratory personnel. Upon receiving the soil samples, the laboratory technician will assume custody of the samples, noting the date, time, and name of the person relinquishing custody of the samples to the laboratory. All samples will be analyzed using *SW-846* methods for the parameters described in the response to Comment F.2 below.

2. *Indicate the parameters selected and the EPA approved or equivalent acceptable analytical method for each parameter;*

Response: The analytical parameters, EPA Hazardous Waste numbers, rationale for parameter selection, and EPA *SW-846* analytical methods to be used for the samples collected as part of the Soil Monitoring Program for the TA-14 OB/OD units are presented in Table 1 below.

Table 1

Selected Parameters and Test Methods

General Chemical Class	Parameter	EPA Hazardous Waste No.	Rationale for Parameter Selection	*SW-846* Test Method[a]
Explosives	HMX[b]	D003	Determine the presence of HE waste residues	8330
	RDX[c]	D003	Determine the presence of HE waste residues	8330
	1,3,5-TNB[d]	D003	Determine the presence of HE waste residues	8330
	1,3-DNB[e]	D003	Determine the presence of HE waste residues	8330
	Tetryl[f]	D003	Determine the presence of HE waste residues	8330
	NB[g]	D003	Determine the presence of HE waste residues	8330
	2,4,6-TNT[h]	D003	Determine the presence of HE waste residues	8330
	4-Am-DNT[i]	D003	Determine the presence of HE waste residues	8330
	2-Am-DNT[j]	D003	Determine the presence of HE waste residues	8330
	2,4-DNT[k]	D003	Determine the presence of HE waste residues	8330
	2,6-DNT	D003	Determine the presence of HE waste residues	8330
	2-NT[l]	D003	Determine the presence of HE waste residues	8330
	3-NT	D003	Determine the presence of HE waste residues	8330
	4-NT	D003	Determine the presence of HE waste residues	8330

Table 1 (Continued)

Selected Parameters and Test Methods

General Chemical Class	Parameter	EPA Hazardous Waste No.	Rationale for Parameter Selection	*SW-846* Test Method[a]
Metals	Barium	D005	Determine the presence of barium metal associated with the HE-contaminated waste treated at the OB/OD units	7081
	Chromium[m]	D007	Determine the presence of chromium metal which may originate from detonator caps used in OD waste treatment process	7191
VOCs[n]	Methyl Ethyl Ketone	F005	Determine the presence of methyl ethyl ketone which may be present on HE-contaminated rags and wipes treated at the OB unit	8260
	Toluene	F005	Determine the presence of toluene which may be present on HE-contaminated rags and wipes treated at the OB unit	8260

a U.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," *SW-846.*
b Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
c Hexahydro-1,3,5-trinitro-1,3,5-triazine
d TNB = trinitrobenzene
e DNB = dinitrobenzene
f Methyl-2,4,6-trinitrophenylnitramine
g NB = nitrobenzene
h TNT = trinitrotoluene
i 4-Amino-2,6-dinitrotoluene
j 2-Amino-4,6-dinitrotoluene
k DNT = dinitrotoluene
l NT = nitrotoluene
m Analyzed for in OD area samples only.
n VOCs=volatile organic compounds; analyzed for in OB area samples only.

3. *List background values for each proposed monitoring parameter or hazardous constituent;*

Response: Because high explosives and the two volatile organic compounds proposed for monitoring are not naturally occurring, background values for these compounds will likely be below instrument detection limits. The background concentrations of the metals proposed for monitoring (barium [from the HE] and chromium [from the detonator caps]) were estimated using data collected as part of LANL's Environmental Surveillance Program; these existing data include a number of on-site (within LANL boundaries) and off-site perimeter (within approximately 5 kilometers of LANL boundaries) sample locations. The values given in Table 2 below represent the average concentrations of samples collected at the 16 on-site and off-site perimeter locations during 1995. The background sample data and locations are provided in Appendix D of this NOD response. If the quarterly sampling approach to the Soil Monitoring Program is implemented, these data will be supplemented with data obtained from the "area-specific" background samples to be collected as described in the response to Comment F.8; all of the background data will be used to calculate a background mean and variance, per the guidance in Appendix IV of 20 NMAC 4.1, Subpart V, incorporating 40 CFR 264.

Table 2

Average Background Concentrations for Selected Metals[a]

Element	Average Background Concentration (ppm)
Barium	108
Chromium	9.7

[a] Source: *Environmental Surveillance at Los Alamos During 1995*, 1996, Los Alamos National Laboratory.

4. *Give details of the proposed sampling, analysis and statistical comparison procedures for the soil sample analytical results;*

Response: If the quarterly sampling approach to the Soil Monitoring Program is implemented, the statistical analysis to be used in the interpretation of analytical data will be Cochran's Approximation to the Behrens-Fisher Students' t-test in Appendix IV of 20 NMAC 4.1, Subpart V, incorporating 40 CFR 264. This method of statistical analysis will be performed by LANL to identify statistically significant differences between background mean and background variance. If at any time during the permitted life of the OB/OD units, analysis reveals statistically significant differences between background concentrations and waste constituent concentrations attributable to OB/OD treatment operations, LANL will notify NMED in writing. However, after one year of performing quarterly soil sampling (if this approach is implemented), LANL proposes to meet with NMED to evaluate the Soil Monitoring Program and to determine if the

quarterly sampling frequency may be justifiably decreased (e.g., if the sampling data indicate no significant adverse effects to human health and the environment as a result of treatment activities).

5. *Specify the sampling method which will be used to obtain a representative sample of the contaminated soil to be analyzed. [A representative soil sample may be obtained using either one of the sampling methods found in Appendix I of 20 NMAC 4.1.200 incorporating 40 CFR §261 or an equivalent acceptable method];*

   Response: Sampling will be conducted according to the spade and scoop method described in ESH-19's SAP.

6. *Provide details of the sampling and analysis plan for monitoring the vadose zone during treatment operations and for the potential of waste constituents to migrate into the ground water as required by 20 NMAC 4.1.500 incorporating 40 CFR §264.273;*

   Response: Previous hydrogeologic studies at LANL ("Hydrogeologic Assessment of Technical Area 54, Areas G and L" [LANL, 1987]) have shown that the combination of very low moisture content in the Bandelier Tuff, the empirical determination that moisture from precipitation does not infiltrate below a depth of 10 to 22 feet, and very low calculated flux rates all suggest that aqueous transport of contaminants through the tuff is not a viable mechanism for contaminant migration from mesatops. In addition, the "RFI Work Plan for Operable Unit 1085" (LANL, 1994), which includes TA-14, does not consider the vadose zone to be a major exposure pathway for contaminant transport; the major pathways discussed therein include surface water runoff and soil/sediments in surrounding drainages. Furthermore, the risk assessment conducted for the response to Item K (Risk Analysis) of this NOD concludes that after 40 years of operations at TA-14, the current level of contaminants for both surface soil and surface water does not pose a threat to human health. Therefore, rather than conducting vadose zone monitoring for the OB/OD units at TA-14, LANL proposes to first address surface systems (surface water, soil, and sediments) and use resulting surface systems analytical data in conjunction with existing data in an iterative manner to reassess additional data needs and thus optimize characterization and monitoring activities. Soil and sediment data will be collected as described above for soil monitoring; surface water runoff data will be collected in accordance with the National Pollutant Discharge Elimination System Storm Water Permit for the site. This proposed iterative process is similar to the iterative characterization and well installation process proposed in the Hydrogeologic Workplan (LANL, 1996). The purpose of the Hydrogeologic Workplan is to characterize the hydrogeologic setting beneath LANL; new data will be incorporated with existing data as input to modeling activities and will be used in an iterative manner in reassessing additional data needs. Similarly, the proposed iterative process for the OB/OD units at TA-14 will allow technical prudence by first addressing the surface systems; proceeding with vadose zone monitoring would then be conducted only if continuing reassessments indicate a need, depending on the interpretation of the surface data. If surface sampling data indicate that RCRA contaminants resulting from OB/OD treatment are present and the mobility of these contaminants so warrant, a vadose zone monitoring program will then be established and conducted.

7. *Describe how "kick-out" residues and unexploded ordnance will be managed. Some types of reactive waste will not detonate but rather deflagrate. Results of detonation of these types of wastes can cause dispersions of untreated explosives into the environment. Explain how this has been considered in the management of the reactive wastes at TA-14 OB/OD sites;*

   Response: Unexploded ordnance is not treated at the TA-14 OB/OD units. LANL minimizes the impact to the environment by conducting treatment operations in strictly controlled, remote areas within the LANL boundaries. Residues (metallic shards and occasional pieces of propellants, explosives, or pyrotechnics) are managed in accordance with SOPs for the OB/OD units; the SOPs require a thorough survey of the area after each detonation and collection of all identifiable pieces of material not consumed by the detonation. Pieces not consumed are collected for detonation. Trained operators ensure that sufficient and appropriate initiating explosives are used so that these materials detonate rather than deflagrate. Any deflagrating material is carefully collected for detonation.

8. *Describe how background soil samples will be taken, the appropriate locations of the background samples, and depths from which the samples will be obtained; and*

   Response: In addition to the background soil data presented in the response to Comment F.3 above, four "area-specific" background soil samples will be collected at TA-14 and analyzed in the same manner and for the same parameters as the field samples described in the responses to Comments F.1 and F.2. The area-specific background soil samples will be collected only if the quarterly sampling approach is implemented. These additional background soil samples will be collected from a distance of 750 to 1250 feet to the north, east, west-northwest, and northeast of the OB/OD area. The proposed distances will allow samples to be collected beyond the hazard zone yet within the flatter regions of the mesatop. (Note: A canyon located approximately 600 feet south of the units prevents the collection of a background sample from the area 750 to 1250 feet due south of the units). All background samples will be collected from the 0 to 6-inch depth interval.

9. *Explain how the results of soil and soil pore liquid monitoring will be expressed for the determination of statistically significant changes over background values for Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Beryllium, Silver and Antimony. [20 NMAC 4.1.500 incorporating 40 CFR §264.278(f)].*

   Response: LANL proposes to analyze only for the metals that may be in the waste stream (barium) and in the detonator caps (chromium). See response to Comments F.2 and F.4.

G. ***Waste Analysis Plan*** *as required by 20 NMAC 4.1.500 incorporating 40 CFR §264.13(b) and 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(3).*

1. *Land Disposal Restrictions as required by 20 NMAC 4.1.800 incorporating 40 CFR §268.30 and §268.35.*

a. *Explain the chemical composition, and the nature of F005 wastes listed in the Part A Permit Application on Page 6 of 7. Are these spent solvent wastes, solvent wastes contaminated with soil and debris, 2-ethoxy ethanol, 2-nitropropane, or benzene?*

Response: As was indicated in Table 3-1 of the OB/OD Part B, the F005 wastes are spent non-halogenated solvents. They may include toluene and methyl ethyl ketone potentially present on HE-contaminated rags or wipes treated at the OB unit.

b. *What is the characteristic toxicity of the Barium-bearing D005 waste based upon? Also, explain why LANL plans to detonate these D005, and F005 wastes contrary to the Land Disposal Restrictions that apply to them.*

Response: Barium in the form of barium nitrate or barium carbonate is a common component of explosives (e.g., the explosive Baratol may be 76 wt% barium nitrate). Because the barium level in these wastes could potentially exceed the regulatory level (100 mg/L), LANL assigned the EPA Hazardous Waste Number D005 to these wastes. Treatment of these highly reactive wastes by open detonation is an appropriate treatment method under RCRA, is necessary to mitigate hazards associated with HE-contaminated waste, and is the preferred waste management practice for health and safety concerns. Although LDR treatment standards for D005 and F005 specified in 40 CFR 268 are not met, attempts to remove the toxicity characteristic (D005) or the spent non-halogenated solvents (F005) prior to treatment by OB/OD to render the wastes no longer reactive (D003) or ignitable (D001) pose unacceptable safety risks. LANL intends to attempt clean closure of these units; if clean closure cannot be achieved, a post-closure plan will be prepared and all post-closure care requirements will be met.

2. *Submit separate lists of all the waste propellants, explosives, and pyrotechnics that will be treated at the OB and the OD units by re-categorizing the list of waste munitions that were provided in Attachment 3 of the September 1996 Part B Permit Application.*

Response: All of the compounds listed in Attachment 3-1 of the OB/OD Part B are highly reactive. They may be used as propellants, explosives, <u>or</u> pyrotechnics, depending on their intended use. For example, black powder may be used as a pyrotechnic (e.g., fireworks), as a propellant (e.g., to propel projectiles/ammunition), or as an explosive, depending on confinement conditions. Thus, for the sake of brevity, the established explosives listed in Attachment 3-1 of the OB/OD Part B were not recategorized for this NOD response.

3. *Present a detailed Quality Assurance/Quality Control Program **(QA/QC)**, or QA/QC Management Plan that will be applied during soil sampling and analysis to ensure that representative discrete soil samples are taken.*

Response: QA/QC for soil sampling to be conducted as part of the proposed Soil Monitoring Program is addressed in the response to Comment F above. LANL proposes to conduct the Soil Monitoring Program as a distinct activity separate from waste analysis. This approach is supported by the U.S. Army Environmental Hygiene

Agency's "RCRA Part B Permit Writer's Guidance Manual for Department of Defense Open Burning/Open Detonation Units," which does not require soil sampling as part of waste analysis. The presence of potential waste residues on the soil as a result of OB/OD treatment will be determined and monitored via implementation of the proposed Soil Monitoring Program, which will meet the monitoring and analysis requirements of 20 NMAC 4.1.500 incorporating 40 CFR 264.602.

4. *Describe how LANL plans to monitor non-reactive hazardous waste treated simultaneously with reactive waste at the OB and OD units. Such non-reactive wastes include lead projectiles of small arms munitions and hazardous constituents of containers, housings, and casings.*

   Response: LANL does not treat non-reactive wastes at the OB/OD units at TA-14. Ancillary components (e.g., containers, housing, and casings) used during waste treatment consist of nonhazardous materials only (e.g., aluminum, plastic). See response to Comment G.1.b.

5. *Specify where copies of the Waste Analysis Plan **(WAP)** will be located at TA-14.*

   Response: Copies of the WAP from the OB/OD Part B and the General Part B will be located at TA-14-23, Room 101.

6. *Identify the designated personnel position(s) and organization responsible for updating the WAP.*

   Response: Personnel from LANL's Hazardous and Solid Waste Group (ESH-19) will be responsible for updating the WAP, when required.

7. *If post-detonation soil monitoring or ground water monitoring is chosen as the method of compliance with the Waste Analysis Plan, describe sampling methods that will be used to obtain discrete representative samples of the soil or water to be analyzed. List the parameters that will be analyzed for in each reactive and non-reactive hazardous waste, the rationale for the selection of these parameters, and the test methods which will be used for these parameters.*

   Response: See responses to Comments F, G.3, and G.4 above and responses to Comment I.

8. *Submit to HRMB, the analytical results of soil samples taken from Building 35 located in TA-14. The "Results Summary of the Soil Sampling Survey" presented in Attachment 4-3 of the unit-specific Part B Permit Application is insufficient for NMED to interpret.*

   Response: The analytical results (raw data) of soil samples collected near TA-14-23 are included as Appendix E of this NOD response. (Note: A typographical error in a LANL memo incorrectly stated the building number [Building 35]. The data are actually from near Building 23, which is the control building near the OB/OD units at TA-14.)

H. ***Closure and Post-Closure Plans*** *in accordance with the requirements contained in 20 NMAC 4.1.500 incorporating 40 CFR §264.112 through §264.115, §264.117-118, and 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b).*

1. *Explain why closure activities are described for container storage areas, tanks, and surface impoundments on page 9-3, Section 9.1.3 of LANL's General Part B Permit Application. Since these units are not part of the OB/OD units LANL must:*

   a. *Provide specific information on the container storage areas and tanks, their locations, and the purpose for which they are used at TA-14.*

      Response: As explained in the response to Comment B.2, the General Part B was developed to consolidate general, LANL-wide information, applicable to all of LANL's current and future hazardous waste management units, into a single document to eliminate repetitive information. NMED verbally approved this strategy in December 1996. Certain sections of the General Part B (e.g., Section 9.1.3) include language that is broad or generalized in nature. It is indicated throughout the General Part B that units for which a permit is sought will be addressed in TA- or unit-specific Part B permit applications (e.g., the OB/OD Part B) to be submitted separately. LANL is not seeking permitted status for container storage areas, tanks, or surface impoundments at TA-14 because there are none of these unit types subject to RCRA regulation at TA-14. Permitted status is being sought for the OB/OD units located at TA-14 and described in the OB/OD Part B.

   b. *Submit a separate Part B permit application for the surface impoundments, container storage units, and tanks mentioned on page 9-3 of the LANL General Part B Permit Application of August 1996.*

      Response: See previous response.

2. *Provide information on the TA-14 OB/OD units which must include the following information:*

   a. *Provide a description of the maximum extent of the unclosed portion of the OB/OD units during their permitted life;*

      Response: The maximum extent <u>of the operations</u> which will be unclosed during the active life of the facility (i.e., during their permitted life) is 50 pounds per treatment at the OB unit and 20 pounds per treatment at the OD unit. LANL does not intend to reduce the areal extent of either unit during the active life of the units. Both units will eventually undergo closure; LANL does not anticipate leaving unclosed portions of these units. Both the design capacity and the areal extent are addressed in this response, as provided in the "RCRA Guidance Manual for Subpart G Closure and Post-Closure Care Standards and Subpart H Cost Estimating Requirements" (EPA, 1987).

b. *Submit an outline of the procedures for removal of hazardous waste, residues or post investigation derived waste, and contaminated soils as well as the location of disturbed soils when removed;*

Response: As was stated in Section 9.3 of the OB/OD Part B, hazardous wastes will be treated at or removed from the unit to be closed prior to initiation of closure activities. If removal is required, the wastes will be transported to an active, permitted treatment unit in accordance with the most current and approved applicable SOPs (e.g., DX-16:SOP 1.9). See response to Comment F.7 for procedures regarding removal of residues. When LANL decides to close the OB/OD units, the existing closure plan will be revised to present detailed information, including procedures on removal of investigation-derived waste (e.g., contaminated soils, borehole cuttings, decontamination fluids). LANL typically revises closure plans to address conditions at the time of actual closure. The revised closure plan will be submitted to NMED for review and approval. The location and disposition of all wastes generated during closure will be documented in the final closure report.

c. *Provide the estimated year of closure of the OB/OD units;*

Response: The estimated year of closure of the OB/OD units is 2100.

d. *Submit a description of the location and number of copies of the Closure and Post-Closure Plans for OB/OD;*

Response: At a minimum, copies of the closure plan for the OB/OD units at TA-14 will be located at TA-14-23, Room 101. In addition, copies will be maintained at DOE/LAAO, ESH-19, and the DX Facility Management Office. See response to Comment H.2.g.

e. *Name the personnel responsible for storage, updating of facility copies of the Closure and Post-Closure Plans, and the procedure for updating all other copies of the subject plans.*

Response: As stated above, personnel at DOE/LAAO, ESH-19, the DX Facility Management Office, and TA-14 will be responsible for storing their respective copies of the closure plan. Personnel from ESH-19 at LANL will be primarily responsible for updating the plan. The names of these personnel are not provided here because they are subject to frequent change. Updated plans will be identified with the latest revision number throughout the document. See response to Comment H.2.g.

f. *Explain the potential request for extension of closure time.*

Response: LANL does not anticipate the need to request an extension of the time allowed for closure of these units. However, as was stated in Section 9.1.3 of the General Part B and as allowed by the regulations cited therein, LANL may request

an extension if unforeseen events occur prior to or during closure activities and these events necessitate such a request.

g. *Submit a detailed contingency Post-Closure Plan and Post-Closure Care mechanisms as per 20 NMAC 4.1.500 incorporating 40 CFR §264.603 in order to fulfill the requirements of 40 CFR §264.601. This required information was not included in the Subject Application.*

Response: LANL fully intends to achieve clean closure of the OB/OD units at TA-14 by decontamination or removal of contaminated structures, equipment, or media. However, should clean closure not be achieved, a post-closure plan meeting the requirements of 20 NMAC 4.1.500 incorporating 40 CFR §264.603 will be developed for the TA-14 OB/OD units and submitted to NMED for approval.

I. ***Protection of Ground Water***

1. ***Hydrology*** *as required by 20 NMAC 4.1.900 incorporating 40 CFR §270.23(b). The Permit Applicant must provide a detailed description of the hydrology below the OB/OD units at TA-14. (This may be available through published or private reports. Include a copy or copies of the references used.)*

Response: As stated in Section 4.6 of the OB/OD Part B, geologic and hydrologic characteristics of the LANL facility are discussed in Section 2.0 of the General Part B. A detailed description of the hydrogeologic characteristics immediately below the OB/OD units at TA-14 is not currently documented in published or internal reports. However, a conceptual hydrologic model of the area is presented in Section 3.5 of the "RFI Work Plan for Operable Unit 1085" (LANL, 1994).

The U.S. Army Environmental Hygiene Agency's "RCRA Part B Permit Writer's Guidance Manual for Department of Defense Open Burning/Open Detonation Units" states that "ground-water monitoring would only be required for OB units that burn directly on the ground without leak detection and containment systems" and that "OD units, where proper operational procedures are followed (particularly management of residuals), are exempt from the ground-water protection requirements" presented in the manual. It goes on to state that "ground-water monitoring at OD units was deemed to be both impractical and unnecessary." The OB unit's design prevents burning directly on the ground and the unit has a containment system. Proper operational procedures are followed at the TA-14 OD unit and materials not consumed in a detonation are collected for detonation. Together, the OB unit design and operation and the proper operating procedures at the OD unit meet the criteria for exemptions from groundwater monitoring.

NMED's August 17, 1995, letter to DOE/LAAO (see Appendix F of this NOD response) required LANL to develop a RCRA site-wide hydrogeologic workplan and to submit this workplan to NMED and EPA for review and approval. Part of the workplan objective was to address RCRA groundwater monitoring requirements for regulated units; implementation of the plan will also provide information on the hydrology below the OB/OD units at TA-14. Because the workplan will address groundwater monitoring

requirements and because its implementation will provide hydrologic information for TA-14, LANL wishes to defer to that plan where appropriate for relevant issues addressed in this NOD. NMED and LANL are currently addressing LANL's groundwater monitoring program and hydrogeologic characterization requirements under the "Hydrogeologic Workplan," submitted to NMED in December 1996.

The "Hydrogeologic Workplan" proposes the construction and subsequent sampling of 4 alluvial wells and 4 regional aquifer wells upgradient from, adjacent to, and downgradient from TA-14 in Cañon de Valle and in Water Canyon. Well installation will characterize the alluvial, intermediate perched, and regional aquifer zones for a more complete understanding of the hydrogeologic setting. However, the proposed iterative characterization and well installation process will incorporate new data with existing data as input to modeling activities and then be used to reassess additional data needs; therefore, it may be determined that one or more of the wells are not necessary. In any case, the general objectives of the 8 proposed wells near TA-14 are described in Sections 4.3.5.2 and 4.3.6.4 of the plan and are summarized herein.

The planned alluvial wells include A-45 and A-46 upgradient in Cañon de Valle, A-47 downgradient near the confluence of Cañon de Valle and Water Canyon, and A-48 further downgradient in Water Canyon. Alluvial wells A-45 and A-46 are proposed to confirm the presence of alluvial saturation, to measure the parameters in the alluvium that control contaminant migration, and to analyze the quality of the alluvial water. The well A-45 location is upgradient of LANL activities and will provide background water quality characteristics of the alluvial water. Well A-46 will identify the presence of alluvial water, and data from the well may be compared to that from well A-45 to assess impacts of operational practices upgradient from the OB/OD units at TA-14. Alluvial wells A-47 and A-48 are proposed to evaluate the presence of alluvial water and the possible migration of contaminants from Cañon de Valle into Water Canyon alluvium. Well A-47 will also be used to measure the saturated thickness, water quality, and parameters controlling infiltration and contaminant migration. Well A-48 will be used to determine the downstream extent of alluvial water.

The planned regional aquifer wells include R-24 and R-25 upgradient in Cañon de Valle, R-27 downgradient near the confluence of Cañon de Valle and Water Canyon, and R-28 further downgradient in Water Canyon. All of the regional aquifer wells will characterize the intermediate perched zone(s) as the wells are drilled. Well R-24 will be located near the trace of the Pajarito Fault system west of the LANL boundary. Its purpose will be to provide water quality on the upthrown block of a major splay of the fault system. Water level data from this well will be compared to similar data from well R-25 to evaluate the influence of the Pajarito Fault system on the regional aquifer piezometric surface and the role of the fault as a recharge zone for the regional aquifer. Water quality data from R-24 will define the expected background distribution of constituents upgradient from LANL operations. These background data will be used to estimate the impact of LANL operations and provide input data for geochemical and hydrological modeling of the groundwater systems. Well R-25 will be located adjacent to MDA P at TA-16, which is upgradient from the TA-14 OB/OD units. This well will provide needed regional aquifer water level and water quality information and water quality data for any intermediate perched zones encountered. Core will be collected

from R-25 to support sitewide studies of the hydrogeologic framework and constrain geologic and hydrologic relationships in surrounding cored boreholes (e.g., wells R-24 and R-27). Data from wells R-24 and R-25 will also provide important information on flow conditions near the LANL boundary that will enhance groundwater flow modeling. Well R-27 will be located below the confluence of Water Canyon and Cañon de Valle, which is downgradient from the OB/OD units at TA-14. This well will be used to identify intermediate perched zones and the depth to the regional aquifer, and data from this well will be used to characterize the water quality of the intermediate perched zones and in the regional aquifer. Well R-28 will be located downgradient of well R-27. It will also be used to provide water quality information for any intermediate perched zones and the regional aquifer.

2. *Provide site-specific data for initially characterizing the OB/OD units and the surrounding area. Hydrology and geology supportive of published reports must be confirmed through direct methods of data collection. Any saturated zones must be identified. Discuss appropriate spacial and temporal intervals for data collection prior to initiating any data collection program.*

   Response: See previous response.

3. ***Prevention of Releases*** *- Explain what measures will be incorporated into the OB/OD treatment unit design to exclude water from entering the units. [Direct rainfall entering the open burn device and the open detonation pit (created by the blast) could cause a hydraulic head that would drive waste constituents into the vadose zone. Some facilities have used weather covers over their OD pits and burn container devices during periods of inactivity].*

   Response: The OB unit (burn cage) is covered with a tarp when not in use, per DX-2:SOP 6.1.5 (see Appendix A of the OB/OD Part B). The OD unit is located on the ground surface (tuff overlain by a thin layer of sandy soil). There is no pit associated with this unit; therefore, no hydraulic head will be created to drive waste constituents into the vadose zone. In addition, a natural drainage north of and the road west of the OB/OD units divert potential run-on away from the units.

4. *The location map of water supply wells* ***(Map Number 6 in Part A Permit Application)*** *that LANL submitted to HRMB does not show any ground water monitoring or test wells in the vicinity of TA-14. NMED acknowledges receipt of the December 6, 1996 Hydrogeologic Work Plan from LANL. HRMB will evaluate this section within the context of that Plan. However, LANL is required to present the following information to HRMB:*

   a. *Submit a Ground Water Detection Monitoring Program in accordance with all the requirements contained in 20 NMAC 4.1.500 incorporating 40 CFR §264.98. The ground water monitoring wells must include one upgradient and at least two downgradient monitoring wells. Attach a topographic map that shows the location of background water quality monitoring wells at the site of the OB/OD treatment units.*

Response: As was shown on Map 6 of the OB/OD Part A, there currently are no groundwater monitoring or test wells in the vicinity of TA-14. LANL has been working with HRMB to plan and develop a facilitywide groundwater program. The placement of a detection monitoring well(s), if deemed necessary, will be determined by implementation of the "Hydrogeologic Workplan." See response to Comment I.1 for additional information on this issue.

b. *Provide a description of well design, sample collection, preservation, shipment, QA/QC procedures, sampling and analysis procedures, data evaluation and reporting that satisfy the requirements of 20 NMAC 4.1.500 incorporating 40 CFR §264.97. List the indicator parameters and hazardous waste constituents that will be analyzed for, and how monitoring well evacuation will be conducted at TA-14.*

Response: Well designs will follow specifications in Section 4.1.1 of the "Hydrogeologic Workplan" (LANL, 1996). As presented in Sections 4.1.3 and 4.1.4 of the "Hydrogeologic Workplan," sample collection, preservation, shipment, QA/QC procedures, sampling and analysis procedures, data evaluation, and reporting will be conducted according to Environmental Restoration (ER) Project Quality Assurance Project Plans (QAPjP), SOPs, RFI Work Plans, and sampling and analysis plans (SAP). The parameters that will be analyzed for include those listed in the response to Comment F.2 (Table 1). Monitoring well evacuation will be conducted in accordance with guideline in EPA's "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document" (EPA, 1986).

5. *Provide a description of any plume of contamination that has entered the ground water due to previous OB/OD activities. Indicate on the topographic map the vertical and horizontal extent of the plume.*

Response: Currently, there are no wells in place near the OB/OD units at TA-14. The risk assessment conducted in response to Item K (Risk Analysis) of this NOD concludes that after 40 years of operations at TA-14, the current level of contaminants for both surface soil and surface water does not pose a potential significant risk to human health. Therefore, it is highly unlikely that contaminants from previous OB/OD activities have migrated to the groundwater and created a plume of contamination. However, the "Hydrogeologic Workplan" described in the response to Comment I.1 will provide information on water quality in this area.

6. *Present a description of the proposed sampling and analysis and the statistical comparison procedures and data evaluation that will be applied to ground water samples in accordance with 20 NMAC 4.1.900 incorporating 40 CFR §270.14(c)(6)(iv).*

Response: Procedures to be followed for proposed sampling and analysis, statistical comparison procedures, and data evaluation will adhere to those contained in ER Project QAPjPs, SOPs, RFI Work Plans, and SAPs.

7. *Provide an account of how background values for each proposed monitoring parameter or constituent will be determined to meet the requirements contained in 20 NMAC 4.1.900 incorporating 40 CFR §270.14(c)(6)(iii).*

Response: Background groundwater values for barium and chromium will be collected from planned alluvial well A-45 and planned regional aquifer well R-24. These background data will be used to calculate a background mean and variance, per the guidance in Appendix IV of 20 NMAC 4.1, Subpart V, incorporating 40 CFR 264.

8. *Describe how LANL would determine the direction, ground water flow rate, and the rate of plume migration in case of ground water contamination. [20 NMAC 4.1.500 incorporating 40 CFR §264.601(a)(5)].*

Response: According to current published reports, the direction of groundwater flow in the Los Alamos area is generally southeast, as was shown on Figure 2-9 of the General Part B. The flow rate depends on which rock formation the groundwater is located in, as was discussed in Section 2.2.5 of the General Part B. Data collected during activities performed for the "Hydrogeologic Workplan" (described in the response to Comment I.1) will provide more detailed information on groundwater direction and flow rate, and on plume migration rate in case of groundwater contamination.

9. *Provide an account of the precipitation patterns at TA-14, proximity to and withdrawal rates of current and potential ground water users in accordance with the standards required by 20 NMAC 4.1.500 incorporating 40 CFR §264.601(b)(3) and 40 CFR §264.601(b)(5).*

Response: Published precipitation data for TA-14 do not exist; however, a precipitation measurement site is located at TA-16, just south of and adjacent to TA-14, and annual precipitation at this site is 23.28 inches per year ("Environmental Surveillance at Los Alamos during 1995," p. 94 and p. 128). As was stated in Section 4.6.1.1 of the OB/OD Part B, no supply wells are located within 3,500 feet of any of the OB/OD units at LANL, and there are no supply wells located within the boundaries of TA-14. In addition, there are no supply wells located at TA-15, TA-36, and TA-39; these are the locations of the remaining OD units at LANL. Therefore, withdrawal rates are not applicable to any of the OB/OD units at LANL.

10. *Provide an account of water quality standards, water quality data and uses. These data will allow NMED to evaluate the impact of the activities at the OB/OD units on surface aquatic environment in compliance with the requirements of 20 NMAC 4.1.500 incorporating 40 CFR §264.601(b)(7), and 40 CFR §264.601(b)(8).*

Response: Water quality standards are contained in 20 NMAC 6.1, effective January 23, 1995. General standards that apply to LANL are contained in 20 NMAC 6.1, Section 1102. Surface water runoff sampling was conducted downslope of the OB/OD units during the summer of 1995 to quantify the concentrations of potential hazardous constituents. Gas chromatography/mass spectrometry results showed no detectable amounts of volatile and semivolatile organic compounds. Graphite furnace atomic absorption spectroscopy results for metals showed the following: barium, 120 μg/L; beryllium, 3 μg/L; cadmium, 1.0 μg/L; chromium, 5.8 μg/L; and lead, 11 μg/L (see QEW-1 data in Appendix G of this NOD response). As was stated in Section 4.6.2.1 of the OB/OD Part B, surface waters in the vicinity of the OB/OD units at TA-14 are limited to ephemeral streams in Cañon de Valle; thus, these surface waters

do not provide municipal or industrial water supply. Under LANL's NPDES permit issued August 1, 1994, water uses include livestock and wildlife watering. Wildlife habitat standards are contained in 20 NMAC 6.1, Section 3101, Paragraph L.

J. ***Air Quality Assessments*** *as required in 20 NMAC 4.1.500 incorporating 40 CFR §264.601(c)(1) and 20 NMAC 4.1.900 incorporating 40 CFR §270.23(b).*

LANL must submit the following information to NMED:

1. *Provide a description of the operating conditions of the OB and OD units on a case-by-case basis. [Examples are: not to expose ash residues from the OB unit to the open air when wind speed is greater than 15 miles per hour (24 km/hr), allowable quantities of waste per unit, operating time frames, acceptable meteorological conditions, ambient air monitoring requirements, meteorological, monitoring etc.].*

   Response: Operating conditions for the OB and OD units at TA-14 were described in Sections 4.1 and 4.5 and in the SOPs (e.g., DX-2:SOP 6.1.5; DX-16:SOP 6.1) provided in Appendix A of the OB/OD Part B. In summary, operating conditions for the OB unit include removing ash residue after a safe period of time (approximately 24 hours) and then covering the OB unit with a tarp; accepting only 50 pounds of combustibles per burn, which is the maximum allowable quantity of waste for this unit; transporting waste to the OB unit on the day of the treatment; conducting only one burn per day due to the 24-hour post-burn waiting period; and not conducting burning operations during adverse weather conditions (e.g., electrical storms, high winds). OB operations are postponed if the mean wind speed is equal to or greater than 10 meters per second, atmospheric stability conditions are unsuitable, and/or the mixing depth is less than 200 meters (see Appendix H). Operating conditions for the OD unit include not conducting detonation operations during adverse weather conditions (e.g., electrical storms, high winds); accepting only 20 pounds of waste HE per detonation, which is the maximum allowable quantity of waste for this unit; and transporting wastes to the OD unit on the day of the treatment. Beginning in 1990, NMED operated the LANL-owned criteria pollutant (ambient air) monitoring station at TA-49, adjacent to Bandelier National Monument and approximately 10,000 feet SSE of TA-14. The original purpose of this site was to collect baseline data for Bandelier National Monument over a three-year period. In 1994, the National Park Service, NMED, and LANL all agreed that the original purpose of the study was fulfilled and that the low levels of pollutants measured did not warrant further study at the site. Therefore, the ambient air monitoring was discontinued on September 30, 1994. Because the measured pollutants are so low and because air quality impact modeling results do not indicate the need (see response to Comment J.2 below), ambient air monitoring is not conducted at TA-14. The closest meteorological monitoring station is located at TA-6, approximately 1 mile north of TA-14. Wind speed data are available from this station.

2. *Submit a description of the effectiveness and reliability of any systems and structures used to reduce or prevent emissions of hazardous constituents to the air. This may be demonstrated by semi-annual sampling and analysis programs following the last semi-annual waste treatment event; [20 NMAC 4.1.500 incorporating 40 CFR §264.601(c)(2)].*

Response: By definition (see 20 NMAC 4.1.101 incorporating 40 CFR §260.10), "open burning means the combustion of any material without ... control of emissions of the gaseous combustion products." As such, emissions of hazardous constituents to the air are not prevented; however, the burn cage is operated with a wire mesh cover during treatment operations to reduce the potential for releases of burning particles to the environment. Air quality impact modeling was performed assuming a worst-case waste treatment and receptor location for open detonation; results of this modeling were provided in Attachment 4-9 of the OB/OD Part B. Air quality impact modeling was also performed for the TA-14 OB unit; results of this modeling are provided in Table 9 of Appendix I of this NOD response. Ambient air sampling is not conducted at the site because the air quality impact modeling results for the OB unit at TA-14 and for a worst-case OD scenario do not support the need for ambient air sampling.

K. *Risk Analysis*

Provide a Risk Analysis that includes the following issues:

1. *A description of the existing air quality, other sources of contamination and the potential cumulative impact on human health and the environment. Present an estimate of the individual excess lifetime cancer risk.*

   Response: At a meeting on August 12, 1997, NMED requested that the language in Comments K.1 and K.2 be modified and treated as one comment.

   An evaluation of human health risks was conducted and included a complete description of available on-site analytical data and off-site modeled concentrations (including those for air, surface water, and soil). This evaluation also included an exposure assessment (with potential receptors and complete exposure pathways), a toxicity assessment, and a risk characterization which, together, assess the potential cumulative impact on human health and the environment. The evaluation of human health risks is included in Appendix J of this NOD response, and includes both hazard quotients and incremental lifetime cancer risks. An estimate of the individual excess lifetime cancer risk is summarized in Table 3-4 of Appendix J. The potential receptors at TA-14 include residential, occupational, and recreational. An evaluation of complete and incomplete exposure pathways for each of the potential receptors is also presented in Appendix J of this NOD response. For OB/OD operations at TA-14, the primary receptor is an on-site worker.

2. *An outline of the potential for health risks caused by human exposure (including the explosive ordnance disposal personnel) to hazardous waste constituents;*

   Response: See response to Comment K.1.

3. *A discussion of potential damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to hazardous waste constituents from the OB/OD units. Discuss other exposure pathways such as: plant ingestion by herbivores, prey consumption by carnivores, and water ingestion pathways;*

Response: At a meeting on August 12, 1997, NMED requested that the language in Comment K.3 be modified to read only "Evaluate the food web."

An evaluation of ecological pathways and predicted risk is presented in Appendix J of this NOD response. The ecological receptors selected include: a non-specific perennial plant, vagrant vole (insectivore), western harvest mouse (omnivore), Montane vole (herbivore), gray fox (omnivore), American kestrel (insectivore), and Mexican spotted owl (carnivore). Using the 95 percent upper confidence limit of the mean concentration, potential ecological risk was only predicted for the mouse, vole, and fox exposed to HMX, RDX, and TNT; and the kestrel exposed to bis(2-ethylhexyl) phthalate (hazard quotient = 10.3). TA-14 is not utilized by domestic animals or crops. Surface water associated with the site consists of infrequent runoff and was not evaluated as a source of drinking water. However, potential impacts to aquatic biota in surface water associated with the drainage in Cañon de Valle were assessed. For this evaluation, barium, beryllium, cadmium, and total lead were included as the constituents in surface runoff that may be hazardous to aquatic biota using the 95 percent upper confidence limit as the exposure concentration.

4. *An account about the presence of the following endangered or threatened species at or around the TA-14 OB/OD treatment units:*

   a. *Bald Eagle (Haliaeetus leucocephalus alascanus);*
   b. *Jemez Mountains Salamander (Plethodon neomexicanus);*
   c. *American Peregrine Falcon (Falco peregrinus anatum);*
   d. *Whooping Crane (Grus americana);*
   e. *Broad-billed Hummingbird (Cynanthus latirostris magicus);*
   f. *Southwestern Willow Flycatcher [Empidonax ludovicianus (3ssp.)];*
   g. *Gray Vireo (Vireo vicinior); and*
   h. *Meadow Jumping Mouse (Zapus hudsonius luteus)*

Response: At a meeting on August 12, 1997, NMED requested that the language in Comment K.4 be modified by deleting "An account about the presence of" and replacing this language with "In the evaluation, consider the potential exposure of". In addition, NMED requested that LANL add the Mexican Spotted Owl (*Strix occidentalis lucida*) as Item K.4.i.

The following accounts describe the potential for exposure of each of the species as a result of thermal treatment operations at the TA-14 OB/OD units.

a. **Bald Eagle.** Bald eagles migrate and winter along the Rio Grande, roosting in White Rock Canyon and hunting on Cochiti Reservoir, as far upstream as Alamo Canyon. Storm water runoff from the area of the OB/OD units is hydrologically connected to this part of the Rio Grande through Cañon de Valle and Water Canyon, over a distance of about 9 miles, making possible a pathway for chemicals from this site to enter the food chain for this species. However, the large degree of dilution occurring along the path to the Rio Grande coupled with dilution within the reservoir itself would make this exposure pathway insignificant.

b. **Jemez Mountains Salamander.** The Jemez Mountains salamander has been recorded in several canyons that cross LANL boundaries. The species occurs in moist locations, such as rotting logs, and especially on north-facing slopes with slopes greater than 37 percent. It has been recorded at elevations ranging from over 10,000 feet down to 7,180 feet (in Los Alamos Canyon). In Cañon de Valle, the Jemez Mountains salamander has been found at an elevation of 8,101 feet. Thus, the OB/OD units are situated at the lower extreme of the known elevation range of this species and nearly 700 feet below its known occurrence in Cañon de Valle. Because the slopes below this site are south-facing, it is highly unlikely that the moist microhabitat conditions necessary for this species exist on these slopes. Therefore, due to the absence of favorable habitat conditions, it is unlikely that this species will be affected by thermal treatment operations at the OB/OD units.

c. **American Peregrine Falcon.** American peregrine falcon nesting habitat (cliffs) has been identified in Los Alamos County, north of LANL. The species has been observed on occasion in the area of LANL, but no nests have been recorded there. Lower Water and Ancho Canyons are marginally suitable for falcons, but no observations of the species have been made in the area of TA-14. Therefore, the potential for exposure of this species to chemical constituents resulting from thermal treatment operations at the OB/OD units is very low.

d. **Whooping Crane.** Whooping cranes migrate with sandhill cranes along the Rio Grande to and from their wintering areas in central New Mexico (e.g., the Bosque del Apache National Wildlife Refuge) and other locations farther south. They use open fields and shallow bodies of water for feeding and resting during migration. Migratory flights between these locations tend to be at high altitudes for extended distances. Because open habitats favorable to this species do not occur at LANL, it is not expected that this species will be present within LANL boundaries except possibly as a fly-over. Thus, the potential for exposure of this species as a result of thermal treatment operations at the TA-14 OB/OD units is very low.

e. **Broad-billed Hummingbird.** The broad-billed hummingbird nests in arid scrublands of southern New Mexico and occurs as far north as LANL as a vagrant. Thermal conditions limit the northern extent of successful breeding in this species. Therefore, its potential for occurrence at or near the OB/OD units is low, and the possibility of it nesting in the area is very remote. Consequently, the potential for exposure of this species to hazardous constituents resulting from thermal treatment operations at the TA-14 OB/OD units is low.

f. **Southwestern Willow Flycatcher.** The southwestern willow flycatcher is known to occur in the Jemez Mountains, but breeding has not been confirmed there. Willow flycatchers nest in wooded riparian areas, particularly in willow-cottonwood associations. This species has been detected on LANL property. Although potential habitat exists for this species in Pajarito Canyon, it is unlikely to occur at or near the TA-14 OB/OD units due to the lack of favorable habitat in Cañon de Valle. Consequently, the potential for exposure of this species to hazardous constituents resulting from thermal treatment operations at the TA-14 OB/OD units is very low.

g. **Gray Vireo.** The gray vireo nests in piñon-juniper woodlands throughout much of central New Mexico, occasionally being as far north as Santa Fe. It has not been recorded in the area of TA-14. Consequently, the potential for exposure of this species to hazardous constituents resulting from thermal treatment operations at the TA-14 OB/OD units is very low.

h. **Meadow Jumping Mouse.** The meadow jumping mouse is typically found in dense, tall, grassy vegetation, especially near streams, meadows, and other wetlands. The species occurs at higher elevations and populations have been found along the Rio Grande in the central part of New Mexico. It has not been recorded in Los Alamos County and species-specific surveys at LANL have failed to document it in areas of favorable habitat. Because favorable habitat for this species does not occur at or near the OB/OD units at TA-14, it is highly unlikely that this species will be affected by thermal treatment operations at the site.

i. **Mexican Spotted Owl.** The Mexican spotted owl has been documented at LANL, and nesting and roosting habitat for this species has been identified along Cañon de Valle, adjacent to TA-14 (LANL, 1997). Therefore, the potential exists for this species to occur at or near the OB/OD units. This species was used in the evaluation of ecological pathways.

References:

Los Alamos National Laboratory (LANL), 1995, *Biological and Floodplain/Wetlands Assessment for Environmental Restoration Program Operable Unit 1085, TAs 14 and 67 (Draft)*, LAUR 95-648, Los Alamos National Laboratory, Los Alamos, New Mexico.

Los Alamos National Laboratory (LANL), 1997, *Preliminary Risk Assessment of the Mexican Spotted Owl under a Spatially-Weighted Foraging Regime at the Los Alamos National Laboratory*, LA-13259-MS, Los Alamos National Laboratory, Los Alamos, New Mexico.

5. *A description of any sensitive receptors within a 2 kilometer radius, and an estimate of exposed individuals living and/or working on the OB/OD premises;*

Response: At a meeting on August 12, 1997, NMED requested that the language in Comments K.5, K.6, and K.9 be modified to read only "Evaluate the potential residential and workers exposure scenarios. Consider all potentially affected media and relevant exposure pathways."

As summarized in the response to Comment K.3, all potential receptors within a 2 kilometer radius are evaluated in Appendix J of this NOD response. For the human health evaluation, the only receptors within a 2 kilometer radius are LANL employees.

As stated in the response to Comment K.1, calculations of lifetime cancer risk are summarized in Table 3-4 of Appendix J of this NOD response. Included in these calculations are risks to on-site personnel during routine operations using on-site

analytical data, and risks to off-site personnel using available air modeling concentrations.

As outlined in the responses to Comments K.1 and K.2, all potential receptors at TA-14 are evaluated in Appendix J of this NOD response. All major exposure pathways are included in the risk calculations. For surface soil, these pathways include ingestion, dermal contact, and inhalation of fugitive dust. A complete description of the exposure models used in the risk calculations is also provided in Appendix J of this NOD response.

6. *Calculations of the lifetime cancer risk as a function of downward concentrations, unit risk value, and exposure duration;*

Response: Calculations of lifetime cancer risk are presented in Table 3-4 of Appendix J of this NOD response.

7. *An explanation of how atmospheric air quality will be monitored to detect air borne hazardous waste contaminants and constituents during the active life of the OB/OD units. Section 4.6.4.2 of LANL's Part B Permit Application mentioned that efforts to detect "air borne contaminants at TA-14 have not yet been established", explain why.*

Response: Section 4.6.4.2 of the OB/OD Part B stated "Atmospheric monitoring efforts to detect airborne contaminants at TA-14 have not yet been established." Air quality impact modeling, provided as Attachment 4-9 of the OB/OD Part B, shows that a worst-case scenario using 100 times the allowable volume capacity of the OD unit at TA-14 resulted in concentrations far below the ambient air quality standards. Air quality impact modeling, provided in Table 9 of Appendix I of this NOD response, for the OB unit at TA-14 also resulted in concentrations below the ambient air quality standards. In addition, as discussed in the response to Comment J.1, the National Park Service, NMED, and LANL all agreed in 1994 that the low levels of ambient air criteria pollutants measured over a three-year period at the site of the nearest receptor did not warrant further ambient air monitoring. Therefore, ambient air quality monitoring is not warranted at the TA-14 OB/OD units.

8. *Provide a detailed network of receptor points to permit the estimation and identification of receptor points that are exposed to maximum contaminant concentrations.*

Response: As discussed in the response to Comment K.3, several ecological receptors occupying different trophic levels were used in the ecological risk assessment for TA-14 (see Appendix J of this NOD response). In each instance, the lower value of either the maximum detected concentration in soil or the 95 percent upper confidence limit of the mean concentration was used as the exposure concentration.

9. *Provide a detailed estimation of the exposed population. The noninhalation pathways (ingestion and dermal) must be addressed using appropriate pathway exposure models. (The* U.S. Army Environmental Hygiene Agency Guide *may be used for reference].*

Response: See response to Comment K.5.

10. *If operating procedures will require wetting of the open burn area before and after each operation, describe how this will be accomplished and what measures will be taken to minimize release of hazardous waste to the environmental media.*

Response: SOPs do not require wetting of the open burn area before and after each operation. Measures taken to minimize releases of hazardous waste from the open burn area to environmental media include using sufficient fuel to aid in ignition and enhance waste destruction, covering the top of the burn cage with wire mesh to minimize the release of burning material, not conducting operations during adverse weather conditions (e.g., high winds [see response to Comment J.1]), and using secondary containment beneath the OB unit to contain treated or undestroyed material and ash residue.

11. *Provide a brief historical description of TA-14 and the OB/OD areas, and the presence of any archeological sites.*

Response: A brief historical description of TA-14 and the OB/OD areas was provided in Section 2.1.1 of the OB/OD Part B. There are 4 archeological sites within a 1,200-foot radius of the OB/OD units; the closest site is approximately 800 feet from the units ("Firing Site Impacts to Cultural Resources," Beverly M. Larson and Don A. McClure, Cultural Resources Assessment Report No. 131, September 1996 draft). There are no archeological sites within the hazard zone (a radius of approximately 700 feet) surrounding the OB/OD units.

L. ***Potential Pathways of Exposure and Potential Exposure Magnitude*** *as required in 20 NMAC 4.1.900 incorporating 40 CFR 270.23(c). The Permit Applicant must describe the potential for the public to be exposed to hazardous wastes. Include*

1. *Information on how long waste will remain in the unit before it is detonated, the length of time after operation of the unit before re-entry of personnel to the detonation site is allowed, and*

Response: Waste to be detonated is transported to the OD unit on the day of treatment. Only the amount of waste that can be treated in one day is transported to the unit (i.e., 20 pounds for the OD treatment unit). Depending on preparation activities, the time during which waste may remain at the unit typically ranges from several minutes to a few hours. The Firing Leader determines when it is safe to re-enter the detonation site, as described in DX-16:SOP 6.1.

2. *Procedures for management of ash residues, unexploded ordnance, and post-detonation soils.*

Response: Ash residues from the OB unit are removed 24 hours or more after treatment (a time sufficient to allow complete cooling) and are containerized and managed appropriately outside of TA-14-23. Unexploded ordnance is not treated at TA-14. SOPs for OD require a thorough survey of the area after detonation, collection of identifiable pieces of material not consumed by the detonation, and subsequent detonation of these materials. See response to Comment F for information regarding post-detonation soils.

M. ***Health and Safety Plan***

Provide health and safety procedures during waste management operations in the form of a stand-alone health and safety plan for routine operations at the OB/OD units.

Response: The health and safety procedures followed by site personnel during routine operations are discussed in the SOPs that were included in Appendix A of the OB/OD Part B. LANL is providing additional and/or updated SOPs, where applicable, in Appendix C of this NOD response.

N. ***Noise Considerations*** *and the distance of OB/OD units from off-plant inhabited buildings, and minimum safety distances to the property of others in compliance with 20 NMAC 4.1.600 incorporating 40 CFR §265.382.*

1. *Describe how noise from open detonation activities will be controlled, since noise will be carried in the direction of the wind towards the city of Los Alamos.*

   Response: Noise resulting from treatment activities is controlled by conducting treatment in a remote area within LANL boundaries. Impulse noise measurements were made at TA-14 during the detonation of HE on two separate occasions in 1991. The TA-14 noise level data are provided in Appendix K of this NOD response. The noise levels of three 20-pound detonations were recorded at four locations in relatively close proximity to the detonation area. (Note: 20 pounds of HE is the maximum amount of waste that can be treated by OD at TA-14). The average noise level at the TA-14 site gate, located approximately 460 feet away, was 145 decibels (dB). Although noise level readings were not taken beyond the distance to the site gate, it is reasonable to assume that the noise level exposure to the nearest public receptor located over 6,000 feet away would be within acceptable limits. (For comparison purposes, six noise measurements made in White Rock [located more than four miles to the southeast] during detonations at the TA-15 PHERMEX site yielded a maximum peak noise level of 71.6 dBA for a 100-pound HE detonation. The TA-14 OD site is nearly six miles from White Rock and over two miles from the nearest approach to the Los Alamos townsite.) Workers involved in actual OD operations are stationed in the control room during detonation and, based on the levels measured, would receive exposure to approximately 122 dB, which is below the occupational exposure limit of 140 dB set by the American Conference of Governmental Industrial Hygienists.

   LANL fully meets the minimum distance requirements of 20 NMAC 4.1.600 incorporating 40 CFR §265.382. The maximum amount of waste that can be treated at the OD unit at TA-14 is 20 pounds; this amount requires a minimum distance of 670 feet from the property of others. As can be seen on Map 2 of the OB/OD Part A, LANL maintains a safe distance greatly exceeding the minimum required distance.

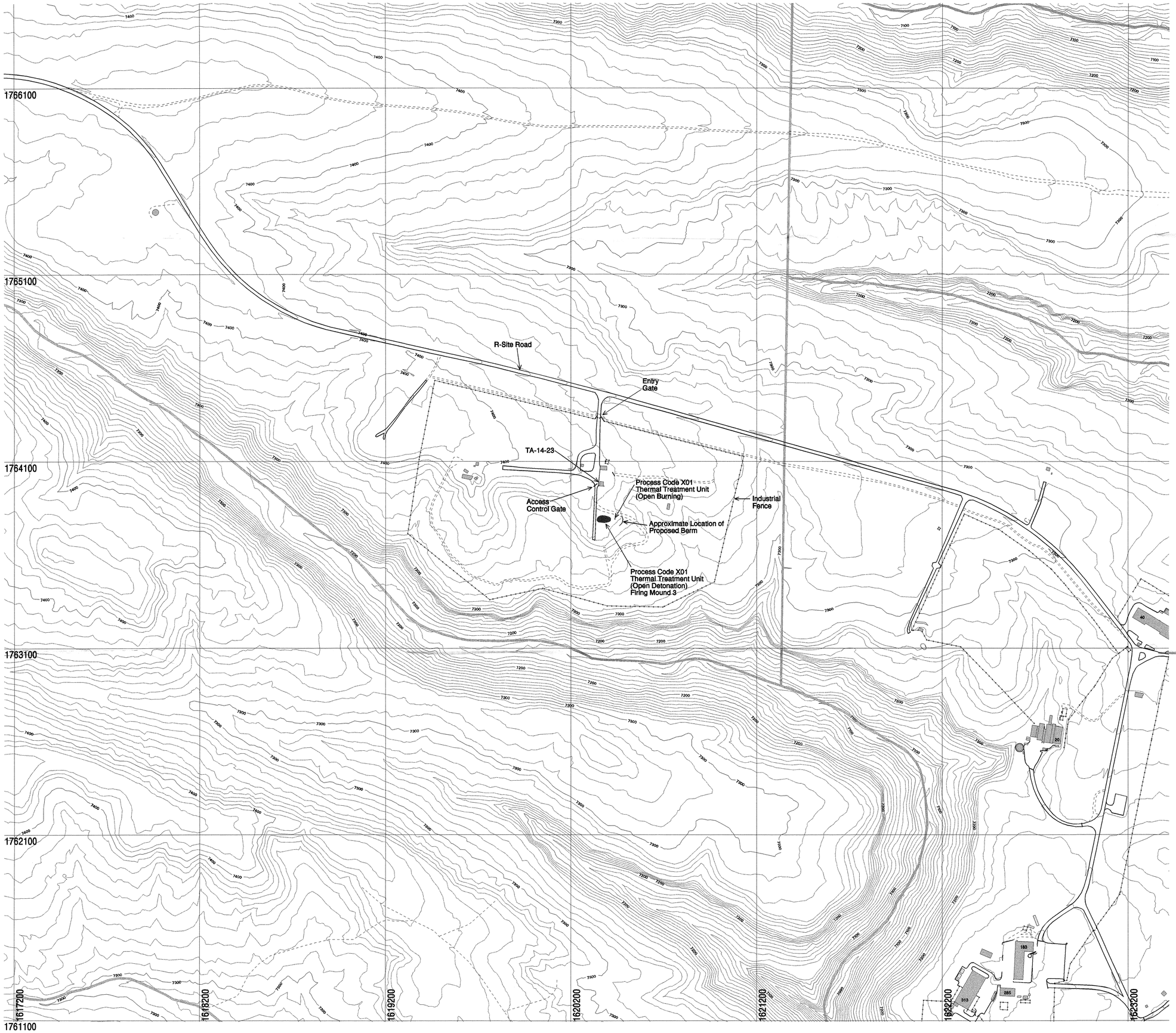
2. *Describe a method for determination of ground vibration at the OD unit, and specify the maximum ground vibration resulting from OD blasts.*

   Response: LANL does not measure ground vibration during OD treatment operations. Due to the unit's remote location, the limited amount of waste treated per detonation,

and the infrequency of treatment operations (up to 6 OD treatment operations per year), potential impacts to human health and the environment resulting from ground vibration are reasonably assumed to be minimal.

Appendix A

Revised Map 2 from the OB/OD Part A Permit Application



LEGEND

- Berm, Proposed
- Boundary, TA
- Contour, 10 foot
- Contour, 100 foot
- Fence, Industrial
- Fence, Security
- Road, Paved
- Road, Dirt
- Road/Trail
- Permanent Structure
- Temporary Structure

3866

MAP 2:
Contour Map Showing Hazardous Waste Units at Technical Area (TA) 14

N

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 1000
Feet per inch on map = 250

SCALE 1:3000

0 76 152 228 304

METERS

0 250 500 750 1000

FEET

NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1995. Contour data are from a September 1991 aerial survey. All other data are from various sources and are part of the FIMAD repository.

University of California
Los Alamos National Laboratory
Earth and Environmental Sciences Division

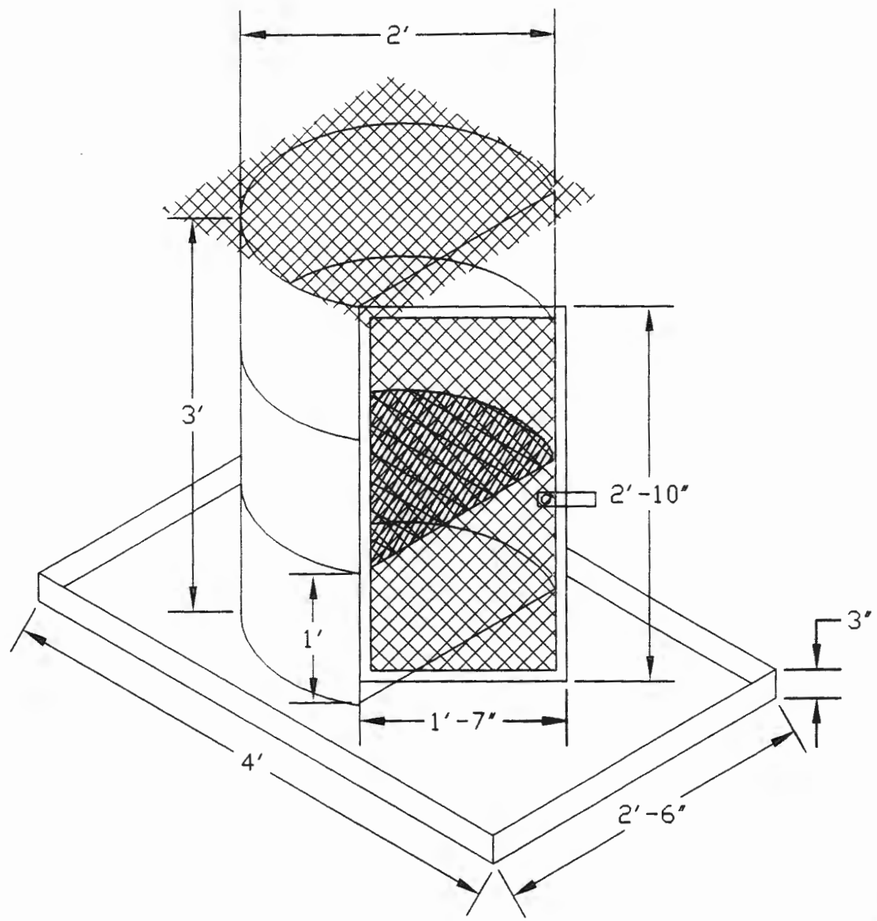
FIMAD Facility for Information Management, Analysis, and Display
FIMAD is the electronic data repository for the Environmental Restoration Project at Los Alamos National Laboratory.

Produced by: Marcia Jones

Date: September 25, 1997 FIMAD Plot ID: G105867

Appendix B

Engineering Drawing of the Technical Area 14 Open Burning Unit



NOT TO SCALE

JEFFREY K. TUCKER
NEW MEXICO
12183
REGISTERED PROFESSIONAL ENGINEER

NO	DATE	CLASS REV.	REVISIONS	DWN	DES	CHKD	REL	SUB	REC	APP

INTERNATIONAL TECHNOLOGY CORPORATION

THERMAL TREATMENT
(OPEN BURNING) UNIT NEAR
TA-14, BLDG 23

TA-14

DRAWN	D. MEADOWS
DESIGN	–
CHECKED	J. TUCKER
RELEASED	K. MUNYON
DATE	08-22-97

SUBMITTED | RECOMMENDED | APPROVED

Los Alamos — Los Alamos National Laboratory, Los Alamos, New Mexico 87545

SHEET 1 OF 1

CLASSIFICATION: REVIEWER: DATE:

PROJECT ID: 766969.10

DRAWING NO

REV

Appendix C

Additional and/or Updated Standard Operating Procedures

DX DIVISION

STANDARD OPERATING PROCEDURE

FOR

PACKAGING AND TRANSPORTATION OF

HAZARDOUS MATERIALS

SOP-3

Prepared by: Stephen J. DePaula — Date: 1-16-97
Stephen J. DePaula, DX-1

Approved by: Kathy Smith — Date: 1/16/97
Kathy Smith, Group DX-1 ES&H Officer

Approved by: [illegible] — Date: 3/21/97
ESH Deployed Team

Approved by: B. Pruit Ginsberg — Date: 3/20/97
B. Pruit Ginsberg, DX-1 Group Leader

Approved by: [illegible] — Date: 3/21/97
DX-DO Operations Coordinator

CONTENTS

1.0 INTRODUCTION

2.0 PURPOSE

3.0 SCOPE

4.0 DEFINITIONS

5.0 RESPONSIBILITIES
- 5.1 DX-Division Line Management
- 5.2 Packaging and Transportation Coordinator
- 5.3 Packaging and Transportation Customer

6.0 PRECAUTIONS AND LIMITATIONS
- 6.1 General Precautions
- 6.2 On-Site/Off-Site Limitations
- 6.3 Authorized/Qualified Limitations
- 6.4 Required Training
- 6.5 Explosive and Radioactive Contaminated Materials
- 6.6 General Explosives Transportation Precautions
- 6.7 Authority to Receive HAZMAT
- 6.8 Laboratory "Shippers of Record"

7.0 PROCEDURAL STEPS
- 7.1 On-Site, Intra-Laboratory, and Off-Site Shipments
- 7.2 Shipment Preparation
- 7.3 Quality Assurance
- 7.4 Emergency Procedures

8.0 REQUIRED DOCUMENTS

9.0 REFERENCES

10.0 ATTACHMENTS

231

1.0 INTRODUCTION

The Dynamic Experimentation Division (DX) conducts operations and performs experiments requiring the use of various hazardous materials (HAZMAT) such as: Explosives, Gases, Flammable liquids and solids, Oxidizers, Poisons, Radioactive materials, Corrosives, and miscellaneous hazardous materials. Laboratory policy requires that all hazardous materials be packaged and shipped safely and in full compliance with all applicable regulations. This policy is intended to help ensure that personal, public and environmental exposures associated with the packaging and transportation of hazardous materials are minimized. Packaging and transportation of hazardous materials is regulated by the federal government and the DOE Explosives Safety Manual. This Standard Operating Procedure (SOP) describes methods to ensure DX Division personnel involved with all aspects of packaging and transportation of hazardous materials are in compliance with these regulations and policies.

2.0 PURPOSE

The purpose of this SOP is to describe the requirements and procedures to facilitate the safe handling and shipment of hazardous materials for movement within or outside of the Division.

3.0 SCOPE

This SOP is applicable to all DX-Division personnel involved the packaging and transportation of hazardous materials within the DX-Division Technical Areas (On-site), on public roads within Los Alamos County (Intra-Laboratory), and outside the Laboratory (Off-site).

4.0 DEFINITIONS

Authorized Personnel — A DX-Division employee who has demonstrated to his/her line manager the skills required to perform tasks associated with handling and transportation of hazardous materials. Individual is specifically authorized, in writing, by name, group, task and hazardous materials.

Hazardous Material (HAZMAT) — A material or substance that has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety and property when transported in commerce. The term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials as defined in 49 CFR 171.8, materials listed in the Hazardous Materials Table 49 CFR 172.101 and

172.102, and materials that meet the defining criteria for hazard classes and divisions listed in 49 CFR 173.2.

HAZMAT Employee

A person employed by a HAZMAT employer who in the course of employment directly affects hazardous materials transportation safety. This term includes owner-operators of motor vehicles that transport hazardous materials in commerce. It also includes any individual who during the course of employment:

1. Loads, unloads or handles hazardous materials;
2. Tests, reconditions, repairs, modifies, marks or otherwise represents containers, drums, or packaging as being qualified for use in the transportation of hazardous materials;
3. Prepares hazardous materials for transportation;
4. Is responsible for safety of transporting hazardous materials; or
5. Operates a vehicle used to transport hazardous materials.

HAZMAT Employer

An employer who uses one or more of its employees in connection with the activities listed for a HAZMAT employee. The Los Alamos National Laboratory and its subcontractors are HAZMAT Employers.

Hazardous Materials Transfer Form (HMTF)

The Laboratory form that acts as a shipping manifest for non-radioactive hazardous materials shipped within the Laboratory. It contains such information as the names of the hazardous materials being transported, the quantities of HAZMAT being transported and an emergency response telephone number. (See attachments for an example of this form).

Intra-Laboratory

The movement of hazardous materials between Laboratory buildings, Technical Areas or across public roadways to which the public has uncontrolled access. Intra-Laboratory shipments must conform to DOT regulations.

Material Safety Data Sheet (MSDS)

The document that provides detailed technical information relating to a specific hazardous material. Required by OSHA to accompany hazardous materials in the workplace.

Off-Site	The movement of hazardous materials beyond the confines of the Laboratory to another site. The shipment must conform to DOT regulations.
On-Site	The transfer of hazardous materials between Laboratory buildings within controlled areas (not across roadways to which the public has access). The transfer must conform to the requirements of the LANL Packaging and Transportation Manual. On-Site is sometimes referred to as "behind the fence".
Originator (Customer)	The person or organization that owns the hazardous material and wishes to make an off-site, intra-laboratory or on-site shipment.
Packager	Performs the physical preparation of HAZMAT packaging, i.e. places material in packages, assembles internal packaging components, secures and fastens packaging, marks and labels the package.
Qualified Personnel	Personnel trained and certified to perform tasks associated with hazardous material packaging and transportation.
Radioactive Material Transfer Form (RMTF)	Same as HMTF. Specifically for Radioactive Materials.
Shipper	The person or organization shipping the hazardous material. Shipping includes classifying, preparing or signing shipping documents to ship or offer materials for shipment. LANL training requirements must be met before a person can be authorized as a qualified shipper at LANL.
UN Packaging	A packaging which conforms to the specifications in 49 CFR or the International Air Transport Association (IATA) Dangerous Goods Regulations. Sometimes referred to as UN Standard or Performance Oriented Packaging (POP).

5.0 RESPONSIBILITIES

5.1 DX-Division Line Management

- Ensures that the necessary policies, procedures, and resources are provided for Division personnel to perform the tasks required to safely package and transport hazardous materials.
- Provide a current listing of personnel within DX-Groups authorized to perform tasks associated with the handling and movement of hazardous materials within the Group.

5.2 DX-Division Packaging & Transportation Coordinator

- Identify, package, handle, mark, label and transport hazardous material and non-hazardous material for shipment on-site, intra-Laboratory and off-site.
- Prepare required shipping documentation for hazardous materials and non-hazardous materials. Documentation includes: HMTFs, RMTFs, Purchase Requests (PRs) Checklists and Shipping Manifests (SMs).
- Coordinate with Laboratory "Shippers of Record" for Division hazardous material shipments.
- Implement DOT, DOE, LANL, DX-Division, and DX-Group P&T policies and procedures.
- Develop and maintain the DX-Division P&T database for HAZMAT shipments.
- Earn and maintain certifications and qualifications as a LANL HAZMAT Shipper, Packager, Shipper by Air, RAM Shipper, Waste Shipper, and Explosives Shipper. Provide technical guidance for training requirements for DX-Division HAZMAT employees.
- Ensure that DX-Division P&T activities are in full compliance with all established directives.
- Mitigate improperly prepared HAZMAT shipments.
- Act as and coordinate oversight for all DX-Division internal and external P&T audits and assessments.
- Develop DX-Division P&T policies and procedures.
- Receive hazardous materials for the Division.

5.3 P&T Customer

- Submit DX-Division P&T Request for services in a timely manner to provide P&T Coordinators reasonable time to prepare shipment and meet Customer's required delivery date.
- Provide adequate information to enable P&T Coordinators to properly identify, package, mark, label and prepare required shipping papers to facilitate shipment. This includes an accurate, up-to-date MSDS for the material being shipped.
- Ensure that Consignee is authorized to receive HAZMAT.

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Many of the chemicals used in homes on a daily basis are not regulated; however, once they are put to use in a "Laboratory Environment," they may be regulated and require that specific P&T procedures be followed for on-site, intra-laboratory and off-site shipment. If there is doubt whether a material is hazardous or not, contact the P&T Coordinators for a determination.

6.2 Currently, the Laboratory is permitted to move hazardous materials On-Site- within the confines of Laboratory recognized controlled access areas (behind the fence). These movements of HAZMAT are authorized by DOE because of controls demonstrated by the Laboratory. These controls, in the form of access control, employee training, and written safety procedures, allow for relief from DOT regulations and permit movement of hazardous materials as what normally would be a prohibited practice. DOE requires that On-Site movement of hazardous materials demonstrate the maximum control and safety of operation as practicable to accomplish the mission.

All Intra-Laboratory and Off-Site shipments of hazardous materials form DX Division shall be coordinated through the Division P&T Team.

6.3 DX-Division Line Management is required to identify and designate authorized personnel within specific groups who are permitted to handle and transport hazardous materials on-site. The DX-Division P&T Coordinators are the Laboratory certified/qualified shippers of HAZMAT for intra-Laboratory and off-site hazardous material shipments for the Division. DX-Division Waste Management Coordinators are the recognized shippers of waste for the Division.

6.4 A HAZMAT employee who performs any function regulated by hazardous material regulations may not perform that function unless he or she has received training as described in Subpart H of Part 172 of 49 CFR. Every HAZMAT employee must receive both initial and recurrent training that includes--

- General awareness/familiarization training
- Function-specific training
- Safety training
- Testing

In DX Division, personnel assigned to the P&T Team and the Waste Management Coordination Team are trained/certified HAZMAT Employees.

6.5 The P&T Customer is responsible for ensuring that materials being shipped are correctly identified as either hazardous or nonhazardous. Nonhazardous materials shall be screened to ensure they contain no explosive or radioactive contamination.

6.6 General Explosives Transportation Requirements (See attachment VII).

6.7 The P&T Customer is responsible for ensuring that persons or organizations intended to receive hazardous materials shipped from DX-Division are authorized and prepared to receive these shipments and that approved storage facilities exist for the materials shipped. For On-Site and Intra-Laboratory shipments this requirement is addressed in the LANL Administrative Manual, AR 6-6. Explosive shipments intended for non-DOE facilities shall be approved by the LANL Explosives Review Committee prior to shipment.

6.8 Off-Site shipments of hazardous materials are required to be processed through the Laboratory "Shipper of Record." Explosives, classed 1.1, 1.2 and 1.3, are transferred from DX-Division to ESA-WMA for Off-site shipment. Explosives, classed 1.4, may be transferred to ESA-WMA or BUS-4 for Off-Site shipment. Gases are transferred to the LANL Gas Plant for Off-site shipment. Wastes are transferred to CST for Off-site shipment. All other hazardous materials, to include Radioactive Materials, are transferred to BUS-4 for shipment Off-site.

7.0 PROCEDURAL STEPS

7.1 On-Site, Intra-Laboratory & Off-Site Shipments

7.1.1 On-Site

See **Attachment X** for On-Site P&T procedures.

On-Site shipments of hazardous materials are not regulated by DOT; however, Laboratory policy requires that site-specific activities be described and defensible with respect to the methodology and compliance process used to meet packaging and transportation safety requirements. Only authorized personnel may participate in packaging and shipping functions. These shipments may be of a routine nature, customary, usual, and/or repetitive to the organization. **Routine shipments** are normally conducted using approved packaging that meets the requirements of the DOE Explosives Safety Manual and DOT Regulations. **Nonroutine On-Site shipments** are emergency or one-time shipments of hazardous materials within controlled access areas for which there is no approved packaging. Line management shall decide that deviation from standard procedures is necessary to mission accomplishment and permit the deviation. Packages used in the transportation of nonroutine On-Site shipments of HAZMAT shall be adequate and provide the maximum safety possible. The package shall be designed to ensure that there will be no significant release of hazardous

material into the environment. The containment measures shall take into account the likelihood and consequences of accidents, route and time of transit. An HMTF or RMTF shall be completed as appropriate and shall accompany the shipment. Emergency response information shall be entered on the transfer form with the person identified as the point of contact available/reachable during the time the shipment is in transit. The package shall be marked and labeled as appropriate to describe the hazards of the material being shipped. Vehicles used to transport hazardous materials shall be approved for such purposes, have the necessary installed safety and emergency equipment and shall be placarded when applicable (See Attachment VII). **Personnel performing On-Site hazardous material P&T functions shall be authorized to perform those tasks by their Group Management.** (See Attachment IX)

7.1.2 Intra-Laboratory

See **Attachment XI** for Intra-Laboratory P&T procedures.

Intra-Laboratory shipments of hazardous materials must comply with the requirements of DOE Orders, 49 CFR, other applicable regulations and Laboratory policies and procedures. Intra-Laboratory shipments of hazardous materials, in packaging that does not meet DOT requirements, become <u>On-Site</u> shipments and must be transferred over closed roads. Intra-Laboratory shipments of hazardous materials shall be made in authorized government vehicles operated by qualified Laboratory personnel. Training and safety requirements of 49 CFR and the Federal Motor Carrier Safety Regulations apply. An HMTF or RMTF, as appropriate, shall be completed and approved, to include emergency response information, for each Intra-Laboratory shipment and shall act as the Shipping Document. Procedural steps governing Off-site shipments shall be followed for Intra-Laboratory shipments of hazardous materials.

Only <u>qualified</u> HAZMAT personnel may perform Intra-Laboratory hazardous material P&T tasks.

7.1.3 Off-Site

See **Attachment XI** for Off-Site P&T procedures.

Off-site shipments of hazardous materials must be packaged, documented and transported by certified personnel in full compliance with applicable international, federal, state and Laboratory regulations. Off-site shipments of hazardous materials shall be processed through the appropriate Laboratory Shipper of Record. Before shipping hazardous materials off-site, the originator must include emergency response information in the shipping papers. The emergency response point of contact named on the shipping document must then be available to be contacted on a 24 hour basis

while the shipment is in transit. The Laboratory Shipper of Record shall forward the emergency response information to the Laboratory emergency response organization before the shipment is released to the commercial carrier. A Shipping Manifest, HMTF or RMTF, as appropriate, shall be completed and approved and together with the MSDS, Emergency Response Guide Book extracts and any applicable exemptions, accompany the shipment to the Shipper of Record.

Only qualified HAZMAT personnel may perform Off-Site hazardous material P&T tasks.

7.2 Shipment Preparation

7.2.1 On-Site Shipments: (See Attachment X)

7.2.2 Intra-Laboratory Shipments: (See Attachment XI)

7.2.3 Off-Site Shipments: (See Attachment XI)

7.3 Quality Assurance

DX-Division P&T activities are conducted under the "umbrella" of the LANL Quality Assurance Plan for Hazardous Material Packaging and Transportation dated May 20. 1993.

7.4 Emergency Procedures

In case of a spill, the Division Waste Management Coordinator, the DX Division Facility Management Designee and the Building Contact shall be notified. If the spill occurs outdoors, the Team Leader with ownership for the area will be notified. If emergency help is needed, call 911. During all emergencies or incidents, Group Management shall be called as soon as possible.

Should an emergency situation arise while transporting explosives on-site, the driver is expected to use a two-way radio. Radios shall be available in HE transport vehicles to enable employees to call for assistance should an emergency or breakdown situation occur.

Instructions and guidelines to follow in the event of an emergency or breakdown with a vehicle carrying High Explosives

7.4.1 Accident / Fire

- Inspect the load for evidence of fire. If there is a fire but the explosive material is not presently or imminently involved, attempt to prevent the fire from spreading to

the load. The fire may be fought using the vehicle's fire extinguisher. If explosive items are removed from the vehicle, ensure their security.

- If there is a fire that presently or imminently involves the load, evacuate all personnel to a minimum distance of 1250 feet from the vehicle. Block or divert traffic from the accident or fire. Notify and/or evacuate any potentially affected personnel.
- Unless the explosive cargo is imminently involved in the fire, the operator shall stay with the vehicle until proper disposition of the cargo is accomplished. Immediately notify the fire department of the accident / fire and provide information on the general type and a quantity of explosives involved. Notify the Group office.
- Because of the potential of toxic and radioactive fumes in the event of a fire, the transporter should move "upwind" if possible from the burning vehicle. The emergency radiation exposures and risk of injury to individuals involved in rescue and recovery shall be kept ALARA per 10 CFR 835.1302 and RPP 107-7 of the Radiation Protection Standards.

7.4.2 Mechanical Breakdown

- Remove the vehicle from the roadway as far as practical.
- Notify the appropriate authorities of the situation.
- Maintain visual contact with the vehicle
- If necessary, unload the vehicle to facilitate repair.

8.0 REQUIRED RECORDS - Not Applicable

9.0 REFERENCES

- Department of Transportation (DOT) Code of Federal Regulations (CFR) 49
- International Air Transport Association (IATA) Dangerous Goods Regulations
- Department of Energy (DOE) Orders 460.1/460.2, "Packaging and Transportation Safety"
- DOE Explosives Safety Manual
- Los Alamos National Laboratory (LANL) Environment, Safety and Health Manual
- LANL Packaging and Transportation Manual
- LANL BUS-4 Site Specific Work Procedures
- ESA-WMA Hazardous Materials (HAZMAT) Transportation Procedures

- DX-Division Operations Manual
- DX-Division Training and Qualification Manual
- 10 CFR 835 and RPP 107-7 (Radiation Protection Standards)

10.0 ATTACHMENTS

I. DX-Division P&T Request

II. LANL Hazardous Materials Transfer Form (HMTF), Form 1468 (2/95)

III. LANL Radioactive Materials Transfer Form (RMTF), Form 1586 (2/95)

IV. DX-Division HAZMAT Checklist for Off-Site / Intra-Laboratory Shipments

V. DX-Division Checklist for On-Site Explosives Shipments

VI. DX-Division Checklist for Off-Site / Intra-Laboratory Explosives Shipments

VII. General Explosives Transportation Requirements

VIII. DX-Division Personnel Authorized to Perform HAZMAT Functions

IX. Hazardous Materials Advisory Council Hazardous Materials Regulatory Reminder (HMAC HMRR) Checklist

X. DX Division On-Site P&T Procedures

XI. DX Division Intra-Laboratory and Off-Site P&T Procedures

XII. Record Of Annual Inspection

XIII. Driver's Vehicle Inspection Report

ATTACHMENT I

DX DIVISION P&T REQUEST

Send to P950 / Fax 667-6301

Stephen DePaula / Bill McGarity

FROM/ Z#	
DATE	
GROUP/PHONE/MS	
TA/BLDG./ROOM	

To Group or Organization	
Attn.: (name / Z#)	
PHONE/MS	
FAX(if Ram/Classified)	
TA/BLDG./ROOM/ Street Address if Off Site	

Item(s) to be Shipped

Quantity	Description	Line Value

Special Handling Requirements

check one:

Type of Material: ☐ Hazardous ☐ Non-Hazardous (inert)

MSDS Available: ☐ Yes ☐ No
(must accompany P&T Request if haz.)

Type of Shipment: ☐ On-sit ☐ Offsite Inta-Laboratory

Transportation Mode: ☐ FEDEX ☐ Air ☐ Lab Vehicle ☐ Surface

Classification: ☐ CRD ☐ SRD ☐ Unclassified

Check if shipping hazardous material:

☐ Oxidizer ☐ Explosives ☐ Flammable ☐ Corrosive ☐ Gases

☐ Poison ☐ Liquid ☐ Solid ☐ RAM ☐ Other

HAZARDOUS MATERIAL EMERGENCY RESPONSE CONTACTS

Name & Z#	Group	Office Telephone	After Hour Telephone
1)			
2)			

Cost Code/ Program Code/ Acct. Code:	
Requester/ Z#/Group #	
Required Delivery Date	
Explosive Review Committee Approval	

Written by S. J. DePaula, 11-2-96, revision

LOS ALAMOS
NATIONAL LABORATORY

ATTACHMENT H

HAZARDOUS MATERIALS TRANSFER
(Other Than Radioactive)

HM No.	SM No.	Date

GENERAL INSTRUCTIONS: This form is an official shipping document for transporting hazardous material within LANL boundaries. Type or print all entries. Material Safety Data Sheets (*MSDS*) and appropriate Emergency Response Guide information must be attached to this document. Distribution of completed forms is indicated below.

FROM					TO				
Name					Name				
Telephone	Group	TA	Building	Room	Telephone	Group	TA	Building	Room

Item A	No. of Pkgs.	Proper Shipping Name	Hazard Class and Division	UN/NA Number	Packing Group	Net Qty. Wt./Vol.

Additional Description	Gross Weight	Required Labels	Required Placards

Packaging Used	Packaged By	Z Number	Date

Item B	No. of Pkgs.	Proper Shipping Name	Hazard Class and Division	UN/NA Number	Packing Group	Net Qty. Wt./Vol.

Additional Description	Gross Weight	Required Labels	Required Placards

Packaging Used	Packaged By	Z Number	Date

Item C	No. of Pkgs.	Proper Shipping Name	Hazard Class and Division	UN/NA Number	Packing Group	Net Qty. Wt./Vol.

Additional Description	Gross Weight	Required Labels	Required Placards

Packaging Used	Packaged By	Z Number	Date

Item A	Cost Code\Prog Code\Cost Acct\Wk Pkg	Item B	Cost Code\Prog Code\Cost Acct\Wk Pkg	Item C	Cost Code\Prog Code\Cost Acct\Wk Pkg
	Z Number		Z Number		Z Number

EMERGENCY RESPONSE TELEPHONE NUMBER: (505) 667-6211

EMERGENCY CONTACT TELEPHONE NUMBERS FOR INTRA-LABORATORY TRANSFERS

Name	Z Number	Group	Telephone Number	Emergency Response Guide Number(s)
				Item A _____ Item C _____
Name	Z Number	Group	Telephone Number	Item B _____

SHIPPER'S CERTIFICATION

This is to certify that the above-named materials are properly classified, described, packaged, marked, and labeled/placarded, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Shipper (*Signature*)	Z Number	Mail Stop	Date

ADDITIONAL TRANSPORTATION INFORMATION

Driver/Transporter	Z Number	Transport Vehicle License Tag Number	
Estimated Date and Time of Arrival	Material Received By	Z Number	Date/Time

Form 1468 (2/95)

ATTACHMENT III

LOS ALAMOS NATIONAL LABORATORY

RADIOACTIVE MATERIALS TRANSFER

SM No.	SM No.	Cost Code\Prog Code\Cost Acct\Wk Pkg\Z Number	Date

GENERAL INSTRUCTIONS: This form is an official shipping document for transporting radioactive material within LANL boundaries. Type or print all entries. Emergency Response Guide Information must be attached to this document. Distribution of completed forms is indicated below.

FROM					TO				
Name					Name				
Telephone	Group	TA	Building	Room	Telephone	Group	TA	Building	Room

Item A	No. of Pkgs.	Proper Shipping Name	Hazard Class	UN/NA Number	Quantity (*Grams*)

Radionuclide (*s*)	Physical Form	Chemical Form	Activity	Label Category	Transport Index

Fissile Class	DOE or USNRC Identification Number	Additional Description (*s*)

Gross Weight	Rad. Level (*Surface*)	Required Placards	Packaging Used	Packaged By	Z Number	Date

Item B	No. of Pkgs.	Proper Shipping Name	Hazard Class	UN/NA Number	Quantity (*Grams*)

Radionuclide (*s*)	Physical Form	Chemical Form	Activity	Label Category	Transport Index

Fissile Class	DOE or USNRC Identification Number	Additional Description (*s*)

Gross Weight	Rad. Level (*Surface*)	Required Placards	Packaging Used	Packaged By	Z Number	Date

Radiation Control Technician (*Signature*)	Z Number	Date	
Pro-Force Representative (*Signature*)	Z Number	Date	Tamper ID

EMERGENCY RESPONSE TELEPHONE NUMBER: (505) 667-6211

EMERGENCY CONTACT TELEPHONE NUMBERS FOR ON-SITE TRANSFERS

Name	Z Number	Group	Telephone Number	Emergency Response Guide Number(*s*)
				Item A
Name	Z Number	Group	Telephone Number	Item B

SHIPPER'S CERTIFICATION

This is to certify that the above-named materials are properly classified, described, packaged, marked, and labeled/placarded, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Shipper (*Signature*)	Z Number	Mail Stop	Date

ADDITIONAL TRANSPORTATION INFORMATION

Driver/Transporter	Z Number	Transport Vehicle License Tag Number		
Estimated Date and Time of Arrival		Material Received By	Z Number	Date

ATTACHMENT IV

DX DIVISION HAZARDOUS MATERIAL CHECKLIST FOR OFFSITE/INTRA-LABORATORY SHIPMENTS

PACKAGED BY and DATE	
DESTINATION OF SHIPMENT	
WORK ORDER. NUMBER	
ITEMS BEING SHIPPED	
REQUESTER	
CLASSIFICATION OF ITEMS	CRD UNCL

PACKAGING PROCEDURES

____ 1. Obtain a completed DX-DIVISION P&T REQUEST FORM

____ 2. Verify that shipping address is an approved one for CRD or UNCL

____ 3. Obtain MSDS

____ 4. Obtain items to be shipped

____ 5. If exemption is used

- ____ a) obtain and follow exemption

____ 6. Fill out a HMTF

- ____ a) If CRD make sure it is indicated and highlighted on HMTF

____ 7. Obtain appropriate shipping container in accordance with 49 CFR / exemption

____ 8. Obtain packing materials (foam, tape, trays, ect.)

____ 9. Package securely

____ 10. If CRD ensure CRD label is on outside of inner package only

____ 11. Place inner package inside outer package if CRD (per security requirements)

____ 12. Mark box in accordance with 49 CFR / exemption

____ 13. Place Hazard class & compatibility group labels on box in accordance with 49 CFR / exemption

____ 14. Movement of material by

- ____ a) ESA-WMA or BUS P&T
  - ____ 1) Arrange for transfer
  - ____ 2) Rough draft shipping manifest
  - ____ 3) HMTF approval
  - ____ 4) Offer placards (if needed)
- ____ b) DX-1 with exemption Only
  - ____ 1) Type shipping manifest (if needed)
  - ____ 2) HMTF approval

____ 15. Package with the following items must accompany the shipment

- ____ a) Emergency Response Guide (include: PSN, HC, UN, PG, Net. #)
- ____ b) Shipping Manifest (if required)
- ____ c) HMTF
- ____ d) MSDS
- ____ e) Exemption (if step #5 is used)

____ 16. Retain a copy of HMTF/ Shipping Manifest for DX-1 records

____ 17. Notify consignee of shipment

Checklist approved by: _____

Written by S. J. DePaula, 4-[illegible]-96, Revision

ATTACHMENT V

DX DIVISION CHECKLIST FOR ONSITE EXPLOSIVE SHIPMENTS

PACKAGED BY and DATE	
DESTINATION OF SHIPMENT	
WORK ORDER. NUMBER	
ITEMS BEING SHIPPED	
REQUESTER	
CLASSIFICATION OF ITEMS	CRD UNCL

PACKAGING PROCEDURES

____ 1. Obtain a completed DX-DIVISION P&T REQUEST FORM

____ 2. Verify that shipping address is an approved one for CRD or UNCL

____ 3. Obtain MSDS

____ 4. Obtain items to be shipped

____ 5. Take to QC if required

____ 6. Record issues using HE accountability form and give copy to HE Inventory Custodian (if not already done)

____ 7. If exemption is used

- ____ a) obtain exemption
- ____ b) obtain and proceed with exemption checklist

____ 8. Obtain appropriate shipping container

____ 9. Obtain packing materials (foam, tape, trays, ect.)

____ 10. Package securely

____ 11. Mark box in accordance with 49 CFR

____ 12. If CRD, place CRD label on outside of container

____ 13. Place Hazard class & compatibility group labels on box

____ 14. Fill out a HMTF

- ____ a) If CRD make sure it is indicated and highlighted on HMTF

____ 15. Movement of material by

- ____ a) ESA-WMA or BUS-4 P&T VAN
  - 1) Arrange for transfer
    - ____ a) ESA
    - ____ b) BUS-4
- ____ b) DX-1
  - 1) Get group office approval
  - 2) Must take radio
  - 3) HE vehicle must be used

____ 16. Package with the following items must accompany the shipment

- ____ a) Emergency Response Guide (include: PSN, HC, UN, PG, Net. #)
- ____ b) HMTF
- ____ c) Exemption (if step #7 is used)
- ____ d) MSDS
- ____ e) QC (if required)

____ 17. Retain a copy of HMTF/ Shipping Manifest for DX-1 records

____ 18. Notify consignee of shipment

Written by S. J. DePaula. 4-1-96. Revision

Checklist approved by:

ATTACHMENT VI

DX DIVISION CHECKLIST
FOR OFFSITE/INTRA-LABORATORY EXPLOSIVES SHIPMENT

PACKAGED BY and DATE	
DESTINATION OF SHIPMENT	
WORK ORDER. NUMBER	
ITEMS BEING SHIPPED	
REQUESTER	
CLASSIFICATION OF ITEMS	**CRD** **UNCL**

PACKAGING PROCEDURES

____ 1. Obtain a completed DX-DIVISION P&T REQUEST FORM

____ 2. Verify that shipping address is an approved one for CRD or UNCL

____ 3. Obtain MSDS

____ 4. Obtain items to be shipped

____ 5. Take to QC if required

____ 6. Record issues using HE accountability form and give copy to HE Inventory Custodian (if not already done)

____ 7. If exemption is used

- ____ a) obtain exemption
- ____ b) obtain and proceed with exemption checklist

____ 8. Obtain appropriate shipping container

____ 9. Obtain packing materials (foam, tape, trays, ect.)

____ 10. Package securely

____ 11. If CRD ensure CRD label is on outside of inner package only

____ 12. Place inner package inside outer package if CRD (per security requirements)

____ 13. Mark box in accordance with 49 CFR

____ 14. Place Hazard class & compatibility group labels on box

____ 15. Fill out a HMTF

- ____ a) If CRD make sure it is indicated and highlighted on HMTF

____ 16. Movement of material by

- ____ a) ESA-WMA
  - 1) Arrange for transfer
  - 2) Rough draft shipping manifest (offsite only)
  - 3) HMTF approval (intra-lab only)
- ____ b) DX-1 with Exemption Only
  - 1) Get group office approval / radio
  - 2) Type shipping manifest (offsite only)
  - 3) HMTF approval

____ 17. Package with the following items must accompany the shipment

- ____ a) Emergency Response Guide (include: PSN, HC, UN, PG, Net #)
- ____ b) Shipping Manifest (if required)
- ____ c) HMTF
- ____ d) MSDS
- ____ e) QC (if step #5 was required)
- ____ f) Exemption (if step #7 is used)

____ 18. Retain a copy of HMTF/ Shipping Manifest for DX-1 records

____ 19. NOTIFY consignee of shipment

Checklist approved by:

Written by S. J. DePaula. 4-1-96. Revision

ATTACHMENT VII

GENERAL EXPLOSIVES TRANSPORTATION REQUIREMENTS

1. Vehicles used to transport HE shall have wheel chocks, tie down straps and tie down points/rings to secure the load.
2. When transporting HE, there shall be no loose items, such as handling gear, in the cargo compartment of the vehicle.
3. Rear view mirrors shall be installed/mounted on each side of an HE designated vehicle.
4. One fire extinguisher with a minimum rating of 2A:10BC shall be installed on all HE vehicles.
5. An annual inspection of all HE vehicles shall be accomplished during the annual review of this SOP (See Attachment XII). An operational safety inspection shall be conducted on each HE vehicle prior to daily operation (See Attachment XIII).
6. Safety related equipment checks and repairs shall be performed by maintenance personnel during regularly scheduled maintenance periods.
7. The speed limit for vehicles transporting HE within DX-Division Technical Areas (TAs) is 25 MPH. The speed limit for vehicles transporting HE on roads between TAs is 35 MPH unless a lower speed limit is posted.
8. Explosives shall not be left in vehicles overnight or in unattended vehicles (out of sight of operator).
9. When parking an HE vehicle equipped with a manual transmission, the ignition switch shall be turned off, the vehicle transmission placed in first gear and the emergency brake set. Vehicles equipped with automatic transmissions shall be placed in "park" and the emergency brake set when parked.
10. A rear wheel shall be secured front and rear with wheel chocks when an HE vehicles is parked on a significant grade.
11. Group management approvals shall be obtained prior to transporting explosives.
12. The driver shall, at all times, demonstrate professional actions, behavior, manners and attitude.
13. Fueling or maintenance of vehicles containing explosives is forbidden.
14. No smoking or spark/flame producing devices are allowed within 100 feet of vehicles containing explosives.
15. Explosive containers shall not be opened while inside a vehicle. An exception to this requirement is when explosives must be inspected in an emergency.
16. Government vehicles transporting HE shall not push or tow other vehicles.
17. Vehicle engines shall be off during loading and unloading of HE.

18. Vehicles shall not be operated closer than 25 feet of exposed explosives, magazines, or other HE buildings when the facility doors are open.

19. Low energy electro-explosive devices (EEDs) shall not be transported with other explosives.

20. Personnel are forbidden from riding in the cargo compartment of a vehicle transporting explosives.

21. Explosives shall not be transported during poor visibility, heavy snowfall, fog or during heavy rainfall.

22. Transportation of explosives during a lightning storm is forbidden.

23. When transporting explosives, the driver shall keep a two-way radio with him/her at all times.

24. A physical barrier shall be installed/in-place between the driver and the cargo compartment of vehicles transporting explosives.

Attachment VIII

DX PERSONNEL AUTHORIZED TO PERFORM HAZMAT FUNCTIONS ON-SITE

Name	Group	HAZMAT	Tasks/Authorizations

TTACHMENT IX

HAZARDOUS MATERIALS ADVISORY COUNCIL
1101 VERMONT AVENUE, NW
SUITE 301
WASHINGTON, DC 20005-3521

G S I

HM Regulations Reminder (HMRR) 49 CFR Non-Bulk By Highway

IDENTIFICATION

Proper Shipping Name (§172.101(c))[1] _____

Technical Name(s) (§172.203(k))[15] _____

Class /Division (§172.101(d))[2] _____ UN/NA# (§172.101(e))[2] _____

Packing Group (§172.101(f))[3] _____

Other (§171.8) Hazardous Substance [17] _____ Materials Poisonous By Inhalation [27] _____

PACKAGING (Part 173)

A. Quantity PER Package [30] _____

B. Packaging Authorizations (§172.101(i))[30] Column (8A) _____ Column (8B) _____

C. Special Provisions (§172.102(a))[31] _____

D. Packaging Selection(172.101(i))[31] Single _____ Combination _____ Outer Pkg. _____

E. General Packaging (172.101(i))[32] _____

MARKING

A. Proper Shipping Name (§172.301(a))[43]

B. Technical Name(s) (§172.301(b))[43]

C. UN/NA Number (§172.301(a))[43]

D. Name and Address (§172.301(d))[43]

E. Orientation Arrows (§172.312(a))[44]

F. Haz.Substance (§172.324)[45]

G. Packaging Spec. Marks (§178.503)[45]

H. Inhalation Hazard (§172.313(a)) [45]
H. 6.1 Plastic Packagings (§172.313(b))[45]

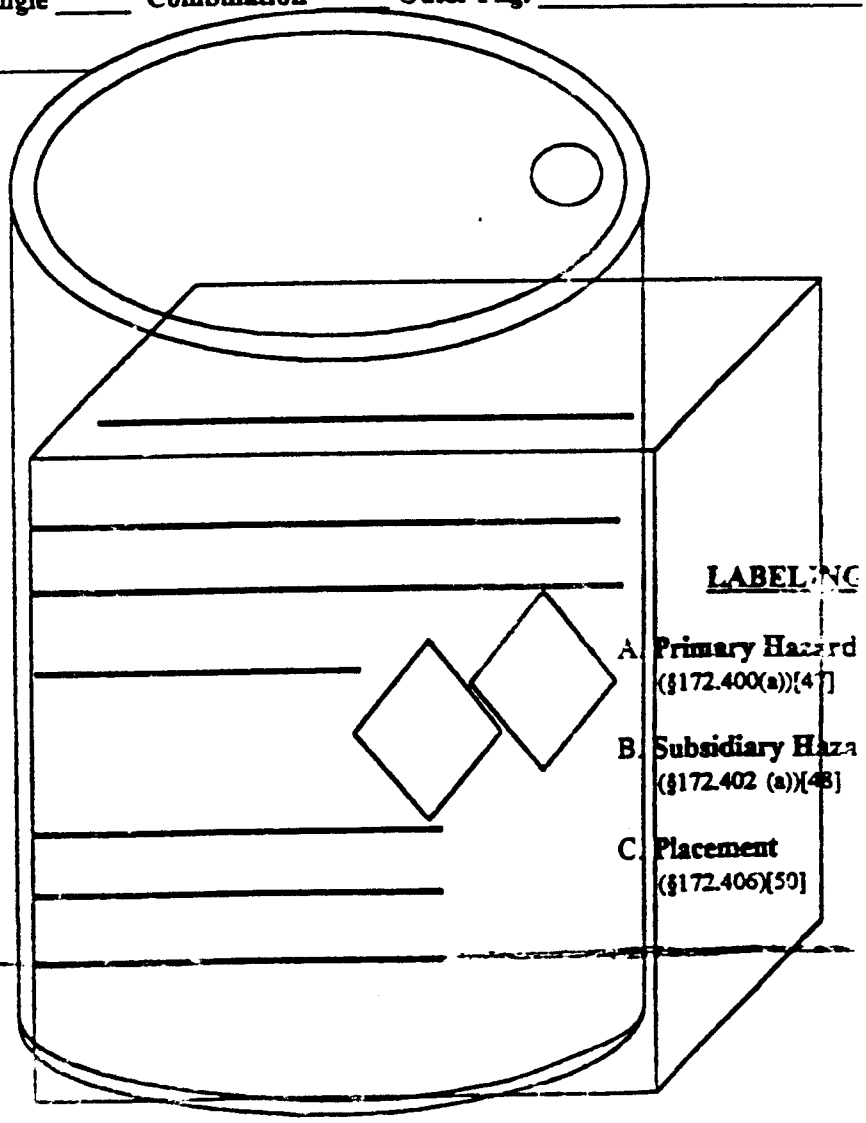
I. Exemption (DOT-E####)(§172.301(c))[46]

J. Radioactive Materials [46]

K. Overpack (§173.25(a))[46]

L. ORM Designation (§172.316(a))[46]

M. Class 1 EX Number (§172.320)[46]



LABELING

A. Primary Hazard (§172.400(a))[47]

B. Subsidiary Haza (§172.402 (a))[48]

C. Placement (§172.406)[50]

SHIPPING PAPERS(Sub Part C)

BASIC DESCRIPTION (§172.202)

A. **Proper Shipping Name** (§172.202(a)(1))[53]

B. **Technical Name(s)** (§172.203(k))[53]

C. **Hazard ClassDivision** (§172.202(a)(2))[54]

D. **UN/NA Number** (§172.202(a)(3))[54]

E. **Packing Group** (§172.202(a)(4))[54]

F. **Sequence** (§172.202(b))[54]

G. **Total Qty.(Gross or Net)** (§172.202(a)(5))[54]

ADDITIONAL DESCRIPTION (§172.203)

A. **DOT-E Number** (§172.203(a))[55]

B. **Ltd Qty** (§172.203(b))[55]

C. **Hazardous Substance (RQ/Name)** (§172.203(c))[56]

D. **Dangerous When Wet** (§172.203(j))[56]

E. **Poison/Name**(§172.203(m)(1))[56]

E. **Inhalation Hazard/Zone** (§172.203(m)(3))[57]

F. Hazardous Wastes [57]

G. **RESIDUE: Last Contained** (§172.203(e)(3))[58]

H. **Emer.Response Tele. No.**(§172.604(a))[55]

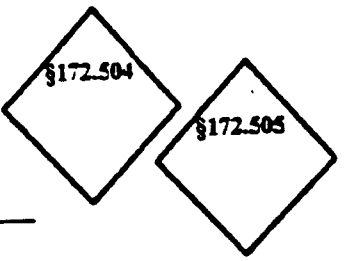
Straight Bill

Number & Type of Units	HM	(Proper Shipping Name, Hazard Class, UN/NA Number, Packing Group)	Net Quantity	Gross Weight

A. **Certification** (§172.204 (a))[61]

This is to certify that the above named materials are properly classified, described, packaged, marked and labeled , and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

B. **Signature** (§172.204(d))[61] (Signature)



PLACARDING (Sub Part F) Initial Emergency Response Information (Sub Part G)

A. **Placards Selected and Offered** (§172.504/505)[62] _____

B. **Placards Not Provided/Refused** [64]: Placarded _____ <454 kg Table II _____ Ltd Qty _____

C. **Properly Affixed/Displayed** (§172.504/516)[D. on 65] _____

D. **Emergency Response Information** (§172.602(a))[87] _____

General Notes and Comments

_____

_____

_____

_____

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ATTACHMENT X

DX DIVISION ON-SITE P&T PROCEDURES

N/A	YES	NO	TASK
			Authorized to perform P&T task.
			Authorized to handle this hazardous material.
			Recipient authorized to receive this hazardous material
			Vehicle inspected and equipped for transporting HAZMAT
			HAZMAT Identified
			Proper Shipping Name
			Technical Name (if required)
			Hazard Class and Division
			UN Number
			Other (Hazardous Substance, Materials Poison By Inhalation)
			Packaging
			Quantity per package
			Authorized packaging (Group Management approval required if packaging used is non-standard)
			General packaging requirements met
			Marking
			Proper Shipping Name
			Technical Name (s)
			UN Number
			To and From Address
			Orientation Arrows (if required)
			Hazardous Substance (if required)
			Inhalation Hazard (if required)
			Exemption # (if used)
			Radioactive Materials (if required)
			Class 1 EX Number (if required)
			Labeling
			Primary Hazard
			Subsidiary Hazard (if required)
			Placement
N/A	YES	NO	TASK
			HMTF or RMTF completed

			Hazardous Materials securely tied-down
			Vehicle Placarded (if required)
			Obtain Group Management (or designee) approval to transport
			Consignee available to receive hazardous material
			Consignee signs HMTF or RMTF as receipt
			HMTF or RMTF filed

ATTACHMENT X

DX DIVISION ON-SITE P&T PROCEDURES

N/A	YES	NO	TASK
			Authorized to perform P&T task.
			Authorized to handle this hazardous material.
			Recipient authorized to receive this hazardous material
			Vehicle inspected and equipped for transporting HAZMAT
			HAZMAT Identified
			Proper Shipping Name
			Technical Name (if required)
			Hazard Class and Division
			UN Number
			Other (Hazardous Substance, Materials Poison By Inhalation)
			Packaging
			Quantity per package
			Authorized packaging (Group Management approval required if packaging used is non-standard)
			General packaging requirements met
			Marking
			Proper Shipping Name
			Technical Name (s)
			UN Number
			To and From Address
			Orientation Arrows (if required)
			Hazardous Substance (if required)
			Inhalation Hazard (if required)
			Exemption # (if used)
			Radioactive Materials (if required)
			Class 1 EX Number (if required)
			Labeling
			Primary Hazard
			Subsidiary Hazard (if required)
			Placement
N/A	YES	NO	TASK
			HMTF or RMTF completed

			Hazardous Materials securely tied-down
			Vehicle Placarded (if required)
			Obtain Group Management (or designee) approval to transport
			Consignee available to receive hazardous material
			Consignee signs HMTF or RMTF as receipt
			HMTF or RMTF filed

ATTACHMENT XI

A. Identification

The first step in the procedure to be followed by all HAZMAT employees, who offer products for transportation, is to determine if the material that is being shipped is regulated as a hazardous material. If the material is regulated as a hazardous material, it must be shipped using the prescribed shipping name and description, packaging, labeling, marking, and must be handled as required by regulations.

You must also be aware of any exceptions which may be authorized within the regulations for specific quantities or hazard classes of materials. An exception means that, when authorized within the regulations, and when specific conditions are met, certain materials may not require full compliance with all of the regulations.

The key to proper identification of a hazardous material is information. Gather as much information as possible prior to beginning the shipping process. Sources of information include: MSDSs, asking specific questions about the material and past practices, if they were done correctly.

Determine if the material is regulated as hazardous material, in the intended mode of transportation, in the quantity being shipped. Using the Hazardous Materials Table (HMT) in 49 CFR 172.101 and the following checklist, determine the proper shipping name (PSN):

1. Is the material listed by technical name in Column (2)?

Yes. It is a regulated hazardous material. Go to Item 2.
No. It MAY be a regulated hazardous material. Go to Item 6.

2. Is the material listed in Column (2) in Roman Type (not italics)?

Yes. It IS a proper shipping name. Go to Item 3.
No. It MAY NOT be used as a proper shipping name.
See the entry following the name in italics. Go to Item 3.

3. Is the material listed in Column (2) technically pure?

Yes. It may be used as the proper shipping name, Go to Item 5.
No. You may need to select an alternate proper shipping name. Go to Item 4.

4. **Is the material in a mixture or solution with other materials, either hazardous or non-hazardous?**

Yes. Select an alternate PSN using the information in Step #1, such as n.o.s., mixture or solution descriptions, etc. For materials which meet the definition of more than one hazard class, consult the Precedence of Hazard Table (49 CFR 173.2(b)). Go to Item 5.

No. Go to Item 5.

5. **After selecting the PSN for the material, check Column (1) of the HMT. Is there a symbol in Column (1), preceding the entry you have selected?**

Yes. Review 49 CFR 172.101(b) that describes the applicability of the symbol in Column (1) to determine if the material is regulated in the intended mode of transportation and if the PSN is authorized. Go to Item 6.

No. The material is regulated by all modes using the PSN you have selected, unless otherwise excepted. Go to Item 6.

6. **If the material identified by the PSN is listed in Appendix "A" of the HMT (49 CFR 172.101) and meets or exceeds the reportable quantity (RQ) listed, it is also an environmentally hazardous substance.**

- Is the material being shipped a hazardous substance?
- Is the material being shipped a marine pollutant?
- Is it both a hazardous substance and a marine pollutant?

Yes. Review Step #1 to select the PSN.

No. Continue - Go to Item 7.

7. **Do the PSN, Hazard Class/Division, UN Identification Number, Packing Group, Special Provisions, Packaging authorization, Quantity limitations, and physical characteristics meet the regulatory requirements and modal considerations for this shipment?**

Yes. Go to Item 8.

No. Review Step #1.

8. **Are the materials poisonous by inhalation?**

Yes. (Keep in mind for Marking - 7.2.3 Item 7, Labeling and Shipping Papers)

No. Checklist complete. Proceed to Package Selection.

B. Package Selection

Each hazard class presents its own unique characteristics which have been take into consideration for determining the safest and most efficient packaging to be use during transportation. As a result of historical experience and extensive testing, specific packaging has been selected for each material to be shipped. This selected packaging is referred to as "authorized" packaging. Only authorized packaging may be used to transport hazardous materials.

When specification packaging is required, hazardous materials shipments must only be offered for transportation when the applicable packaging has been used and the required performance testing has been conducted to qualify the packaging for use. The criteria for testing packages and packaging are found in 49 CFR 178.602-609.

When tests are conducted and packages or packaging are certified as meeting the UN Standard, the packaging manufacturer or other persons conducting the testing, must mark each container with the required specification marking which serves as the official certification. Records of the testing, names and locations where the testing was conducted and the results of those tests are retained for two years and are subject to DOT review at any time. The standards for packaging and the codes for each are found in 49 CFR 178.504 through 178.523. HM 181 and 49 CFR require that all packages and packaging meet or exceed UN Standards.

Using the Proper Shipping Name (PSN) selected, use the following checklist to determine the appropriate package/packaging for each hazardous material to be shipped.

1. **Does an entry appear in Column (8A)?**

   Yes. Go to Item 2.
   No. Go to Item 3.

2. **Read the section listed in Column (8A) and proceed to Section 173.-----. Does the material to be shipped qualify for an exception in the quantity and type of packaging selected?**

   Yes. Follow the packaging instructions for the "exceptions" as authorized. Go to Item 8.
   No. Go to Item 3.

3. **Will the material be shipped in a non-bulk packaging (49 CFR 171.8)?**

   Yes Read the section listed in Column (8B) and select authorized packaging. Go to Item 5.
   No. Go to Item. 4.

4. **Will the material be shipped in Bulk packaging (49 CFR 171.8)?**

   Yes. Read the section listed in Column (8C) and select authorized packaging. Go to Item 5.
   No. Go to Item 6.

5. **Are special provisions listed in Column (7)?**

   Yes. Read and follow the appropriate Special Provisions in 172.102 which correspond to the code in Column (7), in addition to the packaging authorization in Column (8). Go to Item 6.
   No. Go to Item 6.

6. **Check Column (5) of the HMT. Check the performance level (X,Y,Z for Packing Group qualification) code within the UN package marking. If a Packing Group is listed in Column (5) does the packaging selected meet or exceed the performance level testing criteria and marking for that Packing Group?**

   Yes. Go to Item 7.
   No. Select an alternate packaging which meets the performance level for the Packing Group listed. Go to Item 7.

7. **Is the packaging marked with the proper code within the UN marking to qualify it for use with the material which will be put in the container?**

   Yes. Go to Item 8.
   No. Select an alternate packaging which qualifies for use with the intended contents. Go to Item 8.

8. **Does the completed package comply with the General Packaging Standards for all packages in 49 CFR 173?**

   Yes. Go to Item 9.
   No. Make necessary corrections. Go to Item 9.

9. **If specification packaging is required, has the package been tested and marked to show that it is qualified to be used in transportation, for the material contained within the package, by displaying the appropriate UN or DOT specification markings and packaging manufacturers symbol?**

   Yes. Checklist completed.
   No. Review Step #1. Select alternate packaging.

NOTE!!! **DO NOT EXCEED THE QUANTITY PER PACKAGE.**

C. Marking

Markings on packaging containing hazardous materials offered for transportation provide essential information for communicating the hazards which may be present in the package, and for verifying that the package is appropriate for the contents.

Using the PSN and the package selected, use the following checklist to determine the appropriate Marking for the shipment.

1. **The container is a non-bulk package.**

   Yes. Go to Item 2.
   No. It is a bulk package. Go to Item 9. (Item 9 deleted)

2. **The material has been re-named Consume Commodity and re-classified as ORM-D as permitted in Column (8A) of the HMT.**

   Yes. Mark the package with the PSN and the ORM-D marking. Go to Item 8.
   No. Go to Item 3.

3. **The material is being shipped under the Limited Quantity exception as permitted in Column (8A) of the HMT.**

   Yes. Mark the package with the PSN and the words "Limited Quantity." Go to Item 4
   No. Go to Item 4.

4. **Has the PSN, Technical Name, and any other required additional descriptions, and the identification number with the UN or NA prefix been legibly marked in English on the package?**

   Yes. Go to Item 5.
   No. Review the marking requirements in 49 CFR 172.300 and make corrections as appropriate. Go back to Item 1.

5. **Does the package contain inside containers with liquid contents?**

   Yes. Pack with closure upward and mark with orientation arrows to show "this end up". Go to Item 6.
   No. Go to Item 6.

6. **Does the package require marking with the name and address of the consignee or consignor?**

   Yes. Check for the required marking. Go to Item 7.
   No. Go to Item 7.

7. **Does the package contain Division 2.3 materials or 6.1 poisonous liquids which will be identified as "Poison--Inhalation Hazard" on the shipping paper? (reference 7.2.1, Item 8)**

Yes. Check the package for the marking "Inhalation Hazard" in association with the required labels. Go to Item 8.
No. Go to Item 8.

8. **Does the package contain material identified as a Hazardous Substance?**

Yes. Check the package for the letters "RQ" in front of the PSN. Go to Item 9.
No. Go to Item 9.

9. **Item 9 deals with Marine Pollutants. Disregard unless shipping by water. Go to Item 10.**

10. **Are all required markings visible on the package and unobstructed by labels or other markings that could make them ineffective?**

Yes. Go to Item 11.
No Review marking requirements in 49 CFR and make corrections. Go to Item 11.

11. **Have additional markings, when appropriate, been applied such as Warning for Class 6.1 (toxic) plastic containers, DOT-E _____, Radioactive Materials, Overpack, Class 1 EX Number?**

Yes. Checklist completed.
No. Review additional marking requirements in 49 CFR, make corrections. Checklist completed.

D. Labeling

Labels are a very important means of communicating the fact that hazardous materials are contained in a package offered for transportation, and also provide an easily recognized means of identifying the type of hazards involved. Labels communicate the hazards of the material contained within a package by means of their shape, color, and content. Each label required by DOT to be displayed on a package containing hazardous materials must be produced according to specifications in 49 CFR 172.407.

Using the PSN selected, determine the appropriate labeling to be applied to package of hazardous materials using the following checklist:

1. **Is the material identified as a regulated material in the HMT?**

   Yes. Check Column (6) of the HMT, note all labels listed. Go to Item 2.
   No. No labels required. Checklist completed.

2. **Is the material being shipped under an exception as "limited quantity", "small quantity", or other as listed in Column (8A) of the HMT?**

   Yes. Check the requirements of the 49 CFR 173 Section found in Column (8A). Go to Item 3.
   No. Go to Item 3.

3. **Has the material been classified as an ORM-D (Consumer Commodity) as authorized by Part 173?**

   Yes. No labels required. Checklist completed.
   No. Go to Item 4.

4. **Does the material meet the definition of any other hazard class, even though additional labels are not listed in Column (6)?**

   Yes. Follow Subsidiary Hazard Labels Table in 49 CFR. Go to Item 5.
   No. Go to Item 5.

5. **Does the package require labels representing the hazard class of the materials actually contained therein?**

   Yes. Affix the required labels to the package. Go to Item 6.
   No. No labels may be displayed on the package. Go to Item 6.

6. **Are labels affixed as indicated below?**

- Securely affixed to any surface other than the bottom
- On the SAME side as the PSN marking if the package is large enough
- On a background of contrasting color or have a contrasting border
- Visible and not obscured by markings or attachments
- Multiple labels, when required, displayed next to each other (subsidiary should be adjacent to the right and below primary)
- Primary hazard label with Class and/or Division number in lower quadrant
- Subsidiary hazard with NO Class or Division number displayed in lower quadrant.
- Multiple labels when required for larger packages
- Proper color, size, specification and orientation (diamond on point, writing horizontal, readable left to right)
- ALL labels visible when overpacked or placed inside an outer container OR additional labels on the outside container

- All modal label requirements checked and labels or stick-on type markings affixed if required (CARGO AIRCRAFT ONLY, MARINE POLLUTANTS, etc.)

  Yes. Labels comply. Checklist completed.
  No. Review 49 CFR 172.401-450, make corrections and complete checklist again

E. Prepare Shipping Papers

The Shipping Paper is a very important part of the communication process for identifying hazardous materials which are offered in transportation and, if properly prepared, provides vital information for emergency response personnel in the event of an accident.

DX-Division personnel do not prepare shipping papers since shipping papers are prepared by the Laboratory "Shipper of Record" for the hazardous material being shipped. However, the Shipper of Record will require specific information from DX-Division P&T personnel to facilitate the shipment. DX-Division P&T personnel shall provide shipping paper information in draft form to the Laboratory Shipper of Record.

The following information is required as appropriate:

- Proper Shipping Name
- Technical Name
- Hazard Class/Division
- UN/NA Number
- Packing Group
- Total Quantity (Gross or Net)
- 24 Hour Emergency Response Names (2)
  - Work Telephone Number
  - Home Telephone Number
- DOT- E Number
- Limited Quantity
- Hazardous Substance (RQ / Name)
- Dangerous When Wet
- Poison / Name
- Inhalation Hazard / Zone
- Hazardous Wastes
- RESIDUE: Last Contained

F. Placarding

Placards are used to communicate the hazards within a cargo transport vehicle which contains certain packages of hazardous materials when offered for transportation. Placards are required to be constructed of durable material with minimum dimensions specified in 49 CFR 172.519. When properly displayed in transportation, placards provide emergency responders with a warning sign identifying hazardous materials which may pose health or safety problems in an accident.

DX-Division personnel are not normally required to transport hazardous materials in commerce. Placarding of vehicles transporting hazardous materials Off-site and Intra-Laboratory is the responsibility of the Laboratory Shipper of Record and the Carrier. However, DX-Division HAZMAT personnel may be required to transport HAZMAT On-Site, thus requiring placards.

DX-Division HAZMAT personnel transporting hazardous materials ON-Site shall placard the transport vehicle as required by 49 CFR 172.504, Table 1 or 2. If Placards are required, they shall comply with display requirements outlined in 49 CFR 172.504-519.

G. Exceptions

1. General Procedures

Elements of DX-Division as well as other organizations in the DOE Complex create new explosives to be used and tested for future projects. A new explosive is (1) an explosive produced by a person who has not previously produced that explosive or (2) an explosive previously produced by a person who has made a change in the formulation, design or process so as to alter any of the properties of the explosive.

Transportation regulations require new explosives be approved by a competent authority. The authority in the United States is the Associate Administrator for Hazardous Material Safety.

New explosives made by or under the supervision of the DOD or the DOE may be approved in the same manner as commercial explosives producers through Bureau of Explosives or the Bureau of Mines; or through examination, testing and approval by either the designated Army, Navy, or Air Force component of DOD, or by the Department of Energy. The classifying entity sponsoring development of an explosive item or assembly is responsible for developing necessary data. This data is used to assign an appropriate hazard class/division, compatibility group, DOT shipping description, DOT label and UN number. A report of each approval granted by DOD or DOE(with supporting laboratory data) must be filed with the DOT Associate Administrator and an acknowledgment must be received prior to offering the new explosive for transportation.

2. Interim Hazard Classifications

An Interim Hazard Classification (IHC) exemption temporarily authorizes transportation of new explosives when offered by DOE contractors under commercial bills of lading. The IHC is not applicable for shipment of explosives by private contractors for non-DOE contracts. The organization sponsoring development of an explosive substance or assembly is responsible for requesting the IHC and for providing supporting data to the responsible DOE IHC authority. Any change in packaging or explosive components in an item requires reexamination of the item by the responsible IHC authority to ascertain the need for revision of the IHC. An IHC exemption may be issued for a period up to one year. Extension beyond one year requires a request from the originator, with justification, for renewal by the issuing organization.

3. Explosive Numbers (EX Numbers)

EX Numbers are assigned to new explosives after considerable testing and analysis. A written request for a permanent classification action is prepared stating the proposed classification,

method of packaging, marking, labeling, and mode of transportation. Applicable supporting data is submitted along with the request to the responsible DOE Operations Office. Upon review and determination that the request is proper and the data supports the hazard classification assignment, the operations office will approve the request, assign permanent classification, and issue a classification approval document. Copies of the classification approval document and supporting data are submitted to DOE Headquarters for a submittal review and filing with DOT. The official submittal by HQ/DOE to DOT formally requests the DOT registration of the material being classified. Under DOT's new explosives classification program DOT Competent Authority Approval is provided along with the registration (EX-Number).

4. DOT Exemptions

The use of DOT Exemptions for the packaging and transportation of hazardous materials is authorized in accordance DOT regulations specified in 49 CFR 171-180. The DOT exemption procedures for DOE contractors are detailed in DOE Order 1540.2, "Hazardous Material Packaging for Transport - Administrative Procedures."

ATTACHMENT XII

DX ANNUAL VEHICLE CHECKLIST

DATE:
TAG NUMBER:
INSPECTOR:

SECTION TO CHECK	*OK*	*NOT OK*	*NA*	*COMMENTS*
TIRES				
BODY				
DOORS & LOCKS				
TAILGATE				
WINDSHIELD				
WINDOWS				
MIRRORS				
HEADLIGHTS				
Brights				
Dims				
TURN SIGNALS				
BRAKE LIGHTS				
BACK-UP LIGHTS				
PARKING LIGHTS				
HORN				
WIPERS				
WINDSHIELD WASHER				
RADIO				
HEATER				
DEFROSTER				
AIR CONDITIONER				
UPHOLSTERY				
GENERAL INTERIOR				
SPARE TIRE				
BRAKES				
EMERGENCY BRAKE				
NOISES				
LEAKS (Gas, Oil, Ect.)				
EMERGENCY FLASHERS				
FIRE EXTINGUISHERS				
TIE DOWNS				
WHEEL CHOCKS				
OTHER				

ATTACHMENT XIII

DX VEHICLE CHECKLIST

DATE:
TAG NUMBER:
COORDINATOR:

SECTION	OK	NOT OK	NA	COMMENTS / SIGNATURE
Radiological Check				
Tires				
Wheel wells				
Under frame				
Engine air filter				
Trunk				
Bed				
Floorboard				
Under seats				
Glove box				
Passenger area				
Driver area				
Other				
Explosive Check *Visual*				
Explosive Check *Smear*				
Hazardous Material Check				
Glove box				
Behind seats				
Floor				
Trunk				
Bed				
Tool box				
Other				

DX-4

STANDARD OPERATING PROCEDURE

FOR

GENERAL ACCESS CONTROL

SOP 1.0

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Approved by: John McCofin Date: 6/13/96
DX-4 Group Leader

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EW 6/25/96 ESH-5
ESH-5 SOP review process completed 9/4/96 PM

Final Approval: G. D. Vasilik Date: 9/12/96
G. Vasilik, DX-4 ES&H Officer

Controlled Document Number: ☐

Table of Contents

1.0 INTRODUCTION 3

2.0 PURPOSE 3

3.0 SCOPE 3

4.0 DEFINITIONS 3

5.0 RESPONSIBILITIES 6

5.1 KNOWLEDGEABLE PERSON 6
5.2 FIRING LEADER 6
5.3 ACCESS CONTROL OFFICER 6

6.0 PRECAUTIONS AND LIMITATIONS 7

6.1 CLEARANCE PLANS 7
6.2 SMOKING, MATCHES, AND FLAME-PRODUCING DEVICES IN FIRING AREAS 7
6.3 FIRE DEPARTMENT NOTICES 7

7.0 PROCEDURAL STEPS 8

7.1 GENERAL ACCESS REQUIREMENTS 8
7.2 VISITORS 9
7.2.1 Access Control Office at R183 10
7.2.2 Tours 10
7.2.3 Shot Observation List 10
7.3 VEHICLE ACCESS 11
7.4 EMERGENCY PROCEDURES 11
7.4.1 Building or Site Emergency 11
7.4.2 Personal Injury 11

8.0 REQUIRED RECORDS 11

9.0 REFERENCES 12

10.0 ATTACHMENTS 12

1.0 INTRODUCTION

Access Control prevents people from accidentally being in the vicinity of an explosives test or other hazardous operation such as radiography, by imposing physical barriers and also administrative restrictions. DX Division personnel conduct test-firing operations involving explosives at DX Division firing sites at TA-15, TA-36, TA-39, and TA-40, and the TA-14 outdoor chemical laboratory. DX Division personnel and visitors must be assured of a safe working environment while they are in the DX Division firing areas.

2.0 PURPOSE

This Standard Operating Procedure (SOP) describes the general precautions and procedures for administering access to the DX Division firing areas.

3.0 SCOPE

This SOP applies to all individuals who require access to firing areas of TA-15, TA-36, TA-39, TA-40 and the test area at TA-14. Maps and site descriptions are given as Attachment 1.

This SOP does not describe detailed area Clearance Procedures conducted at each Firing Site. Clearance Procedures are described in DX-4 General Firing Operations and Site-specific SOPs.

"Firing area" refers to a large geographical area containing several firing sites, for example TA-40. "Firing site" refers to an individual Firing Point or Chamber, for example Eenie Site.

4.0 DEFINITIONS

Access Control: Access Control is governed by three Access Control Offices. The Access Control Office in TA-15-183 administers access into firing areas at TA-15, TA-36, and TA-39, and oversees the exchange badge process and controls visitor access into these firing areas. Access to TA-40 is administered by the DX-1 Group Office at TA-22-90. Access to TA-14 is via the DX-2 Group Office at TA-9-21.

Access to TA-39 is also handled through the Administrative Office at TA-39-2.

Access Gates: Gates or chains that can be locked. The keys are administratively controlled by the Access Control Office and Local Access Offices.

Perimeter Gate: A gate at the boundary of explosives buffer area. Keys are kept in the Access Control Office at R-183.

Safety Gate: A gate that marks the entrance to a Firing Point. The last gate before hazard is encountered, the safety gate may be interlocked.

Area K-I: Encompasses Kappa Site (TA-36), and the northern part of R-Site (TA-15) mesa east of the safety fence.

Area III: Encompasses the south leg of R-Site mesa where the PHERMEX firing site is located. It includes all of the mesa leg east of the North-South-running safety fence with the north, east, and south bounded by canyon rims.

Barricade: A portable device, such as a sawhorse, with an appropriate sign, used to halt traffic into an area that is hazardous or is about to become hazardous.

Clearance Plans: Procedures that protect personnel within the firing areas by controlling access during explosive experiments, radiographic operations, or other potentially hazardous operations. The level of the clearance plan determines the control procedures to be followed, an the extent of the cleared area.

Cleared Area: An area that has been physically patrolled by a person performing assigned duties, or an area in which all personnel have been accounted for. A Cleared Area has been declared safe for firing operations to proceed.

Escort: *During hazardous operations*, an escort is defined as a Knowledgeable Person, who is familiar with procedures and operations in the firing areas and who assumes responsibility for the safety of assigned visitors at the firing site.
During non-firing operations, escort refers to a Q-cleared person accompanying a non-Q-cleared person in secure areas.

Firing Area: The areas where firing operations are conducted. Access to these areas is controlled, and is through an Access Gate. These areas are Area K-I, Area III, TA-40 Firing Area, TA-39 Firing Area, and TA-14.

Firing Point or Site: The actual location of an explosive test and its exclusion area behind the appropriate safety gate.

Firing Leader: A full-time DX Division employee, authorized by DX-4 line management to supervise, conduct, and be responsible for operations at the site of the test. This person's accumulated knowledge and experience are crucial to all explosives firing operations.

Knowledgeable Person: A person, designated by the Group Leader or the Deputy Group Leader, deemed eligible for a pictured exchange badge because of specified training and experience. All other personnel are visitors.

Local Access Office: Access to TA-14, TA-39, and TA-40 is governed by Local Access Offices at TA-9, TA-39, and TA-22, respectively. These offices supplement the Access Control Office, and handle some visitor access. (See Access Control.)

Radiological Control Technician (RCT): An ESH-1 Employee who is DOE certified to perform and document radiological surveys according to specified Laboratory and DOE procedures. A specialist who monitors personnel, equipment, or firing sites for radioactivity, and documents the results.

Roadblock: A roadblock is established by having a DX Division employee or trained Knowledgeable Person (Clearance Patrolman) in the road to stop traffic. The roadblock may be an employee with a radio, or an employee with a radio and a vehicle. This person maintains contact with the Firing Leader and the Access Control Office as necessary. The roadblock may be a barricade in the center of the road with a sign stating that hazardous operations are in progress.

Safety Fence: A fence placed to indicate a separation of areas, usually a supplement to, and continuation of, a safety gate or an access gate.

TLD Badges: Thermoluminescent Dosimeter - A dosimeter which is in the form of a badge, intended to record the radiation dose received by the whole body of the wearer.

Visitor: A person in a firing area who has not met the requirements for a "Knowledgeable Person."

Escorted - Visitors who have not received site-specific training or are unfamiliar with operations, or who lack a Q clearance, and are escorted into firing areas.

Unescorted - A visitor who has received site-specific access orientation, and a Visitor's Badge, and may be in a

firing area unescorted when no firing operations are in progress.

Visitor's Badge (V Badge) : A badge bearing a "V" instead of a picture, to be given to visitors who are not knowledgeable in local operations and procedures, but have received site-specific training.

5.0 RESPONSIBILITIES

5.1 Knowledgeable Person

- Responsible for safety and security of firing operations.
- Responsible for ensuring that access control and clearance procedures are properly conducted.
- Accepts personal ownership of working areas.
- In case of ES&H concerns, takes personal responsibility to see that proper actions are requested and implemented.
- May escort visitors.

5.2 Firing Leader

- Determines who is allowed access during firing or other hazardous operations.
- Oversees the safety of personnel, equipment, and facilities at the firing site.

5.3 Access Control Officer

- Administers personnel access into firing areas, and manages exchange badges where they are used.
- Verifies that requirements for visitor access are met. Maintains visitor access documents and records.

- Participates in clearance procedures as appropriate. Interacts with Firing Leader for firing operations.
- Enforces prohibition on matches and lighters.

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Clearance Plans

Clearance Plans have been developed to protect personnel within the firing areas. Clearance Plans are specified for explosives firing operations, for radiographic operations or pulsed-power operations, or for shots that may release toxic material.

For specific details of clearance plans, see Area-specific SOPs for Clearance and Firing Operations.

It is strictly forbidden to pass any barricade or roadblock. Visitors encountering these should return to the Access Control Office or Local Access Office or wait until the restriction is removed. Travelers should check with the Local Access Office before starting.

6.2 Smoking, Matches, and Flame-Producing Devices in Firing Areas

- No one may take matches, lighters, or other flame-producing devices into the firing areas. Matches and lighters must be left at the Access Control Office at R183 or at TA-22. At TA-39, a box is provided at the gate for these items. At TA-14, they are left at the DX-2 Group Office.
- Exceptions are discussed in DX-4 SOP "General Safety."

6.3 Fire Department Notices

- Fire Department notices for Firing Operations are given by the Access Control Office at TA-15-183, for every firing site.

- Fire Department access procedures are specific to individual firing sites and are discussed in Site-specific SOPs.

7.0 PROCEDURAL STEPS

7.1 General Access Requirements

- Access Control Personnel administer access into the firing areas. They instruct visitors on site hazards, make arrangements for enhanced visitor training for off-road access, oversee visitor orientation, and issue the required exchange and dosimetry (TLD) badges. Access Control Personnel appropriate matches, lighters, and other flame-producing items. Access Control Personnel may issue radios or cell phones to visitors who might otherwise be out of communication with firing site staff, allowing personnel in firing areas to be located or warned when firing or other hazardous operations are about to begin.
- Access to TA-15 and TA-36, and visitor access to TA-39 sites is via the Access Control Office, located at TA-15-183. TA-40 Firing Sites are administered by the DX-1 Group Office at TA-22-90. Access to TA-14 is via the DX-2 Group Office at TA-9-21.
- Safety orientations will be given to all visitors entering Firing Areas, to inform them of special rules. Details vary from area to area. The orientation need only be given once a year to each particular visitor, but may be requested at any time. The visitors register is signed for every entry and exit. Access Control personnel will retain records of orientation.
- Fire department access to firing areas must be controlled to avoid exposing the firemen to explosive hazards, but access must be rapid in case of a fire. The Access Control Office at R183 will communicate with and advise the Fire Department when they are needed, and arrange for access to be available and safe. Access Control at TA-15-183 will be notified of emergency Fire Department activities.
- Exchange badges are issued by Access Control Personnel to personnel crossing certain boundaries. Exchange badge systems may serve a variety of functions; badges may be used as a counting system to locate personnel, they may serve as a token that specific training has

been received or RADCON requirements have been met, or they may bear necessary keys, and denote who has these keys.

- When exchange badges are used, they are received upon every entry and exchanged immediately upon exiting from a firing area. Exceptions may be granted by he DX-4 Group Leader in Area III under special circumstances when there are no explosive operations planned for an extended period.
- The DX-4 Group Leader may establish deviations from normal exchange badge policy.
- Uncleared personnel shall be escorted into all areas. L-Cleared personnel shall be escorted into all Q-Cleared areas. Neither uncleared nor L-Cleared personnel will be issued exchange badges. DoD clearances are treated on a case-by-case basis.
- Special keys are found on visitor exchange badges. These keys unlock access gates. **These keys must not be removed from the exchange badges.**
- Perimeter gate keys are controlled by the Access Control Office at TA-15-183. Perimeter gates and barricades are listed in Attachment 1, "Site Description."
- The Access Control Office will be manned after hours for explosives operations at all sites, and in Area III, for A Minor radiation operations if visitors are present. After hours, hazardous operations in any area require Access Control at TA-15-183 to be informed before the close of business (4:00 PM), so that a central point of contact exists for informing all emergency personnel or other traffic in the area. Any visitors remaining at TA-15 or TA-36 firing areas will inform the Access Control Office before 4:00 PM, and make appropriate arrangements for recovering their regular technical badges from the exchange badge rack. The TA-22 DX-1 Group Office will inform the TA-15-183 Access Control Office of any personnel conducting hazardous operations at TA-40 after hours. Personnel conducting hazardous operations at TA-39 after hours will inform the Access Control Office before the close of business.

7.2 Visitors

All visitors must report to the Access Control Office or to the proper Local Access Office (TA-9, TA-15, TA-22, or TA-39) for permission to enter firing areas.

7.2.1 Access Control Office at R183

- Normal working hours at TA-15-183 are 8:00 AM - 4:00 PM. Work after normal working hours needs to be arranged through Access Control.
- Before entering the firing area for the first time, visitors will receive safety instructions, read a visitor orientation packet, and sign the visitor information sheet to certify that they have read and understand the information. They must also sign the visitor log book on each entry and departure.
- Persons holding a Secret-National Security Information (SNSI) security badge will be given permission to enter firing areas on a case-by-case basis to assure that they have the appropriate sigma levels.

7.2.2 Tours

Tours of a firing area are not given while firing operations or other hazardous operations are in progress in that area. Shot Observation is not considered a tour. The DX-4 Group Leader or ES&H Officer may waive any Exchange Badge requirement for tours involving a large number of people. In such cases, the escort will have a pictured exchange badge where required, and will report the number of people in the tour to the Access Control Office, where appropriate information will be attached to the escort's technical badge.

7.2.3 Shot Observation List

A person on site solely to passively observe a shot is classed as a visitor. Shot Observation does not constitute a tour. Observers will be escorted, and their presence at the observation point will be checked against the Shot Observation list at appropriate times.

7.3 Vehicle Access

It is strictly forbidden to pass any barricade or roadblock. Visitors encountering these should return to the Access Control Office or Local Access Office or wait until the restriction is removed. Travelers should check with the Local Access Office before starting.

The Lead Clearance Patrolman and the Firing Leader are authorized to restrict any travel that would affect personnel safety or would delay any firing operation.

7.4 Emergency Procedures

7.4.1 Building or Site Emergency

If an emergency situation should occur, follow the Building Emergency Plan (BEP)/Site Emergency Plan (SEP). The BEP/SEP must be available in the building and the operators shall be familiar with its contents.

7.4.2 Personal Injury

In any emergency involving injury to a person or persons, the employee encountering the accident should use good judgment on the procedures to be followed, depending on the circumstances. Decisions made by a DX Division employee at the scene of an accident will be supported by the DX Division management.

If there is a serious injury or accident, dial 911, aid victims, direct emergency vehicles, notify the Group Office, record accident details.

8.0 REQUIRED RECORDS

- Daily Visitor Log.
- Visitor and Training Databases.
- Visitor Information Sheet.

9.0 REFERENCES

- *DOE Explosives Safety Manual.*
- **Los Alamos *Environment, Safety, and Health* Manual, AR 6-6, "Explosives."**
- **DX Division Operations Manual**

10.0 ATTACHMENTS

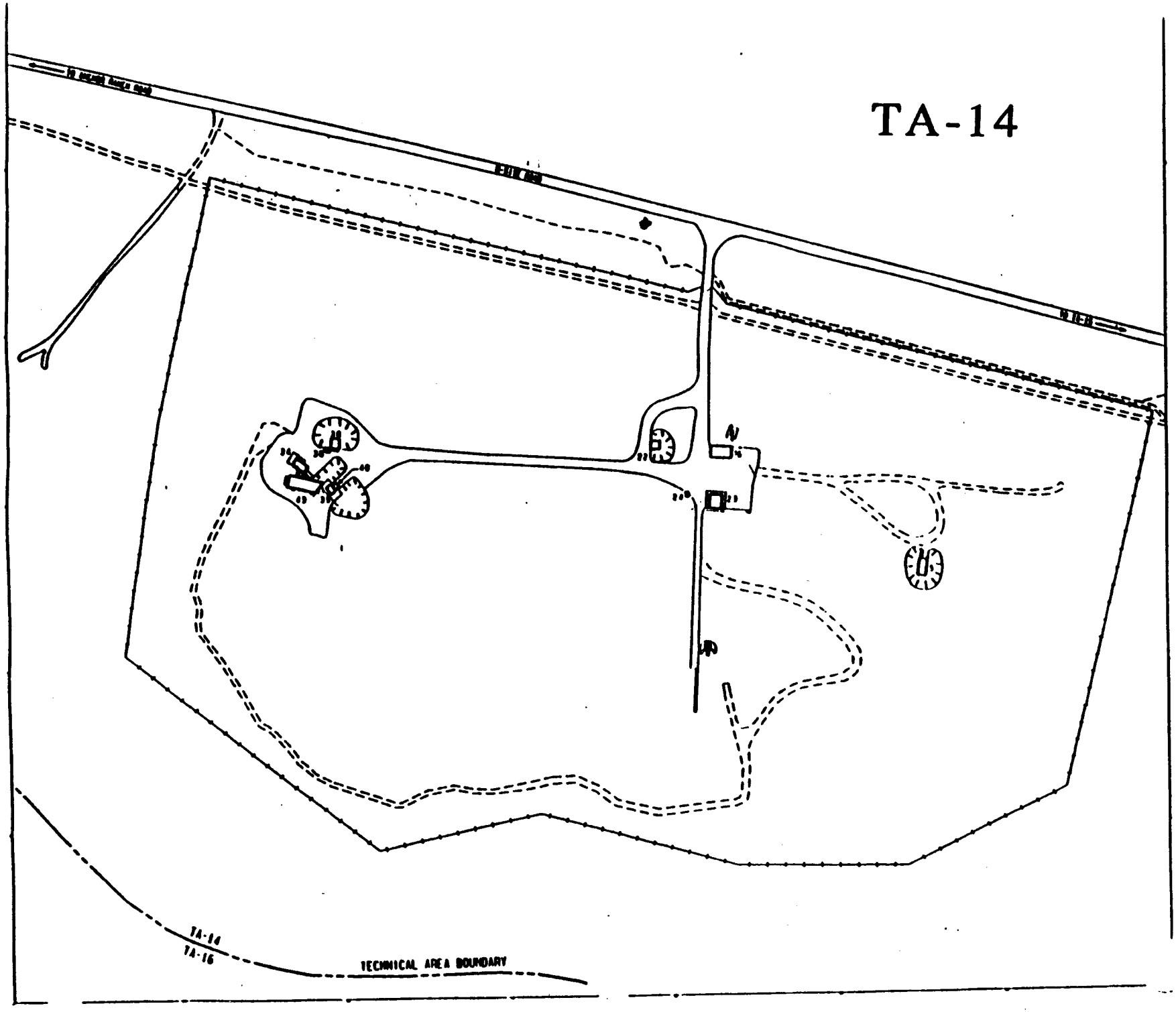
ATTACHMENT 1. Maps and Site Descriptions

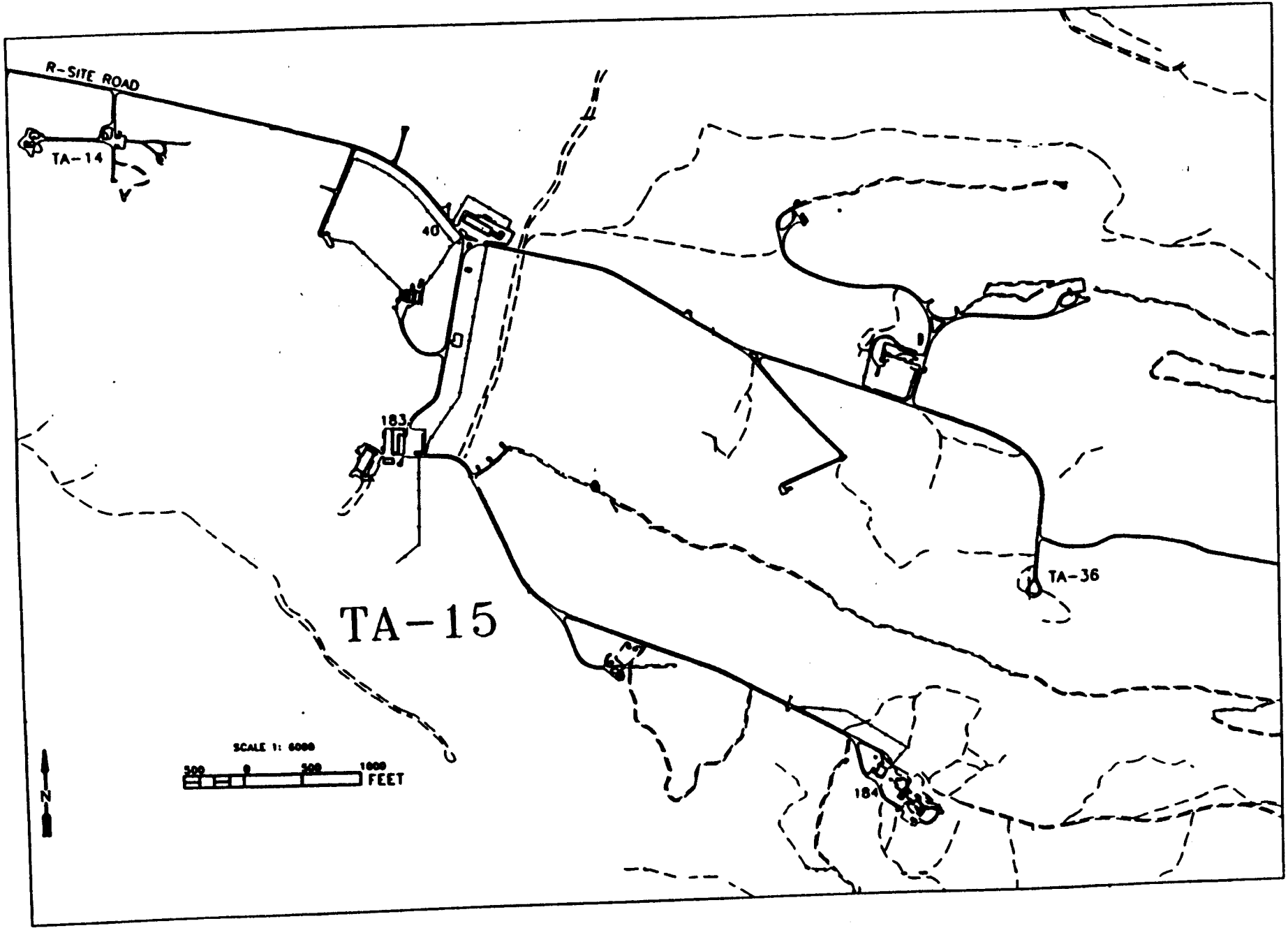
ATTACHMENT 1

Site Descriptions:

DF Site TA-40	Encompasses firing areas at the end of Two Mile Mesa.
Ancho Canyon TA-39	Encompasses firing sites at the head of Ancho Canyon, north of State Road 4.
Q site TA-14	The outdoor chemical laboratory associated with TA-9, and located halfway between TA-9 and TA-15.
Potrillo Canyon	Potrillo Canyon separates K-I and Area III. The power line runs down Potrillo Canyon. The canyon starts east of R-243, runs east between K-I and Area III, passing south of IJ Point and north of PHERMEX, and exiting at Eenie Site.
Area K-I:	Encompasses Kappa Site (TA-15), and the area previously known as Area I, situated on the northern part of R-Site (TA-15) mesa east of the safety fence, where five firing points are located.
Area III:	The south leg of R-Site (TA-15) mesa where the PHERMEX firing site is located. It includes all of the mesa leg east of the safety fence with the north, east, and south bounded by canyon rims.
Redondo Road:	Road west of R40 and leading northeast from its intersection with R-Site Road (link between TA-9 and TA-15). Redondo Road is closed with a chain. Redondo Road provides access to TA-67, formerly called TA-12.
Ridge Road:	The road leading from the immediate vicinity of IJ firing point at TA-15 to Kappa Site, TA-36.
IJ Road:	The road leading from the intersection near R306 to IJ Point, at TA-15.
Jumbo Road:	A dirt road between Eenie Site, TA-36, and the PHERMEX firing point.
Water Canyon:	Located south of R-Site (TA-15) and bordered by State Route 4, on the east and TA-49 on the south. The Access Control Office in TA-15-183 controls access to Water Canyon.

TA-14

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TA-15
TA-36
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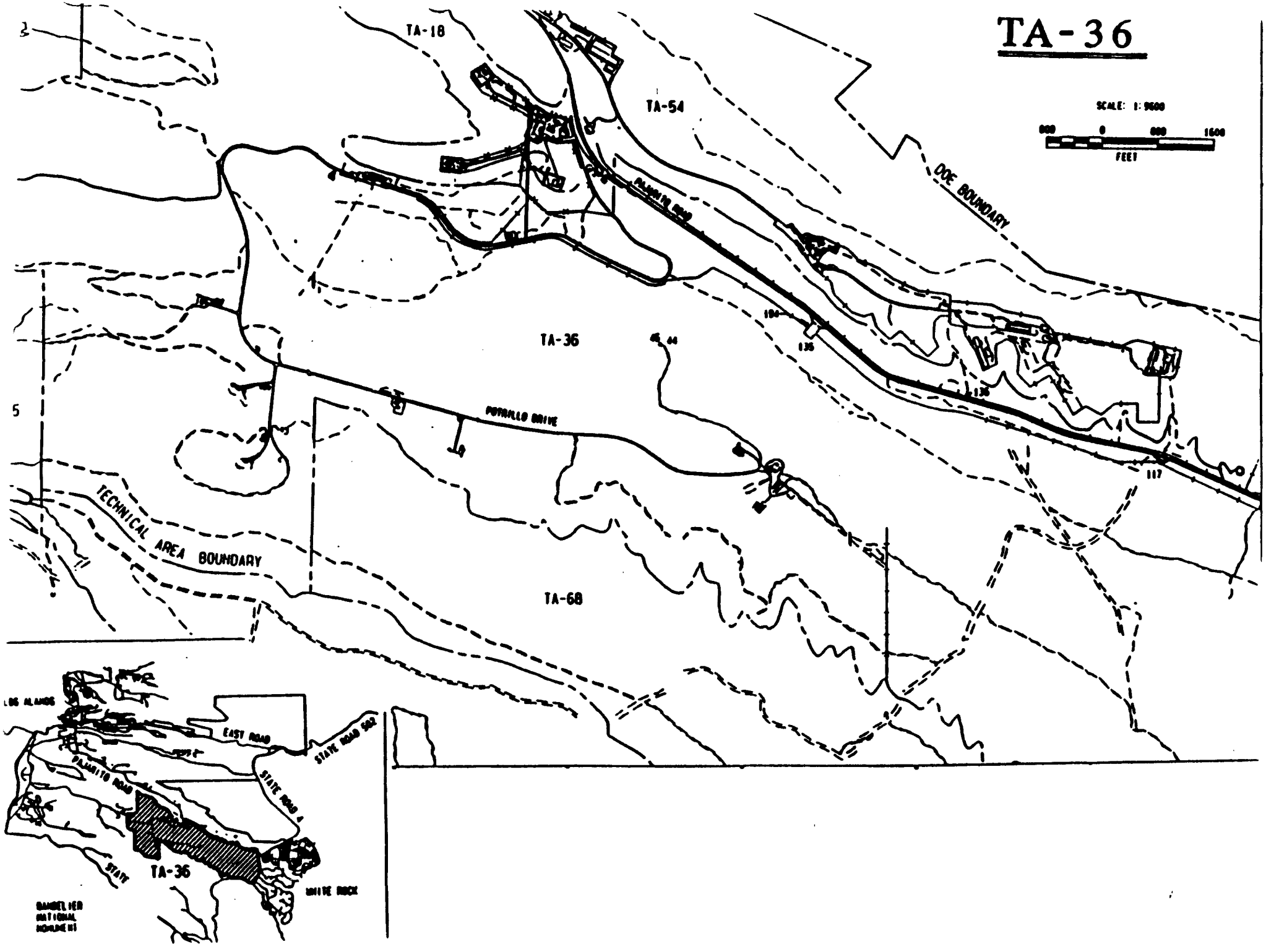
TA-36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POTRILLO DRIVE
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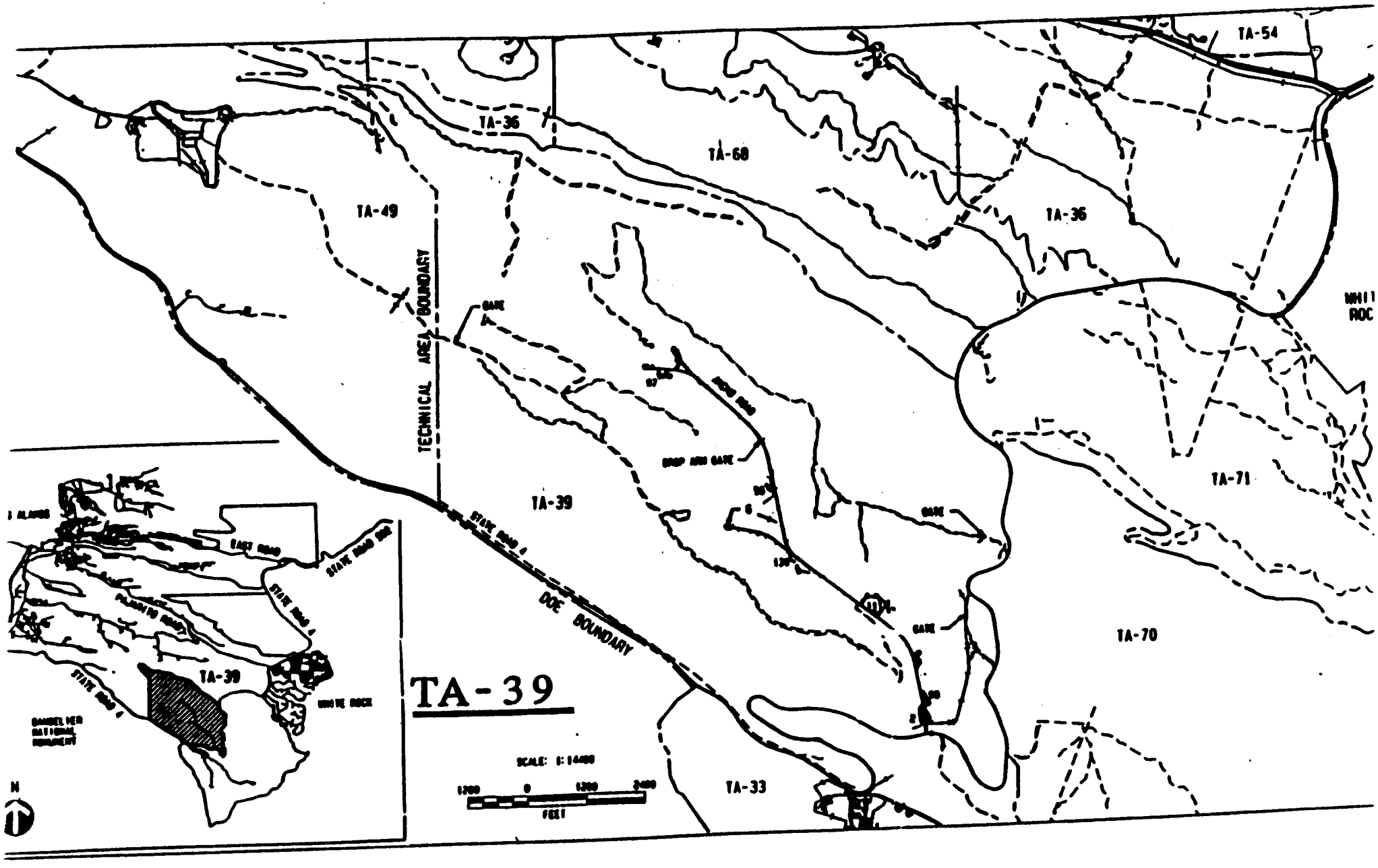
LOS ALAMOS
EAST ROAD
STATE ROAD 502
STATE ROAD 4
STATE
WHITE ROCK
BANDELIER NATIONAL MONUMENT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TA-54
TA-36
TA-68
TA-49
TA-36
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GATE
DROP ARM GATE
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STATE ROAD 4
DOE BOUNDARY
GATE
TA-70
TA-33
SCALE: 1:14400
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PLANTED ROAD
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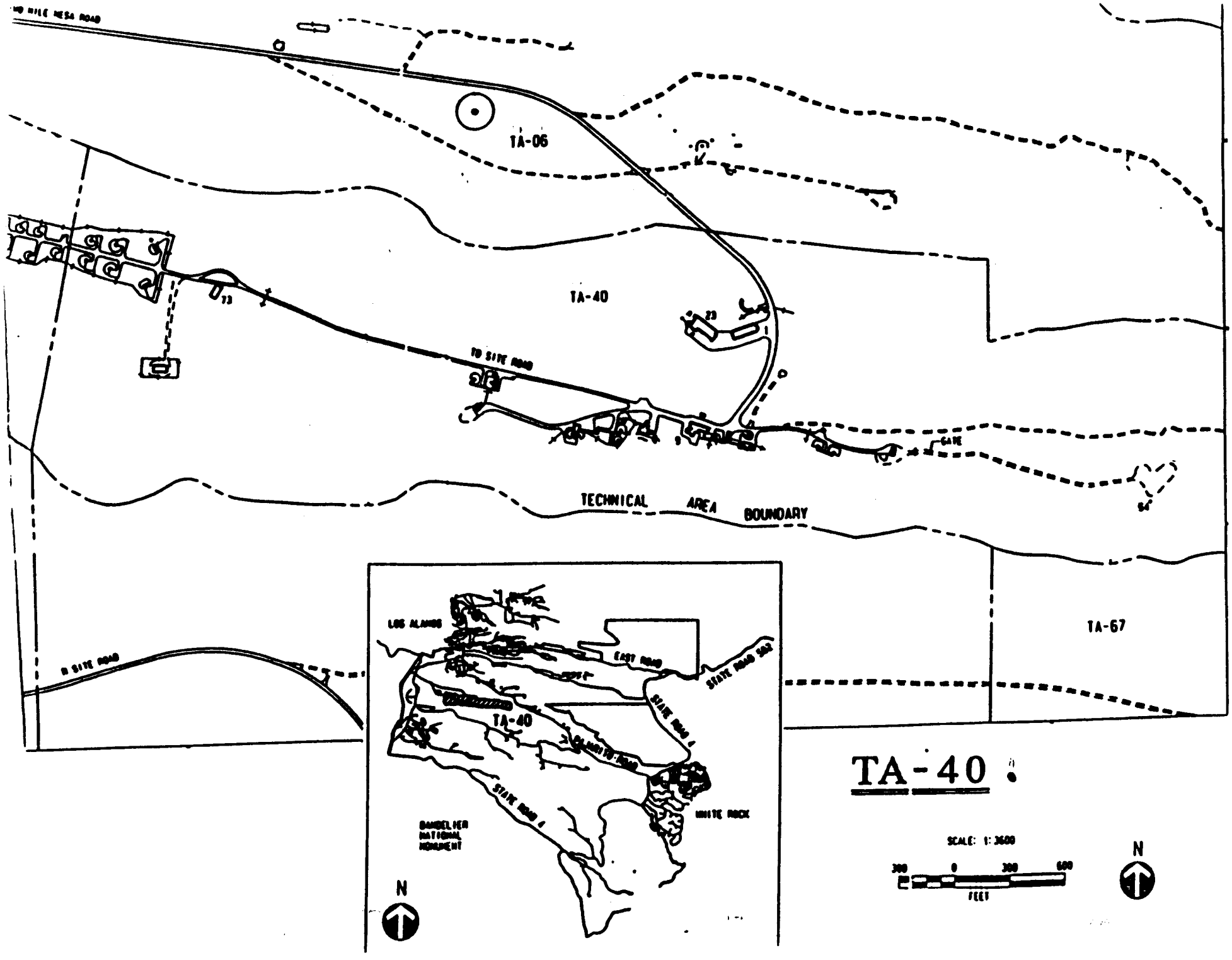
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300 0 300 600
FEET
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DX-4

STANDARD OPERATING PROCEDURE

FOR

GENERAL SAFETY

SOP 3

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TABLE OF CONTENTS

1.0 INTRODUCTION 4

2.0 PURPOSE 4

3.0 SCOPE 4

4.0 DEFINITIONS 4

5.0 RESPONSIBILITIES 7

5.0.1 All Employees 7
5.0.2 Supervisors 7
5.0.3 Firing Leader 7
5.0.4 Knowledgeable Persons 8
5.0.5 Unescorted Visitors 8
5.0.6 Escorted Visitors 8

5.1 REQUIRED READING 8

5.2 TRAINING 9

5.3 WASTE MINIMIZATION 9

6.0 PRECAUTIONS AND LIMITATIONS 9

6.1 HOUSEKEEPING AND PERSONNEL HYGIENE 10

6.2 HEARING PROTECTION 11

6.3 BARRICADES, GATES, AND WARNING SIGNS 11

6.4 WARNING LIGHTS, HORNS, AND SIRENS 11

6.5 RADIO COMMUNICATION 12

6.5.2 Multiple Division Radio Nets 12
6.5.3 Use of Radios During a Test or Experiment 12
6.5.4 Restrictions 12

6.7 MOTOR VEHICLES 13

6.8 REQUIREMENTS FOR DOCUMENTATION 13

6.9 APPROVED EXPLOSIVES AND GLUES 13

6.10 CONTROL OF ACCESS THROUGH FIRING-AREA GATES 13

6.11 WORKING ALONE 14

6.12 ELECTRICAL EQUIPMENT 14

6.13 PROTECTIVE CLOTHING AND EQUIPMENT 14

6.13.1 EYE PROTECTION 14
6.13.2 CLOTHING 15

6.14 EXPLOSIVES LOAD LIMITS 15

6.15 LIGHTNING 15

6.16 EXPLOSIVES EXCLUDED AREAS 16

7.0 PROCEDURAL STEPS 16

7.1 EMERGENCY PROCEDURES 16

7.2 HANDLING OF EXPLOSIVES 16

7.3 FIRES 17

7.4 PERSONNEL AUTHORIZATIONS 17

8.0 REQUIRED RECORDS 18

9.0 REFERENCES 18

10.0 ATTACHMENTS 18

1.0 INTRODUCTION

At Los Alamos, the group's primary mission is to support experimental research and development and application of explosives for the Los Alamos Nuclear Weapons Program and other customers. We provide the safety envelope, operational expertise, and experimental facilities for all explosives firing operations in the Division.

2.0 PURPOSE

This SOP is one of the series of DX-4 SOPs that provides necessary information, describes the hazards, and specifies safety procedures for all the areas and operations under the purview of the Field Operations and Experiment Support Group, DX-4. The purpose of this SOP is to provide general information and to identify the general hazards to which personnel may be exposed and to specify ways to minimize these hazards. This document provides part of the common reference material and the basic procedures and protocols that are part of ensuring a safe working environment.

3.0 SCOPE

This SOP is applicable to all personnel who frequent the areas listed below, or who are authorized to perform explosives firing operations at the areas operated by DX-4. These Explosives Firing Areas are described below and identified on the Maps attached as Figure 1:

- Area 3 (R-Site) includes the area East of the access gate near Building TA-15-40 (R-40), and the areas East of Building TA-15-183 (R-183).
- K1 (Kappa Site) includes all DX Division areas between the R40 gate and the east gate.
- TA-39 (Ancho Canyon) includes all areas North of the firing area access gate (but excludes the gas gun building 69 and support buildings 56 and 89).
- TA-40 (DF Site) includes all TA-40 DX-4 facilities South of Buildings 1 and 23.
- TA-14 (Q-Site) includes TA-14, Q-Site buildings

This SOP applies to all personnel, operations, and equipment involved in these experimental areas.

4.0 DEFINITIONS

- **Access Control** -- Access Control is guided by the General Access Control SOP 1.0. Access Control is governed by the Access Control Office, and by Local Access Offices. The Access Control Office in TA-15-183 administers access into firing areas at TA-15, TA-36, and TA-39, and oversees the exchange badge process and controls visitor access into these firing areas. Access to TA-40 is administered by the DX-1 Group Office at TA-22-90. Access to TA-14 is via the DX-2 Group Office at TA-9-21. Access to TA-39 is also handled through the Administrative Office at TA-39-2.

- **Access Gates** -- Gates or chains that can be locked. The keys are administratively controlled by the Access Control Office and Local Access Offices.
- **Area K-I** -- Kappa Site Area I includes R-306 at TA-15, all (five) firing sites at TA-36, and the northern part of R-Site mesa east of the safety fence.
- **Area III** -- Encompasses the south leg of R-Site mesa where the PHERMEX firing site is located. It includes all of the mesa leg east of the North-South-running safety fence with the north, east, and south bounded by canyon rims.
- **Authorizations and Assignments Document** -- A DX Division document that lists those individuals with special authorizations and/or assignments in the areas of explosives firing operations, firing area access, general industrial safety, special operations, and other areas of ES&H.
- **Barricade** -- A portable device, such as a sawhorse, with an appropriate sign, used to halt traffic into an area that is hazardous or is about to become hazardous.
- **Clearance Plans** -- Procedures that protect personnel within the firing areas by controlling access during explosive experiments, radiographic operations, or other potentially hazardous operations. The level of the clearance plan determines the control procedures to be followed, and the extent of the cleared area.
- **Cleared Area** -- An area that has been physically patrolled by a person performing assigned duties, or an area in which all personnel have been accounted for. A Cleared Area has been declared safe for firing operations to proceed.
- **EED** - Electroexplosive Device
- **ERC** - Explosive Review Committee
- **ES&H** - Environment, Safety, and Health
- **Escort** --
  During hazardous operations, an escort is defined as a Knowledgeable Person, who is familiar with procedures and operations in the firing areas and who assumes responsibility for the safety of assigned visitors at the firing site.
  During non-firing operations, escort refers to a Q-cleared person accompanying a non-Q-cleared person in secure areas.
- **Explosives** -- Explosives are defined in the *DOE Explosives Safety Manual* as any chemical compound or mechanical mixture that will burn or explode if heated, exposed to impact, pinched between moving surfaces, or subjected to an electric discharge or strong shock. The term applies to materials that either detonate or deflagrate. Because explosives do not all behave in the same way, they are divided into classes. Those of most interest to DX Division are initiating, boostering, and bursting-charge (secondary) explosives, propellants, and some types of military ammunition. A list of approved explosives is given in Attachment 1.
- **Explosives Allowed Area** -- Any area where explosives or explosive-containing components are stored, manipulated, prepared, or set-up for firing.
- **Explosives Excluded Area** -- An area where no explosive, explosive contamination, or operations with explosives are allowed. Generally, these are firing and diagnostic bunkers, offices, and buildings not specifically designated for explosives use or operations.
- **Firing Areas** -- The areas where firing operations are conducted. Access to these areas is controlled administratively and by an area Access Gate. These areas are Area K-I, Area III, TA-40 Firing Area, TA-39 Firing Area, and TA-14.

- **Firing Keys** -- Strictly controlled keys that unlock firing circuits.
- **Firing Leader** -- A full-time DX Division employee, authorized by DX-4 line management to supervise, conduct, and be responsible for operations at the site of the test. This person's accumulated knowledge and experience are crucial to all explosives firing operations.
- **Firing Mound** -- Firing mound refers to the sand pile or steel firing pad on which the shot assembly is placed.
- **Firing Point or Site** - The actual location of an explosive test and its exclusion area behind the appropriate safety gate.
- **Hazard Circle** -- A region, not always circular in shape, that is evacuated in a clearance plan because shrapnel from the shot is expected to land within that region. May also be called a hazard zone or a fragment area. However, the definition of a hazard circle is only a guideline, fragments occasionally land outside of them.
- **HE** -- High Explosive
- **Knowledgeable Person or Employee** -- A person, designated by the DX-4 Group Leader or the Deputy Group Leader, deemed eligible for a pictured exchange badge because of specified training and experience. All other personnel are visitors. All required reading, institutional training, and OJT requirements must be completed before becoming a knowledgeable person or employee. These requirements are specified in Site Specific SOPs or the Authorizations and Assignments Document.
- **Local Access Office** -- Access to TA-14, TA-39, and TA-40 is governed by Local Access Offices at TA-9, TA-39, and TA-22, respectively. These offices supplement the Access Control Office, and handle some visitor access. (See Access Control.)
- **Low Energy EEDs** -- Hot-wire initiators, squibs, blasting caps, etc.
- **Pictured Exchange Badge** -- A badge bearing the employees picture, given to employees who are knowledgeable in operations and procedures.
- **Primary Explosives** -- Explosives with a sensitivity greater than PETN
- **Safety Fence** -- A fence placed to indicate a separation of areas, usually a supplement to, and continuation of, a safety gate or an access gate.
- **Safety Gate** -- A gate that marks the entrance to a Firing Point. The last gate before hazard is encountered, the safety gate may be interlocked.
- **SOP** -- Standard (or Safe) Operating Procedure
- **SWP** -- Special Work Permit
- **Visitor's Badge (V Badge)** -- A badge bearing a "V" instead of a picture, to be given to visitors who are not knowledgeable in local operations and procedures, but have received site-specific training.
- **Visitor** -- a person in a firing area who has not met the requirements for a "Knowledgeable Person."
  - **Escorted** -- Visitors who have not received site-specific training or are unfamiliar with operations, or who lack a Q clearance, and are escorted into firing areas.
  - **Unescorted** -- A visitor who has received site-specific access orientation, and a Visitor's Badge, and may be in a firing area unescorted when no firing operations are in progress.

5.0 RESPONSIBILITIES

The responsibilities described below are common to all DX-4 SOPs.

5.0.1 All Employees

By Laboratory policy, the primary responsibility for ES&H rests with line management. However, the individual employee is the one best able to assure his or her personal safety. Employees must not undertake any operation they believe will be unsafe or contribute to an unsafe condition; rather, they must report such to their line supervisor or ES&H Officer who will resolve the concern or seek further guidance from line management.

Urgency is never an excuse for performing an unsafe operation or violating an ES&H rule. Line supervisors are responsible for establishing a safe work environment; the employees, in turn, must follow all ES&H rules for their own safety and the protection of their fellow employees and the environment.

5.0.1.1 All individuals should comply with the SOPs governing any activity in which they are engaged. Ignorance of the contents of an SOP does not excuse any violation. Any confusion regarding an SOP should be clarified before an operation begins.

5.0.1.2 All Employees are encouraged, at all times, to suggest changes to an SOP or procedure. For example, a change might make an SOP easier to read, or an operation safer or more efficient.

5.0.1.3 In situations where an approved SOP cannot or should not be strictly adhered to, the SOP must be revised or a deviation be formally approved (i.e. SWP). Violations of SOPs (or any other action which jeopardizes safety), whether willful or unintentional, cannot be tolerated and must be reported to the Group Leader for appropriate action. If a violation is committed by someone other than an DX-4 employee, that person's organization will be notified by the Group Leader.

5.0.2 Supervisors

Each line supervisor must know the SOPs that apply to operations under their control and will be responsible for assuring that these SOPs are kept current and enforced.

5.0.3 Firing Leader

The Firing Leader shall have immediate responsibility for the operational safety of an operation, and shall be the final authority on questions of safety and procedure during operations at a Firing Point. Also, the Firing Leader is:

- Knowledgeable about group SOPs and operations.

- Responsible for selecting or confirming the choice of the appropriate clearance plan (hazard circle) for the shot, based on details of the experiment.
- Responsible for overseeing the safety of the firing crew, other personnel, equipment, and facilities at the firing site. Responsible for the safety and security of the firing operations.
- Responsible for personnel control on the firing mound or in the firing chamber.
- Shall not permit firing until all personnel within the hazard zone of the shot are in safe shelters, or are removed from the hazard zone.
- Responsible for firing keys during firing operations.
- Ensures that safety and operational equipment is used properly.
- Participates in inspections; ensures that any defects found during routine maintenance and inspection are corrected by the appropriate personnel.
- Assists in critiques and accident investigations; reports occurrences.
- May delegate some responsibilities to authorized personnel.

5.0.4 Knowledgeable Persons

Knowledgeable Persons shall obey the safety and security procedures for firing operations, obey access control and clearance procedures, and assist others in the proper conduct of firing area operations. Knowledgeable Persons must exhibit personal ownership of working areas and, if there are any ES&H concerns, take personal responsibility to see that proper actions are requested and implemented. Knowledgeable persons may escort visitors.

5.0.5 Unescorted Visitors

Unescorted visitors shall have a Q-clearance, obey all aspects of the site-specific access orientation, and stay in communication with Access Control by cell phone or radio. Unescorted visitors will be given V badges for entry to TA-15, -36, -39, and -40. Specifics of access will be determined by the Access Control Office and Local Access Offices. Unescorted visitors may escort Escorted Visitors.

5.0.6 Escorted Visitors

Escorted Visitors shall obey and stay with their escort at all times while in a firing area.

5.1 Required Reading

5.1.1 Each employee must read all the SOPs that apply to their job at the time of their assignment and yearly thereafter. Revisions to the SOPs must be read prior to performing the operations described.

5.1.2 Line supervisors will be responsible for determining which SOPs are required for their employees.

5.2 Training

5.2.1 The line supervisors are responsible for on-the-job-training, documentation of that training, detailed instruction, and monitoring of the operators' competence and adherence to instructions.

5.2.2 Explosive operations shall be performed only by personnel with proper training and supervisory approval.

5.2.3 All training is to be in accordance with the DX Division Training and Qualifications Manual.

5.3 Waste Minimization

5.3.1 Waste minimization will be handled according to the Waste Minimization section of the DX Division Operations Manual and the LANL ES&H Manual, AR 10-8.

5.3.2 Waste generated from operations must be reduced as much as technically and economically feasible. To meet this objective, the waste minimization practices of material substitution, good housekeeping, and hazard segregation must be incorporated into all waste generating activities. All waste generators are responsible for making every practical effort to reduce the amount of waste produced.

5.3.3 All waste will be handled according to the DX Division Waste SOP and the LANL ES&H Manual, AR 10-3.

6.0 PRECAUTIONS AND LIMITATIONS

Precautions: The general hazards associated with DX-4 operations include mechanical equipment (from hand tools to mobile cranes), electrical sources (wall outlets to high voltage capacitors and power supplies), laser and X radiation, DU or other radioactive materials, chemicals, and, foremost, high explosives. The precautions and limitations for each of these hazards are given in the SOPs that cover particular operations or locations. Because explosives are the common element of most DX-4 operations, the precautions and limitations for their use are detailed here.

6.0.1 The hazards associated with explosives and explosive devices are blast, fragments, violent deflagration, and possible toxicity.

6.0.2 Explosives are energetic materials that can react violently. Explosives will be protected from abnormal stimuli or environments, including:

- friction forces
- excessive pressures
- impact, shock, pinching

- deformation
- electrical sparks, abrasive or welding sparks, open flame
- contamination
- excessive temperature

6.0.3 An approved SOP/SWP shall be available before any explosives operation is performed. Such SOPs/SWPs shall be readily available in the work areas to which they apply.

6.1 Housekeeping and Personnel Hygiene

Housekeeping in all areas shall be maintained at extremely high levels. Aisles, corridors, and safety exits shall not be blocked.

6.1.1 Spilled explosives shall be cleaned up immediately, then, if necessary, disposed of according to the DX Division Waste Management SOP.

6.1.2 In addition to being an explosive hazard, explosives also are a possible toxic hazard, with respect both to inhalation and to contact with the skin. Some people are more sensitive than others and can for example develop a skin rash, or get headaches from the nitroglycerin in propellants. For these reasons, personnel shall maintain a high degree of personal hygiene by washing their hands after handling explosives, especially before eating or smoking.

6.1.3 Personnel handling explosives shall visually check their work clothing to be sure no explosives are carried from an explosives area to a non-explosives area. Personnel shall not consume any food or drink item in any Explosives Allowed Area.

6.1.4 All maintenance and custodial personnel shall be cleared into any explosive area prior to any maintenance work. The DX-4 SOP governing Custodial and Maintenance Activities in Firing Areas discusses the procedures and limitations to be followed by all personnel doing such work. The removal of any equipment from an explosives work area shall meet the requirements of this SOP. Maintenance work in an Explosives Allowed Area may require an SWP.

6.1.5 Use of flammable solvents in an explosives area considerably increases the explosive hazard because of the ease-of-ignition of the solvent with a possible spread of fire to explosives. Therefore, solvent use and evaporation shall be kept to a minimum. Solvent use will take place in well-ventilated areas, and with proper personal protective equipment.

6.2 Hearing Protection

Hearing protection must be provided at all operations where there is a potential for hearing damage, and must be worn when appropriate.

6.3 Barricades, Gates, and Warning Signs

It is strictly forbidden to pass any barricade, closed gate, or warning signs.

Typical warning signs are indicated below. All personnel are required to obey the restrictions indicated by any sign in all areas. A warning sign near the firing mound can read:

DANGER
EXPLOSIVES
Return to lights if horn or siren is sounding.

A warning sign used for barricading an access road during a clearance procedure can read:

DANGER
KEEP OUT
High-Explosive Operations in Progress

A warning sign used for barricading an access road during a radiographic operation can read:

DANGER
KEEP OUT
X-Ray Operation in Progress

6.4 Warning Lights, Horns, and Sirens

The particular sequence of lights, horns, sirens, and pauses differs in detail at the various firing sites. An exact description of the horn-siren sequence for a given Firing Point is found in the Site-Specific SOP for that Firing Point. In general:

- Horns sounded alone (and flashing lights where installed) indicate an experiment will commence in the next several minutes. All personnel should be under cover or at a safe distance. If not, they should seek safe shelter or distance immediately.
- A siren sounding for more than 30 seconds indicates that explosives will be fired within a few minutes. All personnel should be under cover or at a safe distance.
- A sequence of at least two short siren soundings indicates an "All Clear" or safe condition now exists on the Firing Point.

6.5 Radio Communication

Communication on the DX Division radio networks shall be brief, necessary, and unclassified.

6.5.2 Multiple Division Radio Nets

There are several frequencies available for DX Division operations. All of the nets are accessible from Division radios. A list of the net names, call signs, frequencies, and normal use areas is given in Attachment 4.

6.5.3 Use of Radios During a Test or Experiment

There is free-channel radio communication among all firing bunkers, vehicles used for clearance operations, the Access Control Office, the Group Office, several offices of DX Division, and Division members whose expertise is often needed during shot operations. During the time that the firing circuit is unlocked, the radio should be reserved for communication concerning the shot being fired and emergencies.

6.5.4 Restrictions

Handheld radios and mobile RF transmitters (e.g., cell phones) are generally allowed for use within the Explosives Firing Areas. However, in areas where low energy EEDs are stored or used in assemblies or test devices, special control must be exercised. Likely restricted areas include:

- TA-22-34
- TA-22-93
- TA-22, all magazines
- TA-40-5, 6, and 7
- TA-36-11, 12

6.5.4.1 Whenever low energy EEDs are present, it shall be the responsibility of the authorized Firing Leader in the potentially restricted areas to inform the appropriate access control personnel that all RF transmitters in these areas are prohibited. This will be accomplished by informing access control personnel in the TA-22 (DX-1) Group Office, the R-183 Access Control Office, or the TA-39 Administrative Office, who will then restrict visiting personnel from using RF transmitters. Further, operators will place signs on all routine entrances to these areas informing personnel to turn off all RF transmitting devices before entering these areas. The Firing Leader will assure that all personnel within the restricted area are informed of the prohibitions.

6.7 Motor Vehicles

All motor vehicles shall be operated with extreme care, particularly when approaching or leaving the Firing Points, or while in the proximity of placarded explosives-carrying vehicles. Vehicles authorized to carry explosives will comply with all the requirements of the DOE Explosives Safety Manual.

Limitations:

6.8 Requirements for Documentation

An approved SOP/SWP shall be available before any explosives operation is performed. Such SOPs/SWPs shall be readily available in the work areas to which they apply.

6.8.1 A hazard assessment must be written for every new, proposed testing program or new process so that all foreseeable hazards involved may be examined. This shall be done by the most knowledgeable person involved in the test or process with the advice and consent of the Division ES&H Committee, as appropriate. All SWPs will be written and approved according to the process given in the DX Division Writers Guide.

6.9 Approved Explosives and Glues

All explosives or explosive-containing devices that have been approved by the ERC or listed in (ESA) WX-3: SOP 1.1.0, Tables 1 & 2 may be used at DX-4. Attachment 1 is a list of HE routinely used at DX-4, and Explosives in (ESA) WX-3: SOP 1.1.0.

6.9.1 No explosive powders or primary explosives will be handled at DX-4 without prior approval or appropriate SOPs/SWPs.

6.9.2 A list of approved glues for use with identified explosives is given in Attachment 2.

6.10 Control of Access Through Firing-Area Gates

DX-4 knowledgeable personnel and other knowledgeable personnel gain access to the firing areas by using administratively-controlled keys. All other individuals must clear through either the Access Control Office (for TA-15, TA-36, and TA-39), the DX-1 Group Office (for TA-40), the DX-2 Group Office (for TA-14), or the Administrative Office at TA-39 before they will be allowed access to a firing area. Qualified Office personnel instruct visitors on the site hazards, have them read the appropriate visitor information, and enter their names in a log. Access Control Procedures are discussed in detail in DX-4 Access Control SOPs, including "General Access Control."

6.11 Working Alone

DX-4 employees with current safety training and experienced in explosive operations may work alone under appropriate circumstances, such as assembly, measurement, gluing, inspection, and clamping of certain consolidated explosives and explosive devices.

6.11.1 This working alone procedure authorizes personnel to work alone in DX-4 HE operations. When working alone with HE, employees will use a procedure appropriate for the particular work area. These procedures require Access Control, Local Access Office, or a coworker to have the following information:

- Who is working alone,
- Where they are located,
- How long they will be working alone (with a completion time).

6.11.2 All operations shall be performed in accordance with existing SOPs/SWPs. Personnel shall be assigned in a manner such that each worker's presence is frequently monitored for example via radio or physical check. New, special, or non-routine operations will require a separate assessment and an SWP.

6.12 Electrical Equipment

All operations shall be performed in accordance with LANL Electrical Safety Policies.

6.12.1 All permanent electrical equipment and wiring for those areas containing explosive hazards shall conform to the standards of National Electrical Code (NEC), Hazardous Locations, Class II or Class I & II (dual rated), as modified by the DOE Explosives Safety Manual.

6.12.2 Certain electrical equipment not rated NEC Class I or II is permitted for administratively controlled use within the Explosive Preparation Rooms. A list of those rooms is given in Attachment 3. The equipment listed in DX-4 SOP "General Firing Operations" is approved as intrinsically safe when used under the restrictions noted. No electrical equipment may be used unless it is considered NEC Class I or II or listed in "General Firing Operations."

6.13 Protective Clothing and Equipment

6.13.1 Eye Protection

It is a requirement that eye protection be worn at all times when there are eye hazards. Operations can involve a wide range of eye hazards making it difficult and impractical to categorize the type of eye protection necessary for each specific operation involved.

- Eye protection must be worn in all areas in which eye hazards are known to exist, whether working with explosives or not (e.g., machine shops, carpenter shops, operations involving chemicals). Eye protection may be removed only as required for use of optical and other inspection devices.
- All personnel entering posted eye hazard areas must wear the appropriate eye protection for that area, except as permitted below.
- The requirement for eye protection may be waived by the Group Leader or designee for persons who are included in a guided tour where operations have been suspended. The waiver may apply to a room, building, or to all buildings to be visited.
- Visitors, other than those described above, must wear the appropriate eye protection in the designated eye hazard areas. It is the responsibility of the person being visited to assure that the visitor is provided with the necessary eye protection.

6.13.2 Clothing

Generally, clothing provided by the Laboratory for the protection of employees (e.g., safety shoes, clothing for working out-of-doors, hard hats) should not be taken off the Laboratory premises. DX-4 employees are expected to wear appropriate and/or required protective clothing according to the operations being performed. Questions regarding requirements and best practices will be resolved by line management.

- Coveralls (without cuffs) or lab coats shall be worn, at all times, if a potential for explosive-contamination by dust or chips on clothing exists. Explosive-contaminated clothing shall not be removed from the Explosives Allowed Area except for final disposal.
- Certain SOPs or SWPs may require that non-sparking soles, conductive shoes or leg stats be worn, therefore a check of the SOP or SWP covering the operations shall always be made.
- Visitors shall wear shoe coverings if their footwear does not meet the requirements for workers in areas where they are visiting.

6.14 Explosives Load Limits

Each Magazine, Explosives Preparation Room, and Firing Point has a maximum limit on the amount of explosive that can be present during normal operations. These limits are generally expressed in terms of "Pounds (or kg) of TNT explosive equivalent." The limits for DX-4 facilities are listed in Attachment 5, and in the Firing-Point, Prep Room or Magazine SOPs.

6.15 Lightning

All operations involving explosives shall be suspended during electrical storms in accordance with the DOE Explosives Safety Manual. Personnel shall be cleared from the Firing Mound during this suspension.

6.16 Explosives Excluded Areas

No explosives-contaminated equipment may be moved to an explosive-excluded area. Every effort should be made to avoid moving explosive contamination to an explosives-excluded area.

7.0 PROCEDURAL STEPS

7.1 Emergency Procedures

7.1.1 In all emergencies, call 911. In the event of an emergency or incident, notify DX-4 management as soon as possible. Follow the DX Division Operations Manual, Section 10.3 to report any incidents or accidents.

7.1.2 The Building/Site Emergency Plan will be followed. It covers what to do, depending on the circumstance.

7.1.3 If a spill occurs, the Building/Site Emergency Plan will be followed, then the Waste Management Coordinators will be called.

7.1.4 In the event of eye damage, suspected eye damage, or tissue burns due to laser radiation, the source of injury shall be turned off or removed (as practical and safe), and the injured person taken to the Occupational Medicine Group (ESH-2) for treatment.

7.1.5 Any person receiving an electrical shock must report to the Occupational Medicine Group (ESH-2) for evaluation and/or treatment.

7.2 Handling of Explosives

The following general criteria apply to all operations that involve explosives:

- Handling of HE should be minimized.
- The distance that an item will fall if accidentally dropped must be minimized.
- Hard surfaces or sharp edges that could be struck by a bare piece of HE in the event of an accidental drop should be padded or otherwise protected.
- Floor areas where the handling of HE items is most likely to occur should be covered with an approved tile to reduce the danger in the event of an accidental drop.
- The work area surrounding an HE item that is to be handled shall be kept clear of extraneous tools, components, fixtures, and other impediments that could interfere with handling operations.
- The sliding of bare HE on surfaces should be avoided because HE surfaces are relatively susceptible to marring by scratching or slipping. This is important from a quality as well as from a safety standpoint.

- The stability of an item must be maintained during all operations. The operator must evaluate the forces that will be acting on an item during the operation. If the operational forces will result in an unstable or unsecured situation, alternate procedures must be developed. Any uncertainty or question should be directed to the line supervisor for appropriate action.
- After an operation on an item has been completed, the item must be placed in a secure location and left in a stable configuration. When possible, all items destined for storage or movement elsewhere should be placed in suitably designed containers. **An item must not be left in any position at any time where it can be easily toppled.**

7.3 Fires

In the event of fire involving or imminently threatening explosives,

Clear the area and report the fire. Do not attempt to fight any fire involving explosives in any DX Division explosive area.

7.3.1 Fire extinguishers at magazines are for the purpose of fighting small external fires.

7.3.2 Vehicle mounted fire extinguishers should be used on fires where explosives are not presently or imminently involved. Should a fire occur, an attempt to prevent the fire from spreading to the load should be made. If safe and possible, the explosives should be removed. If the fire presently or imminently involves the explosive load, evacuate all personnel to a safe distance. This distance should be at least 1,250 feet.

7.3.3 There shall be no smoking, except in designated locations. **No matches, lighters, or other fire, flame, or spark-producing devices shall be taken into an Explosives Allowed Area, except with written authorization (SWP).** There are electrical lighters provided at locations.

7.4 Personnel Authorizations

7.4.1 **Firing Leader** -- The list of authorized Firing Leaders, and the Firing Points they are authorized for, is given in the Authorizations and Assignments Document. Only the Group Leader or Deputy Group Leader can authorize additions or deletions from the list of authorized Firing Leaders.

7.4.2 **Knowledgeable Personnel** have at least four months experience working in a firing area as verified or excepted by the Group Leader or Deputy Group Leader. Knowledgeable persons will meet the training requirements stipulated by DX-4. Persons will be designated as "Knowledgeable" when they are judged competent to perform safely in an authorized firing area. Each of the five firing areas requires separate authorization.

8.0 REQUIRED RECORDS

- Daily Visitor Log
- Visitor and Training Databases
- Visitor Information Sheet
- Authorizations and Assignments Document

9.0 REFERENCES

- DOE Explosives Safety Manual
- Los Alamos Environment, Safety, and Health Manual, AR 6-6, Explosives
- DX-Division Operations Manual
- DX-Division Electrical Safety SOP

10.0 ATTACHMENTS

Attachment 1. HE routinely used at DX Division Firing Areas
Attachment 2. Adhesives and Glues routinely used at DX Division Firing Areas
Attachment 3. DX Division Preparation Rooms
Attachment 4. List of the net names, call signs, frequencies, and normal use areas for radios.
Attachment 5: Load Limits for DX Division Facilities
Attachment 6: TNT Equivalent of some Common Explosives
Attachment 7: Definition of explosive contamination. Memo from the ERC.

Attachment 1

HE routinely used at DX Division Firing Areas

NORMAL EXPLOSIVES

All explosives or explosive-containing devices that have been approved by the ERC or listed in (ESA) WX-3: SOP 1.1.0, Tables 1 & 2 may be used at DX-4.

This list contains the names and identification numbers of all explosives and detonators approved for normal explosives operations. Explosives on this list may be received or handled by Group DX-4, unless a separate SWP or SOP exists covering the operations, or a request for limited tests is approved.

- **Primary explosives** - Explosives with a sensitivity greater than PETN (for example, lead azide, lead styphnate or mercury fulminate) are not used by DX-4 except with specially approved procedures.

SINGLE-COMPONENT EXPLOSIVES

Explosives	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev. Period
AN	130LN	Ammonium nitrate	20 years
DATB	1201	diaminotrinitrobenzene	20 years
DINGU		Dinitroglycouril	
DINA		Di(nitroethyl) nitramine, dioxyethyl dinitrate	20 years
EDNA	1101	ethylenedinitramine, Halite	20 years
HMX	03NN	cyclotetramethylenetetranitramine, Octogen	20 years
LAX-112			
NM		Nitromethane	10 years in 55 gal drum
NQ	07NN	Nitroguanidine, Picrite	20 years
NTO		1.2.4-nitro-tiazole-5-one	
PETN	06NN	pentaerythritoltetranitrate	20 years
Picric Acid		1,3,5-trinitrophenol note: Picric acid forms impact-sensitive compunds with metal ions.	2 years
RDX	02NN	cyclo-1,3,5-trimethylene-2,4,6-trinitramine; Hexogen, Cyclonite	20 years
TATB	1701	1,3,5-triamino-2,4,6-trinitrobenzene	20 years
Tetryl*	04NN	2,4,5-trinitrophenylmethylnitramine	20 years
HNS	3001	Hexanitrostilbene	20 years

TNT	010N	2,4,6-trinitrotoluene; Trotyl	20 years

* Tetryl has greater toxicity and greater sensitivity to electric spark than the other permitted explosives

LIQUID EXPLOSIVES

Explosive	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev. Period
FEFO		1,1'-[methylene bis(oxy)]bis[2-fluoro-2,2-dinitroethane]	90 days
Nitromethane		NM, see also under single-component explosives	10 years in 55 gal drum

MIXED EXPLOSIVES INCLUDING CAST AND PRESSED FORMULATIONS

Explosives	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev. Period
ANFO		Ammonium nitrate/fuel oil	90 days
Boracitols		60 wt% boric acid/40 wt% TNT	20 years
Baratol	76NN	76 wt% barium nitrate/24 wt% TNT	20 years
Calcitol		40 wt% TNT/55–60 wt% $CaCO_3$/0–2 wt% talc/1–2 wt%, microballoons, X-0533	90 days

MIXED EXPLOSIVES INCLUDING CAST AND PRESSED FORMULATIONS, Continued

Plastic Bonded Explosives - Formed from one or more of the explosive compounds listed individually in "Single-component Explosives," above, mixed with binders and, in some cases, nonexplosive ingredients. Production forms of plastic bonded explosives are identified in numbered series denoted by the letter "PBX-" (originated by Los Alamos); "LX-" (originated by Lawrence Livermore); "EDC-" (originated by the United Kingdom); and "PBXN-" (originated by the US Navy). Also permitted are experimental plastic bonded formulations originated at Los Alamos and identified by the prefix "X-" and a four-digit number.

CH-6		97.5 wt% RDX/1.5 wt% calcium stearate/0.5 wt% polyisobutylene/0.5 wt% graphite	20 years
Comp. A			
Comp. A-2			
Comp. A-3	9085	9085, 91 wt% RDX/9 wt% beeswax	20 years
Comp. A-4		97 wt% RDX/3 wt% beeswax	20 years
Comp. A-5		98.5 wt% RDX/1.5 wt% beeswax	20 years
Comp. B	60NN	64 wt% RDX/36 wt% TNT, Comp B, Hexolite, Hexotol	20 years
Comp. B-3	60NN	60 wt% RDX/40 wt% TNT	20 years
Comp. C-3	9080	9080, 88 wt% RDX/12 wt% wax	20 years
Comp. C-4	9081	9081, 91 wt% RDX/2.1 wt% polyisobutylene/ 1.6 wt% motor oil/5.3 wt% di(2-ethylhexyl) sebacate	20 years
Cyclotol 75/25	750N	75 wt% RDX/25 wt% TNT	20 years
Cyclotol 70/30	700N	70 wt% RDX/30 wt% TNT	20 years
Detasheet C	6300	63 wt% PETN/8 wt% NC/29 wt% elastomeric binder	10 years
Detasheet D	6301	75 wt% PETN/25 wt% elastomeric binder NOTE: THIS MATERIAL IS USUALLY RED, BUT IT IS AN EXPLOSIVE, NOT AN INERT	10 years
EDC-8		76.0 wt% PETN/24.0 wt% RTV Silicone	20 years
EDC-28		94wt% RDX/6 wt% FPC 461	20 years
EDC-32		85wt% HMX/15 wt% Viton A	20 years
EDC-37			20 years
EDC-38			20 years
HBX-1		40 wt% RDX/38 wt% TNT/17 wt% Al/4.5 wt% wax/0.5 wt% $CaCl_2$	20 years
LX-04	LX04	85.5 wt% HMX/15.0 wt% Viton	20 years
LX-07	LX07	90 wt% HMX/10 wt% Viton	20 years
LX-10	LX10	95.0 wt% HMX/5.0 wt% Viton A	20 years
LX-14	LX14	95.5 wt% HMX/4.5 wt% Estane 5702-F1 (X-0282)	20 years
MDF		Mild Detonating Fuse	20 years
Nonel		RDX lined metal tubing	20 years
Octogen		94.5 wt% HMX/4.5 wt% wax/1 wt% graphite	20 years

Octol	740N	75 wt% HMX/25 wt% TNT	20 years
PBX 9001	9001	90 wt% RDX/8.5 wt% polystyrene (PS)/ 1.5 wt% dioctyl phthalate (DOP)	20 years
PBX 9007	9007	90 wt% RDX/9.1 wt% polystyrene (PS)/ 0.5 wt% dioctyl phthalate /0.4 wt % resin	20 years
PBX 9010	9010	90 wt% RDX/10 wt% Kel-F 3700	20 years
PBX 9011	9011	90 wt% HMX/10 wt% Estane-5703	20 years
PBX 9205	9205	92 wt% RDX/6 wt% polystyrene (PS)/ 2 wt% dioctyl phthalate (DOP)	20 years
PBX 9206	9206	92 wt% HMX/8 wt% Kel-F elastomer	20 years

MIXED EXPLOSIVES
INCLUDING CAST AND PRESSED FORMULATIONS, Continued

PBX 9404	9404	94 wt% HMX/3 wt% NC/3 wt% tris(b-chloroethyl) phosphate (CEF) note: PBX-9404 is unusually sensitive to certain types of impact, in particular, skidding.	1st period-20 years, 10 years thereafter
PBX 9401	9401	94.2 wt% RDX, 3.6 wt% polystyrene, 2.2 wt% trioctyl phosphate	
PBX 9405	9405	93.7 wt% HMX, 3.15 wt% nitrocelulose, 3.15 wt% tricloroethyl phosphate	20 years
PBX 9407	9407	94 wt% RDX/6 wt% Exon-461	20 years
PBX 9501	9501	95 wt% HMX/2.5 wt% Estane/2.5 wt% BDNPA or BDNPF, X-0242	20 years
PBX 9502	9502	95 wt% TATB/5 wt% Kel-F 800, X-0290	20 years
PBX 9503	9503	80 wt% TATB, superfine/15 wt% HMX/5 wt% Kel-F, X-0351	20 years
PBXN-5		See LX-10	20 years
PBXN-110		88 wt% HMX/5.4 wt% polybutadiene/5 wt% isodecyl pelargonate	20 years
PBXW-113		See PBX N110	
Primacord		Assorted PETN & RDX loaded commercial detonating fuse	20 years
Pentolite	5001	50 wt% PETN/50 wt% TNT	20 years
Tritonal		80 wt% TNT/20 wt% aluminum powder	20 years
X-0208	X-0208	See XTX-8004	20 years
X-0233	X-0233	5-40 wt% HMX; 40-95 wt% tungsten, 0-10 wt% polystyrene, 0-5 wt% plasticizer	90 days
X-0242		See PBX 9501	20 years
X-0282	X-0282	See LX-14	20 years
X-0290	X-0290	See PBX 9502	20 years
X-0309	X-0309	75% TNT, 19% aluminum powder, 5% D-2	90 days

		wax, 1% acetylene black (carbon)	
X-0351		See PBX 9503	20 years
X-0407	X-0407	69.8 wt% TATB, 25.0 wt% PETN, 0.2 wt% dye, 5 wt% kel F800	90 days
X-0533	X-0533	See Calcitol	90 days
X-0534	X-0534	50 wt% TNT/16-24 wt% $CaCO_3$/25-33 wt% talc/1-2 wt% microballoons	90 days
XTX-8003		80 wt% PETN/20 wt% Sylgard 182	20 years
XTX-8004		80 wt% RDX/20 wt% Sylgard 182, formerly X-0208	20 years

PROPELLANTS

Explosives	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev Period
Black powder		Standard commercial and military grades only	20 years if unopened, 2 years if opened
Benite		Black powder based mixture	2 years
Commer-cial sporting		Any commercially available smokeless gun propellant for sport use is approved	20 years if unopened, 2 years if opened
HARP-1,-2		HARP propellants are Al/AP/HMX composites	2 years
HELP-1, -2		HELP propellants are NC/NG/HMX composites	2 years
Smokeless Powder Single, Double, or Triple Base		Standard military grades. Military research explosives are specifically not included.	2 years
VTP 25540		HMX based High Energy Propellant	2 years

DETONATORS

The following high-energy detonators have been approved for use in test devices. All listed detonators have a storage review period of 20 years.

1E23	ER-213	EX-12	SE-1
1E26	ER-235	EX-12B	SE-1/31

1E26B	ER-312		
1E27	ER-312B	MC1991	SC-101
1E29	ER-344	MC2320	
1E30	ER-347	MC2427	
1E31	ER-352		
1E33	ER-353	MK13C	
1E34	ER-370	MK20	
1E36	ER-349	MK22A	
1E38	ER-350		
1E38 T.F.	ER-351	RL1	

DETONATORS, Continued

	ER-371	RL2	
	ER-377		
	ER-379	RP-1	
	ER-380	RP1/31	
	ER-383	RP-2	
	ER-396A	RP-80	
	ER-396B	RP-83	
	ER-400	RP-84	
	ER-402	RP-87	
	ER-403		

MUNITIONS

Military munitions are allowed if no further assembly or disassembly operations are involved. An adequate description should be in the DX-4 file. Internal devices that contain primary explosive are allowed if they are "out-of-line" and are not used as the initial initiation point. The initiator must remain in a safe state until the first ignition source is activated following standard operating procedures. Any configuration where the primary explosive unit is external or is to be used as the first initiation or ignition source becomes a special operation requiring a separate SOP or SWP.

Some of the DX-4 military munitions are listed as rejects or defective lots because they do not meet either physical specifications or performance testing specifications. There are no safety issues related to their rejection. Any arriving munitions marked as rejects will be treated as Storage Compatibility Group L until the reason for rejection is known.

SPECIAL EXPLOSIVES

The use of these explosives is limited to the provisions of the indicated SOPs.

Explosive	Pertinent SOP References	Storage Rev. Period
Liquid Gun Propellant LGP 1846	DX-11 SOP: 15-11-4.20, "LGP 1846, TA-36-3"	2 years
3E-1 Detonator	3E-1 SWP	20 years

COMPOUNDS FOUND in TA-16 SOP 1.1.0, "Established Explosives at TA-16," but not listed in any DX Division list.

Al-ANFO

BDNPA

BDNPF

BTX (5,7-dinitro-1-picrylbenzotriazole) (transportation only)

DNPA (2,2-dinitropropyl acrylate polymer)

DNT

HBX-1

Methane/ Oxygen mixtures

Nitrocellulose (NC)

PYX (2,6-Bis picrylkamino0-3,5-dinitropyridine)

STRATABLAST C (storage and transportation only)

TAGN (triamino guanadine nitrate)

TAL-1005E (storage and transportation only)

TNS (Trinitrostilbene)

TNT/NC

TPM (tripicryl melamine)

Attachment 2

Adhesives, glues, and coatings routinely used at DX Division Firing Areas.

- Methylmethacrylate/solvent glues (Duco, Testor's model cement, other proprietary materials of equivalent composition).
- 3M Industrial Adhesive-226.
- CTA-2 linoleum cement for Detasheet only.
- Elvanol.
- CPR-1009-78 adhesive.
- Silastic TRV-140, -731, -732, -892, -3145
- Eastman 910, Perma Bond 910 adhesive, Loctite 495 adhesive, and other cyanoacrylate ester adhesives .
- 3M Aerosol spray adhesive.
- Aralhex.
- GE Silicone Rubber RTV 162.
- Polad [10 wt% Polacure-740M diamine (Polaroid Corp.)/38 wt% Adiprene 5333/52 wt% acetone].
- Polyurethane 7200, with sets A and B.

When necessary, the following chemicals and gases may be used for light intensification or quenching.

Aluminum Fluorosilicate **(This is a poison; wash hands after use.)**
Aluminum Oxide
Butane
Krylon Spray Paint
Magnesium Oxide
PETN paint

Approved Glues and Adhesives

- An epoxy -polyamide adhesive know as "Green Glue" and formulated from Epon 828 and Versamid 140 is approved for use in detonator and HE assemblies. This adhesive is covered under Mound Facility's Specification 1-9600.

- Cyanoacrylate adhesives such as Eastman 910 may not be used in direct contract with PETN.

- Devcon 5-minute epoxy is approved for permitted explosives, except TNT and explosive compositions containing TNT, and is permitted for assemblies which will hold liquid explosives after the adhesive is cured.

- Barco Bond 165 and 185 - The curing reaction for this material is exothermic: therefore, the thickness of the adhesive layers must not exceed 1.5mm (1/16 in.).

- Sylgard 182, 184, and 186
- DC 93-119
- GE 630
- CPR-1009-78 + Component "T"

Adhesive	Additive or Catalyst	Remarks
Aerobond 2017	Trimethoxy-boroxine	Compatible with HE. Exothermic reaction. Don't make more than 50 g at a time.
VEEP 1579 VEEP 1579T	Versamid 140 DMP-30	Not compatible with all HE. May be used on PBX 9502, TATB, and mixtures of TATB and inert materials.
Torr Seal	Polyamide	Can be used on HE as described in report #250. Ideal for vacuum applications, sealing leaks.
Polamine 1000 cured polyurethanes		Compatible with HE. Slight foaming from moisture. Do not breathe vapors.

Attachment 3

DX Division Preparation Rooms

Location of charge preparation rooms at TA -15 and TA-36:

Building TA-15-242

Building TA-36-4, Room A (Eenie Site)

Building TA-36-5, Room A (Meenie Site)

Building TA-36-7, Room A (Minie Site)

Building TA-36-11, Room A (Lower Slobbovia)

Building TA-36-82 (Daisy Mae-Kup)

Assembly and preparation areas at TA-40:

Building TA-40-14 serves Firing Chamber 15

Building TA-40-11 room 106 administered by DX-1 as part of crystal growing operation at TA-40-12

Building TA-40-6 serves Firing Chamber 5

Building TA-40-41 serves Firing Chamber 4, and miscellaneous large shots

Building TA-40-3 is administered by DX-1, as a part of gas gun operations.

The assembly and preparation area at TA-14 Q Site is

Building TA-14-23 rm 104.

Shot preparation facilities at TA-39 are:

Building TA-39-4	trim shack
Building TA-39-111	shot assembly building

Building TA-39-77 propellant assembly for gas guns is administered by DX-1.

Attachment 4

List of the net names, call signs, frequencies, and normal use areas for radios.

DX Radio Channel	Organization Call letters
1	DX 1
2	DX-2
3	DX-3
4	DX-4
5	DX-5
6	DX-6
7	DX-7
8	DX-DO
9	DX Fleet
10	Emergency
11	Emergency
12	Emergency
13	Emergency
14	Emergency
15	Emergency

Attachment 5

Load Limits for DX Division Facilities

Explosive (Load) Limits During Firing Operations. The firing load limit is the maximum amount of explosive that may be fired at a firing site without special authorization. The maximum amount may be further modified by location of the shot relative to the portglass and the bunker. See site-specific SOPs.

Usual HE Firing Limits at Firing Sites

Building or Site	Limit (kg)	Limit (lbs)
TA-14-34	see site-specific SOP	see site-specific SOP
TA-15-306*	68	150
TA-15-310*	68	150
TA-36-3	227	500
TA-36-6	907	2000
TA-36-8	907	2000
TA-36-12	2268	5000
TA-39-6	91	200
TA-39-57	227	500
TA-39-88	908	2000
TA-40-4	25	55
TA-40-5	0.45	1
TA-40-8	10	22
TA-40-15	25	55

*Limits away from the runways at R310 and R306 firing areas can be exceeded only with the approval of the DX-4 Group Leader or designee.

These limits may be modified by permission of the Group Leader through the SWP process.

Storage Magazine Load Limits and Personnel Limits

Each Magazine has a maximum limit on the amount of explosive that can be present during Normal operations. The limits for DX Division magazines are listed below, and in the Firing-Point-Specific SOPs.

Explosives Load and Personnel Limits at
DX Division Magazines

	structure	load limit, kg	personnel limit	
TA-14				
	Q-22	300 lbs		C
	Q-24	25 lbs (detonators)		
TA-15				
	TA-15-41	200 lbs (propellant)	2	
	TA-15-42 wing vault	2000 lbs	4	
	TA-15-43 magazettes (2)	300 lbs 1000 dets.	3	
	TA-15-241	100 lbs	3	
	TA-15-243	2000 lbs	3	
TA-22				
	TA-22-18	500	3	D
TA-36				
	TA-36-83 Promoe	70,454	7	
	TA-36-83 Promoe side rooms (2)	1000 each part of 70,454 total	7	
	TA-36-10 Moe	4500	5	
	TA-36-9 DetMoe	0	2	
	TA-36-7, south end Minie Site magazine	200	5	
	TA-36-11, south end Lower Slobovia	200	5	
	TA-36-4, west end Eenie magazine	200	5	
	TA-36-205 Ammunition transportainer	450	3	
TA-39				
	TA-39-3	7,500 lb.	4	

	TA-39-5	3,000 lb.	3	
	Vaults/each	10 lb.	-	
	TA-39- 77	300 lb.	3	DX-1 jurisdiction
TA-40				
	TA-40-13 magazette	180 2.0	3 N/A	D
	TA-40-10 (DX-1)			
	TA-40-7 magazette	2.0 2.0	4 N/A	D
	TA-40-2 magazette	40 2.0	3 N/A	L A
	TA-40-40T		N/A	H_2O_2
	TA-40-40	36	4	D
	TA-40-38	165	3	D
	TA-40-37	360	3	
	TA-40-36	360	3	D
	TA-40-39 (DX-1)	57	3	D

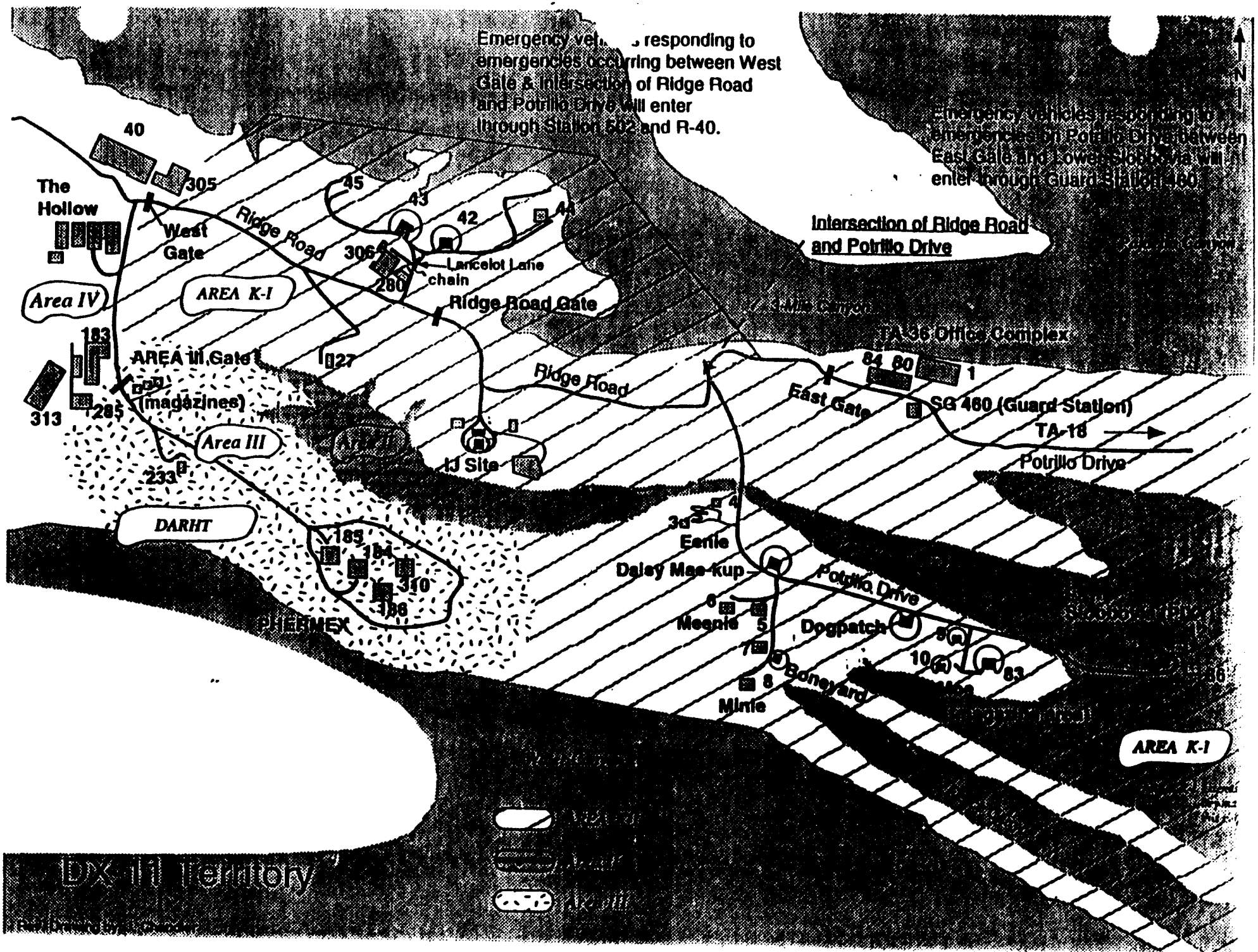
Preparation Room Personnel and Explosives Load Limits

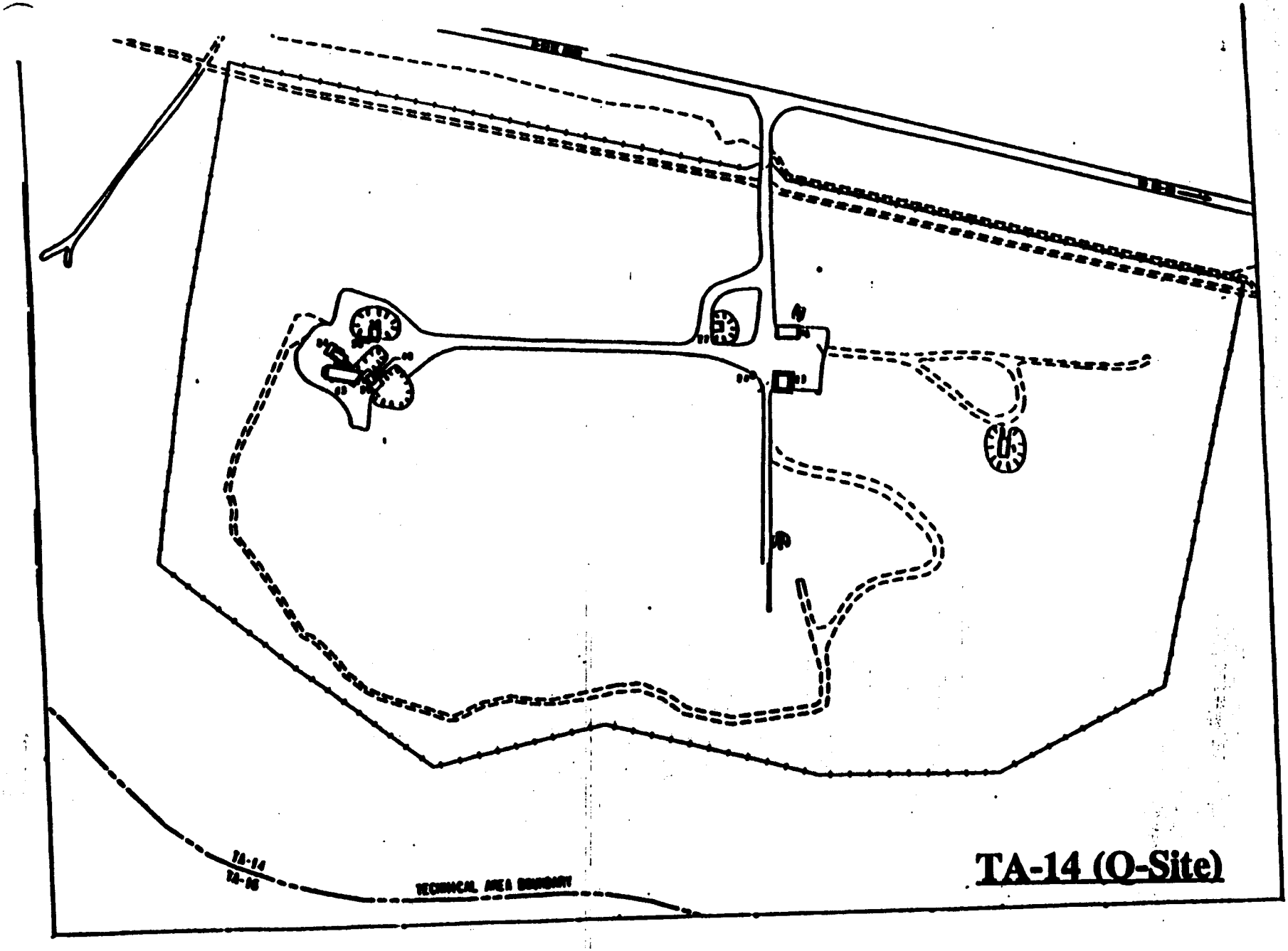
Each Explosives Preparation Room has a maximum limit on the amount of explosive that can be present during normal operations. The limits for DX Division Preparation Rooms are listed on the door of the Preparation Room.

Personnel limits are established to prevent crowding of the preparation room from causing an accident, and to limit casualties in case of an accident.

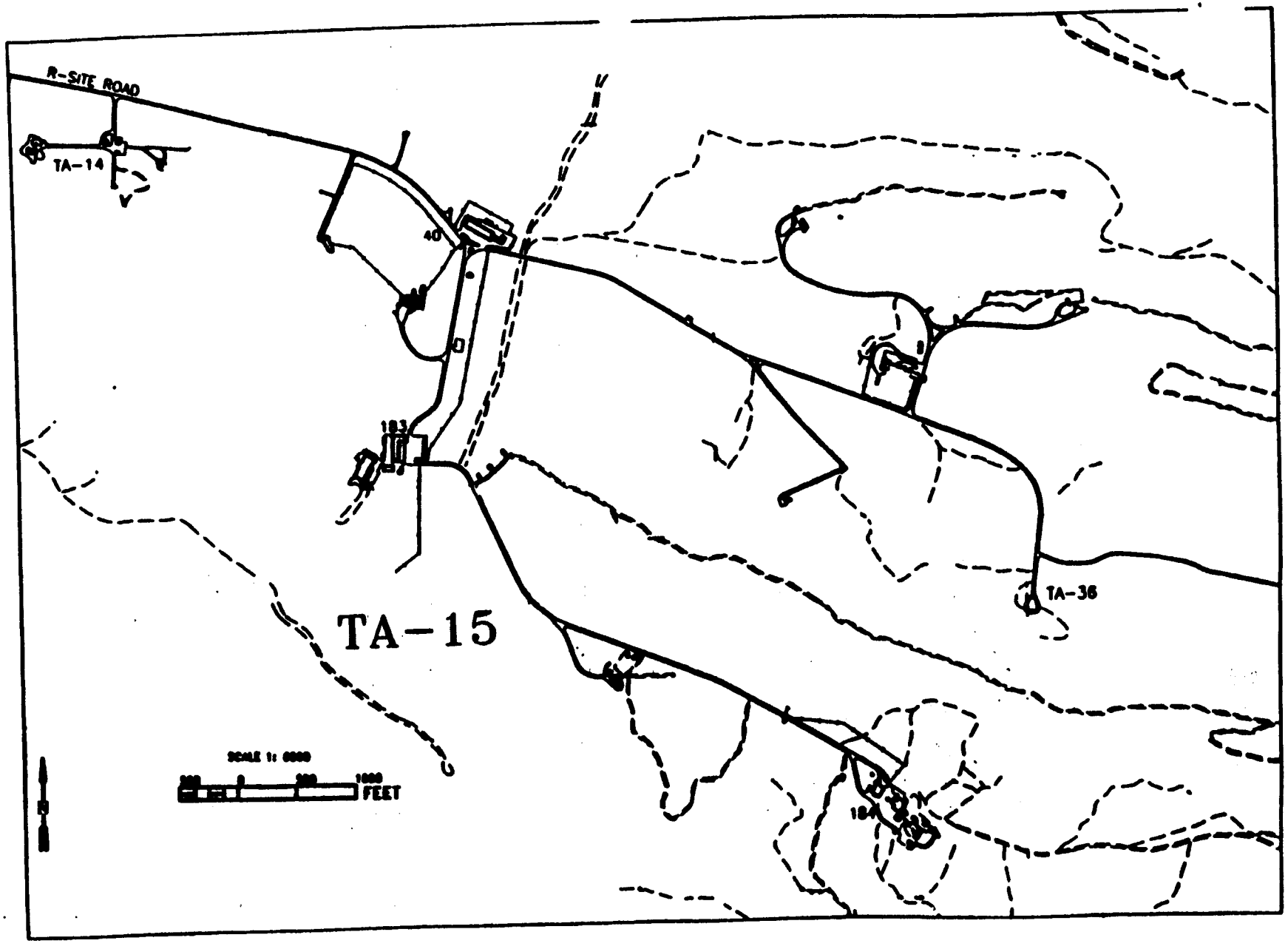
Personnel and Explosive Load Limits at DX Division Preparation Rooms

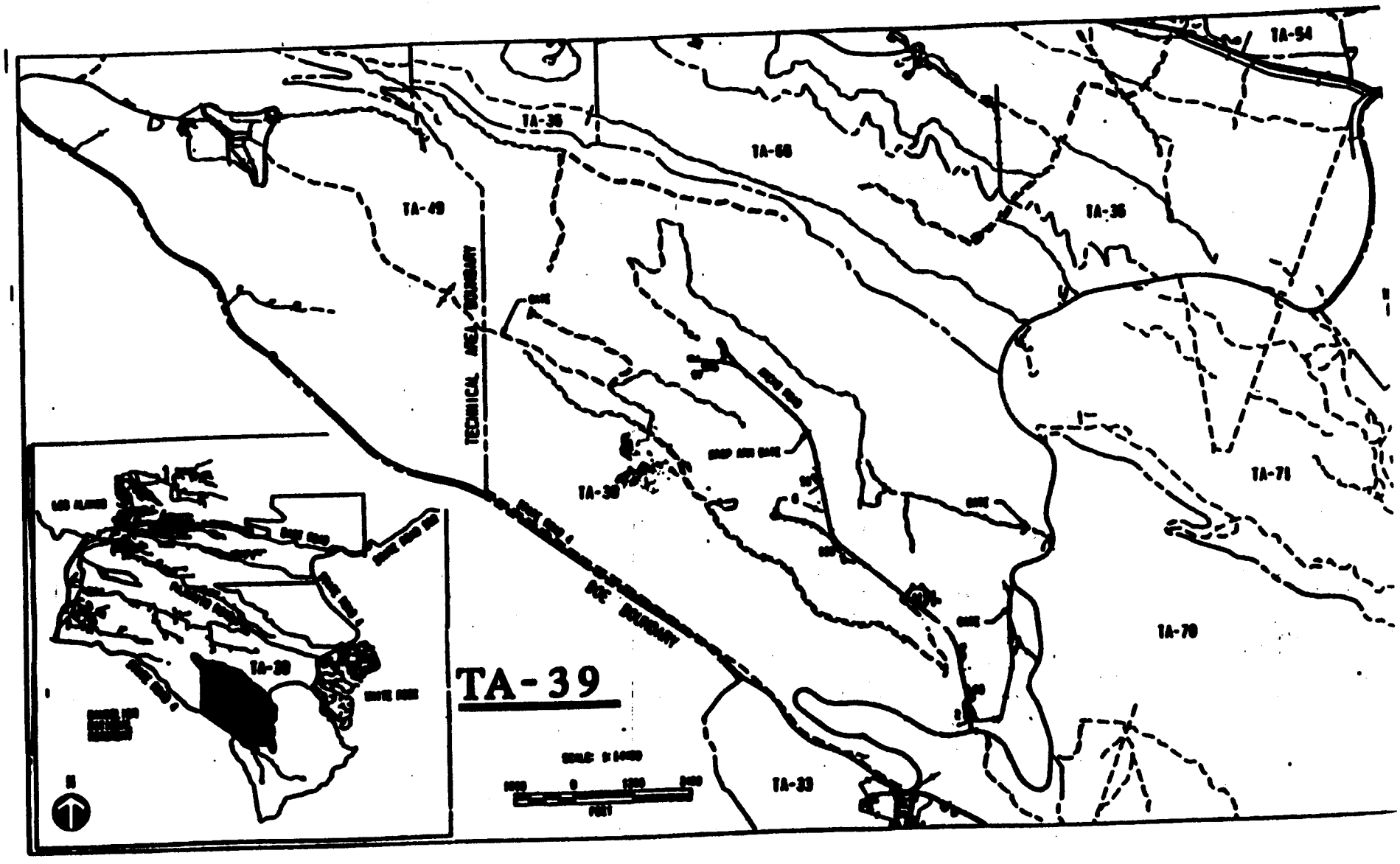
	Building No.	Operators	Casuals	Explosives (kg)
TA-14				
	TA-14-23 room 104	2	1	50
	TA-14-23 room 104	6	0	0
TA-15				
	TA-15- 242			
TA-36				
	TA-36-4	2	2	100
	TA-36- 5	2	2	100
	TA-36- 7	2	2	100
	TA-36-11	3	2	100
	TA-36-82, each room	3	2	No explosive storage, except shot assemblies in process or waiting to be fired.
	TA-39-4 Trim Shack			
	TA-39-111 Assembly Building			
TA-40				
	TA-40-3	3	0	2
	TA-40-6	5	0	2
	TA-40-11 (room 106)	5	0	2
	TA-40-14	4	0	25
	TA-40-41	5	0	36

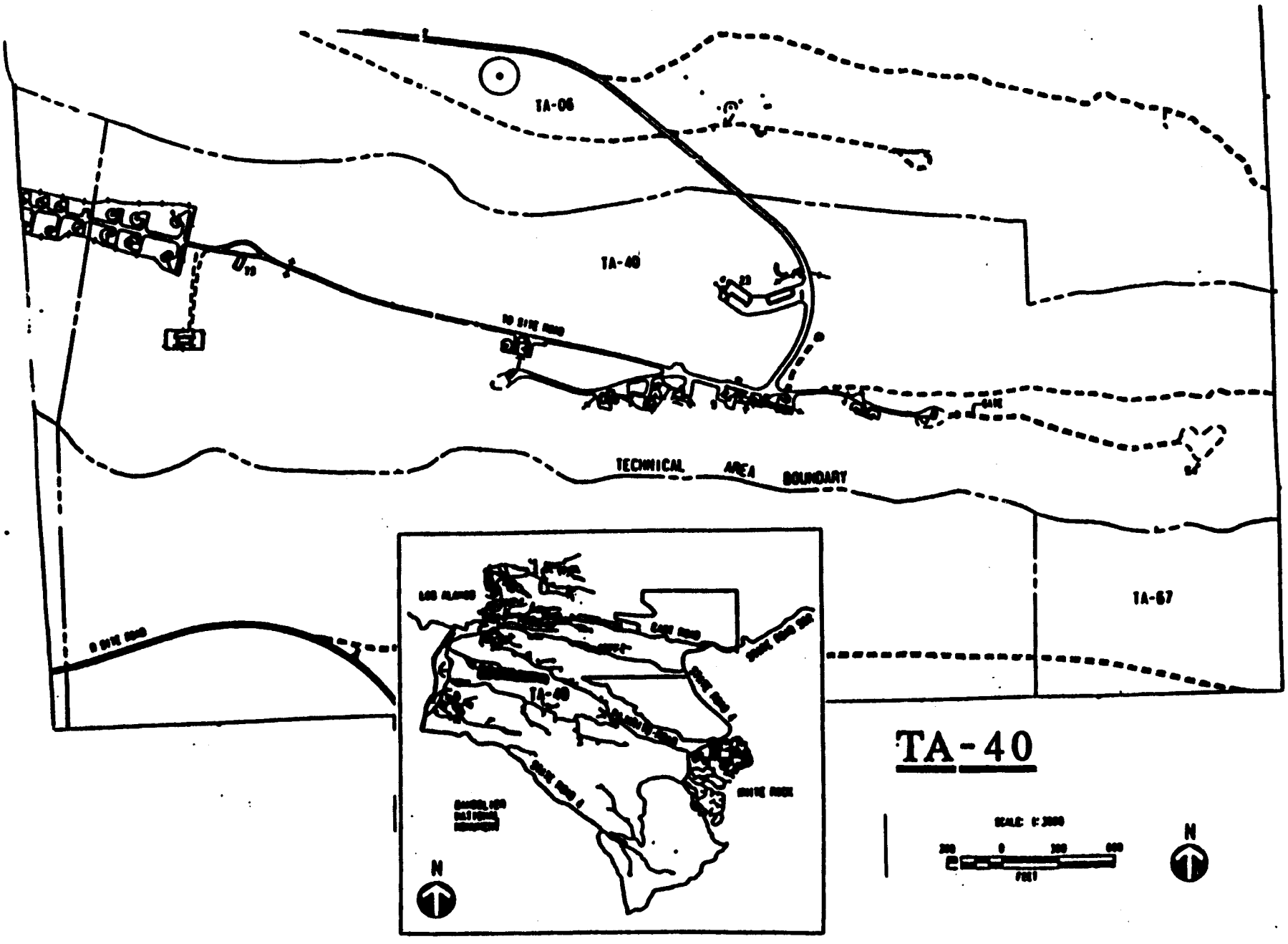

Emergency vehicles responding to emergencies occurring between West Gate & Intersection of Ridge Road and Potrillo Drive will enter through Station 502 and R-40.
Emergency vehicles responding to emergencies on Potrillo Drive between East Gate and Lower Slobbovia will enter through Guard Station 460
N
40
305
The Hollow
West Gate
Ridge Road
45
43
42
44
306
280
Lancelot Lane chain
Ridge Road Gate
Intersection of Ridge Road and Potrillo Drive
Area IV
AREA K-I
183
AREA III Gate
127
(magazines)
313
285
Area III
233
DARHT
185
184
310
186
PHERMEX
IJ Site
Ridge Road
TA 36 Offices Complex
84
80
1
East Gate
SG 460 (Guard Station)
TA-18
Potrillo Drive
4
3
Eerie
Daisy Mae-kup
Potrillo Drive
6
Meenie
5
Dogpatch
7
Boneyard
8
Minie
9
10
83
AREA K-I
DX-11 Territory



TA-14 (O-Site)


R-SITE ROAD
TA-14
40
183
TA-15
TA-36
184
SCALE 1: 6000
FEET


TA-39
TA-54
TA-35
TA-49
TA-36
TA-71
TA-70
TA-33
TECHNICAL AREA BOUNDARY
LOS ALAMOS
TA-39
FEET


TA-06
TA-40
TECHNICAL AREA BOUNDARY
TA-67
LOS ALAMOS
TA-40
WHITE ROCK
N
N

TA-40

Attachment 6

TNT Equivalent of some Common Explosives

Traditionally, load limits are expressed in terms of "Pounds (or kg) of TNT Equivalent." Because the explosive power of some explosives exceeds that of TNT, the actual weight of these explosives needed to reach the load limits are less the number of Pounds of TNT Equivalent.

TNT Equivalent Weights

Explosive	Equivalent
BARATOL	0.525
COMP B	1.092
C-4	1.129
HMX	1.042
LX-01	1.222
LX-10	1.101
LX-11	0.874
LX-14	1.119
NG	1.136
NQ	0.752
OCTOL 70/30	1.113
PBX-9007	1.108
PBX-9010	1.044
PBX-9011	1.087
PBX-9502	1.037
PBX-9404	1.108
PBX-9407	1.136
PBX-9501	1.129
PENTOLITE	1.085
PETN	1.169
RDX	1.149
TATB	1.037
TETRYL	1.071

Attachment 7

Definition of explosive contamination.

Memo from the ERC attached.

Date: Wed, 6 Mar 1996 14:41:16 -0700
X-Sender: u0846970@pobox1663.lanl.gov
To: vasilik_gerald_d@Lanl.GOV
From: rabie@Lanl.GOV (Ron Rabie)
Subject: Contamination

Jerry;

Here is a draft of a memo on the subject of firing site contamination.

With reference to the memorandum to Distribution dated November 29, 1993 from Lucht at DX-16, and the statment therein, "Items which only have trace (non-visible) amounts of non toxic HE on them and are not hazardous in any way, should not be labeled contaminated", the Explosive Review Committee (ERC) wishes to add the following. "The word Items is not restrictive in any sense and may be assumed to apply to shot stands, insulation, shot assembly aids, firing cables, optical components including mirrors, sand bags, barriers, electrical equipments, metal assemblies, etc. The presence of soot on various materials used, abused or consumed in the course of firing a shot does not, of itself, constitute HE contamination."

This elaboration of the original text is meant to clarify the meaning of the original and not to alter the spirit of the original.

Ron Rabie, Acting ERC Chairman

LOS ALAMOS

NATIONAL LABORATORY

memorandum

EXPLOSIVES TECHNOLOGY

EXPLOSIVES REVIEW COMMITTEE

To/MS: Distribution

From/MS: Roy Lucht/C920 Roy

Phone/FAX: 5-0111/7-0500

Symbol: DX-16

Date: November 29, 1993

SUBJECT: Contamination

I recently received a request (enclosed) from Tom Turner (DX-10) for an "official" definition of explosive contamination. Our current charter directs us to review and advise on regulations and administrative directives involving explosives operations at the Lab. Thus, the best I think we can do for Tom is to offer a proposed definition or set of procedures for handling contamination.

It is clear that following the DOE Explosive Safety Manual guidance on decontamination to the letter would put Lab explosives work out of business. For example, with strict interpretation Lab vehicles driven in firing sites and other explosive contaminated areas should be decontaminated before being driven on public roads or repaired by GSA. If GSA needed to weld a new muffler on a site truck, it should be decontaminated to level XXXXX, which would involve complete disassembly. The same is true of any such truck released for public auction.

Thus, we need to follow the intent of the guidelines, ensure that no one, Lab or public, is injured as a result of explosives, and ensure that our guidelines fit within at least a liberal interpretation of the DOE Explosive Safety Manual. It is also true that some tests are so sensitive that an item could be hazard free but still give a positive test result. Because an item has been used in an explosives area, does not mean it is contaminated, just potentially contaminated. According to the DOE Explosives Manual, a "0" classed item is an item from an explosives area that was never directly exposed to contamination. Many site trucks and some of Turner's instruments may fall into this category. If we can in good conscience declare 0 class for an item, a visual inspection is probably adequate for release for repair, calibration, or even salvage. Thus for site trucks or lab instruments such as scales which may be used to hold contained or packaged HE, but do not come into direct contact with it, a visual inspection may be adequate to declare the item to be class 0. For trucks driven over potentially contaminated ground, visual inspection of the tires and wheel wells may be required.

Items which have definitely come into contact with bare HE are more difficult and may have to be handled on a case-to-case basis. Unless the material is also toxic, trace (non-visible) amounts detectable by sensitive tests are not hazardous. Thus, I would propose the following definition: "Items which only have trace (non visible) amounts of non toxic HE on them and are not hazardous in any way, should not be labeled contaminated." This, I believe, agrees with the intent of the XXXXX designation in section 18.6c.3. in the DOE Explosive Safety Manual. However, if an item may have hazardous amounts of HE hidden in them in cracks, joints, voids, etc., then the item would fall into class XXX, and could not be released for welding etc. as in section 18.6c.2.

Regardless of what guidelines are used, a fair amount of subjective evaluation is left to the person involved with the decontamination. Guidelines cannot be written to cover every contingency, so care must be taken that an item with hazardous amounts of HE is not released for repair, salvage etc.

Committee: If you have any thoughts, comments, changes, additions, etc. on this, please return them to me by COB 12/17/93.

DX-4

STANDARD OPERATING PROCEDURE

FOR

GENERAL FIRING OPERATIONS

SOP 4

Prepared by: Roger K. London, DX-4 Date: 12-9-96

Approved by: G. Vasilik, DX-4 ES&H Officer Date: 12-11-96

Approved by: John M. McAfee, DX-4 Group Leader Date: 12-12-96

Approved by: ESH Deployed Team Leader Date: 12-23-96

Approved by: DX-DO Date: 12/20/96

Controlled Document Number:

Table of Contents

1.0 INTRODUCTION 5

2.0 PURPOSE 5

3.0 SCOPE 5

4.0 DEFINITIONS 6

5.0 RESPONSIBILITIES 8

5.1 PERSONNEL RESPONSIBILITIES 8

5.1.2 FIRING LEADER 8
5.1.3 ACCESS CONTROL OFFICER 8
5.1.4 CLEARANCE PATROLMAN 9

5.2 REQUIRED READING 9

5.3 TRAINING 9

5.3.5 FIRE DEPARTMENT TRAINING 10

5.4 WASTE MINIMIZATION 10

6.0 PRECAUTIONS AND LIMITATIONS .....

6.1 ADMINISTRATIVE 10

6.2 IDENTIFIED HAZARDS 10

6.3 GENERAL CONSIDERATIONS 11

6.3.1 ACCESS TO FIRING AREAS AND FIRING SITES 11
6.3.2 EXPLOSIVE (LOAD) LIMITS DURING FIRING OPERATIONS 11
6.3.3 PERSONNEL LIMITS DURING FIRING OPERATIONS 12

6.4 PRE-SHOT 12

6.4.1 HAZARD CIRCLES 13
6.4.2 CLEARANCE PLANS 13
6.4.3 CLEARANCE NOTICES 13
6.4.4 CLEARANCE CHECKLISTS 14
6.4.5 FIRE DEPARTMENT NOTICES 14

6.5 OPERATIONS WITH HIGH EXPLOSIVES 15

6.5.1 HANDLING AND TRANSFER OF EXPLOSIVES 15
6.5.2 TOOLS AND MATERIALS 15
6.5.3 ELECTRONIC DEVICES AND DIAGNOSTICS 16
6.5.4 VACUUM ..... 1[illegible]
6.5.5 FISSILE MATERIAL ..... 1[illegible]
6.5.6 GAS HANDLING 17
6.5.7 ASSEMBLING EXPERIMENTS ON THE FIRING MOUND .....

6.5.8 Charge Protection from Weather 18
6.5.9 Unattended Assemblies 18
6.5.10 Working Alone 18
6.6 SAFETY KEYS 19
6.7 FIRING SYSTEMS 20
6.7.1 Firing Units 20
6.7.2 Firing Cables 21
6.7.3 Firing System Interlocks 21
6.7.4 BYPASS SYSTEMS 22
6.7.5 Final Arming and Energizing 22
6.8 CAMERA AND OPTICAL DIAGNOSTICS ROOM 22
6.8.1 Commercial Rotating-Mirror Cameras 22
6.8.2 Home-Made Rotating Mirror Cameras 22
6.9 WARNING SIGNALS 22
6.10 EXPLOSIVE CONTAMINATION OF FIRING POINT 23
7.0 PROCEDURAL STEPS 23
7.1 TEST ASSEMBLY 23
7.2 FIRE DEPARTMENT PROCEDURES 23
7.3 CLEARANCE PROCEDURES 23
7.3.1 Steps Before the Clearance 24
7.3.2 Clearing the Firing Site (Hazard Zone) 24
7.3.3 Post-Shot Procedures 25
7.3.4 Unexpected Breaking of a Clearance 26
7.3.5 Clearance Outside Normal Working Hours 26
7.4 DETONATOR CONNECTIONS AND ARMING 26
7.4.1 Continuity Measurement (Resistance Measurement, "DCOing") 26
7.4.2 Detonator Connection 27
7.5 GENERAL FIRING STEPS 28
7.5.1 Using a Category I CDU 28
7.5.2 Using a Category II CDU 28
7.6 SPECIAL PROCEDURES 29
7.6.1 Misfires 29
7.6.2 Partial Firings 30
7.6.3 Disconnecting 30
7.6.4 Aborted Shots 31
7.6.5 Firing Sequence Interrupt or Shutdown 31
7.6.6 Rotating Mirror Cameras 31
7.7 EMERGENCY PROCEDURES 32
7.7.1 Building or Site Emergency 32

7.7.2 PERSONAL INJURY 32
7.7.3 ELECTRICAL SHOCK 33
7.7.4 LASERS 33

8.0 REQUIRED RECORDS 33

9.0 REFERENCES 34

10.0 ATTACHMENTS 34

1.0 INTRODUCTION

This SOP covers the conduct of explosives test-firing operations and nonexplosive tests conducted at DX Division firing sites. This document is not to be used as a "stand alone" document. Further training and understanding a site-specific SOP are required before conducting firing operations at any DX Division firing area or site.

2.0 PURPOSE

This SOP provides necessary information, describes the hazards, and specifies safety procedures common to all Firing Areas. Detailed descriptions of operations at particular firing sites may be found in the Site-specific SOPs for those firing sites. This SOP also generally describes the procedures for preliminary preparations, circuit testing, clearance, firing operations, misfires, test failures, and postshot activities at DX Division firing sites.

3.0 SCOPE

This SOP is applicable to all personnel who frequent the areas listed below, or who are authorized to perform explosives firing operations at the areas operated by DX-4. In addition, DX-4 support personnel (staff members, appropriate clerical personnel, etc.) shall also be familiar with this SOP.

This SOP covers operations at the following firing sites.

Building or Site	Common Reference
TA-14-34	Q Site
TA-15-306	R306
TA-15-310	R310, PHERMEX/MOC
TA-36-3	Eenie Site
TA-36-6	Meenie Site
TA-36-8	Minie Site
TA-36-12	Lower Slobbovia
TA-39-6	Point 6
TA-39-57	Point 57
TA-39-88	Point 88
TA-40-4	Chamber 4
TA-40-5	Chamber 5
TA-40-8	Chamber 8 (10-kg vessel)
TA-40-15	Chamber 15

These Explosives Firing Sites are identified on the Maps in Attachment 1.

Gun facilities at TA-39 and at TA-40 are under the jurisdiction of DX-1.

Access to the firing areas is covered in the DX-4 SOP, "General Access Control," and by area-specific SOPs for TA-14, TA-39, TA-40, Area III, and Area K-I.

4.0 DEFINITIONS

- **Aborted Shot** -- An aborted shot is one that for any reason cannot be fired as planned and is to be returned to storage.
- **Access Gates** -- Gates or chains that can be locked. The keys are administratively controlled by the Access Control Office and the Local Access Offices.
- **Barricade** -- A portable device, such as a sawhorse, with an appropriate sign, used to halt traffic into an area that is hazardous or is about to become hazardous.
- **Bunker** -- The main protective building at a firing site, housing the control room, and usually the CDU, camera and diagnostics.
- **CDU** -- Capacitor Discharge Unit.
- **Chamber** -- Bunker. The main protective building at a firing site, housing the control room, and usually the CDU, camera and diagnostics.
- **Clearance** -- Process by which an exclusion area is established and determined to be free of unprotected personnel, and safe for a firing operation.
- **Clearance Checklist** -- A step by step guide to ensure that each element of the clearance plan is executed and documented.
- **Clearance Patrolman** -- A Knowledgeable Person who physically inspects a clearance area or manually observes a barricade to assure that people are excluded from hazard zones.
- **Clearance Plans** -- Procedures that protect personnel within the firing areas by controlling conditions during explosive experiments, radiographic operations, or other potentially hazardous operations. The level of the clearance plan determines the control procedures to be followed.
- **Cleared Area** -- An area that has been physically patrolled by a Clearance Patrolman performing assigned duties, or an area in which all personnel have been accounted for. A Cleared Area has been declared safe for firing operations to proceed.
- **Detonator Cable** -- The electrical conductor connecting a detonator to a CDU, or any initiating device to a firing unit.
- **EED** -- Electroexplosive Device
- **EBW** -- Exploding Bridgewire
- **Firing Area** -- The areas where firing operations are conducted. Access to these areas is controlled, and is through an Access Gate. These areas are K-I, Area III, TA-40 Firing Area, TA-39 Firing Area, and TA-14.
- **Firing Cable** -- The electrical conductor conveying a trigger or firing pulse to a CDU or other firing unit.

- **Firing Checklist** -- (may include clearance checklist) A list of steps to be taken in preparing to fire and firing. Used as a reminder to ensure that no steps are forgotten, and all steps are documented.
- **Firing Keys** -- Strictly controlled keys that unlock firing circuits.
- **Firing Leader** -- A DX Division employee, authorized by DX-4 line management to supervise, conduct, and be responsible for operations at the site of the test. This person's accumulated knowledge and experience are crucial to all explosives firing operations.
- **Firing Point or Site** - The actual location of an explosive test and its exclusion area behind the appropriate safety gate.
- **Firing mound** -- Firing mound refers to the sand pile or steel firing pad on which the shot assembly is placed.
- **Hazard Circle** -- A region, not always circular in shape, that is evacuated in a clearance plan because shrapnel from the shot is expected to land within that region. May also be called a hazard zone or a fragment area. However, the definition of a Hazard Circle is only a guideline, fragments occasionally land outside of them.
- **Hazard Zone** -- Hazard Circle
- **HE** -- High Explosives.
- **HV** -- High Voltage
- **HVPS** -- High Voltage Power Supply
- **Low Energy EEDs** -- Hot-wire initiators, squibs, blasting caps, etc.
- **Misfire** -- That which occurs when there is no evidence of detonation or energy release after pulsing the firing circuit.
- **Partial Firing** -- When one or more of the explosive charges in an experiment fail to initiate. Often significant quantities of unreacted explosives are scattered on and around the firing mound.
- **PFN** -- Pulse Forming Network. (includes pin boards and pulse boosters)
- **Roadblock** -- A roadblock is established by having a DX Division employee or trained Knowledgeable Person (Clearance Patrolman) in the road to stop traffic. The roadblock may be an employee with a radio, or an employee with a radio and a vehicle. This person maintains contact with the Firing Leader and the Access Control Office as necessary.
- **Safety Gate** -- A gate at the entrance to a Firing Site. The last gate before hazard is encountered. A safety gate may be interlocked.
- **Shot Information Packet** -- For the Fire Department, a list of hazardous materials included in shots that they attend, and MSDS forms for those materials.
- **Test Mode (Firing circuit)** -- A condition in which firing circuits may have power on them, while clearance conditions are not met, by use of a special key and a special procedure. Administrative requirements for using test mode are defined in site-specific SOPs. Neither detonators nor explosives are connected to the firing circuit in test mode.

5.0 RESPONSIBILITIES

5.1 Personnel Responsibilities

5.1.2 Firing Leader

Shall have immediate responsibility for the operational safety of an operation, and shall be the final authority on questions of safety and procedure during operations at a Firing Point.

- Knowledgeable about group SOPs and operations.
- Responsible for selecting or confirming the choice of the appropriate clearance plan (hazard circle) for the shot, based on experience, knowledge of shot design, calculations, DOE or DoD guidelines, and weather conditions.
- Responsible for overseeing the safety of the firing crew, other personnel, equipment, and facilities at the firing site. Responsible for the safety and security of the firing operations.
- Responsible for personnel control on the firing mound or in the firing chamber.
- Shall not permit firing until all personnel within the hazard zone of the shot are in safe shelters, or are removed from the hazard zone.
- Responsible for firing keys during firing operations.
- Ensures that safety and operational equipment is used properly.
- Participates in inspections; ensures that any defects found during routine maintenance and inspection are corrected by the appropriate personnel.
- Assists in critiques and accident investigations; reports occurrences.
- May delegate some responsibilities to authorized personnel.

5.1.3 Access Control Officer

- Participates in clearance procedures as appropriate. Interacts with Firing Leader for firing operations.
- Interacts with Lead Clearance Patrolman during a clearance.
- Administers personnel access into firing areas.
- Responsible for managing the exchange badge process, both pictured exchange badges when used for Knowledgeable employees, and visitor badges.
- Responsible for the flow of personnel to and from firing areas.
- Verifies that requirements for visitor access are met. Maintains visitor access documents and records.
- Is the single point of contact between the firing sites and the Fire Department.
- Frequently handles communication to DX-4 Group Office, DX Division Office, and security personnel, on behalf of the Firing Leader.

5.1.4 Clearance Patrolman

- Assists activities in the firing area, including communications, traffic, and visitor control, when a clearing or firing operation is in progress.
- Responsible for the successful performance of clearance processes and post-shot sweeps.
- Erects and controls barricades as necessary along access routes. Locks safety gates with key controlled by the Firing Leader or Lead Clearance Patrolman as necessary; posts warning signs for approaching traffic and removes barricades when clearance is lifted.

5.2 Required Reading

5.2.1 Each employee who participates in firing operations must read this SOP, other applicable general SOPs, and the Site-specific SOP(s) applying to the firing site(s) used.

5.2.2 The DX-4 Group Leader or designated line supervisors will determine who must read these SOPs, and who will be authorized to work in the DX Division firing areas.

5.3 Training

5.3.1 All training is to be in accordance with the DX Division Training and Qualifications Manual. Explosive operations shall be performed only by personnel with proper training and supervisory approval.

5.3.2 Supervisors are responsible for on-the-job training, documentation of on-the-job training (as required), detailed instruction, and for monitoring the operators for competence and adherence to instructions.

5.3.3 All personnel conducting or involved in on-site preparation or firing activities shall have read, understood, and agreed to adhere to the established procedure and requirements of this SOP, the DX Division Operations Manual, the LANL Electrical Safety Program, the DX Division ES&H Charter, and the local Building and Site Emergency Plans.

5.3.4 All visitors present during a firing operation shall have read, understood, and agreed to adhere to the Visitor Instruction Packet and to the instructions given by the Firing Leader or his designee.

5.3.5 Fire Department Training

The Fire Department shall be provided with the Visitor Information Packet, Off-Road training, and the Shot Information packet (MSDSs of hazardous materials) for each shot they attend.

5.4 Waste Minimization

5.4.1 Waste minimization will be handled according to the Waste Minimization section of the DX Division Operations Manual and the LANL ES&H Manual, AR 10-8.

5.4.2 Waste generated from firing operations must be reduced as much as technically and economically feasible. Material substitution, good housekeeping, and hazard segregation must be incorporated into all waste generating activities, in order to meet this objective.

5.4.3 All waste will be handled according to the DX Division SOPs 1, and 6, governing waste and the LANL ES&H Manual, AR 10-3.

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Administrative

6.1.1 Appropriate Standard Operating Procedures (SOPs) or Special Work Permits (SWPs) shall be available before any explosives operation is performed. Such SOPs or SWPs shall be available at the site of the operation and shall be understood and obeyed. When operations will be performed that will change or bypass these procedures or introduce additional hazards, a Special Work Permit (SWP) or another SOP will be written and approved to cover each operation.

6.1.2 Any major departure from previously approved shot configurations must be reviewed by the DX-4 Group Leader or designee before firing. A change in configuration includes any change in hazard resulting from alterations in firing protocol, materials, shrapnel potential or direction, heating methods, invasive diagnostics, electrical equipment, location on firing mound, or any other modifications.

6.2 Identified Hazards

Explosives, high voltage, x radiation, laser radiation, chemicals, DU, and normal industrial hazards are the hazards identified with firing operations. These and other hazards associated with firing and other DX-4 operations are described here, in the General Safety SOP, and other operation- or site-specific SOPs. Some of the general hazards to be aware of are:

- Explosives testing is loud. Hearing protection must be provided at all operations where there is a potential for hearing damage.
- Electrical hazards exist due to the firing circuits and High Voltage circuits or those used to power the circuits that are used to gather data.
- Lightning is a hazard, particularly where explosives are present. All operations involving explosives are suspended during electrical storms in accordance with the DOE Explosives Safety Manual. Any person perceiving a safety hazard from lightning may suspend the operation.
- Cranes, crane operations, and forklift use are discussed in the DX-4 Hoisting and Rigging SOP.
- Vacuum and high pressure lines or vessels, or use of HE under vacuum, present serious mechanical and explosive hazards which are discussed in the DX-4 Vacuum SOP.
- Radiography is covered by site-specific Firing SOPs, the DX-4 Portable X-ray Operation SOP, and the DX Division Radiation Protection SOP.

6.3 General Considerations

6.3.1 Access to Firing Areas and Firing Sites

Access to all DX-Division Firing Areas is administratively controlled by the issuance of keys and through access control procedures detailed in the General Access SOP and Firing-Area-specific SOPs. Firing Areas are entered through key-operated gates. During hazard operations, firing sites are entered only with permission of Firing Leader.

DX-4 knowledgeable personnel and other knowledgeable personnel gain access to the firing areas by using administratively-controlled keys. All other individuals must clear through either the Access Control Office (for TA-15, TA-36, and TA-39), the DX-1 Group Office (for TA-40), the DX-2 Group Office (for TA-14), or the Administrative Office at TA-39 before they will be allowed access to a firing area. Qualified Office personnel instruct visitors on the site hazards, have them read the appropriate visitor information, and enter their names in a log. Access Control Procedures are discussed in detail in DX-4 Access Control SOPs, including "General Access Control."

6.3.2 Explosive (Load) Limits During Firing Operations

The firing load limit is the maximum amount of explosive that may be fired at a firing site without special authorization. The maximum amount may be reduced by location of the shot relative to the portglass and the bunker. See site-specific SOPs.

Typical HE Firing Limits at Firing Sites

Building or Site	Limit (kg)	Limit (lbs)
TA-14-34	see site-specific SOP	see site-specific SOP
TA-15-306*	68	150
TA-15-310*	68	150
TA-36-3	227	500
TA-36-6	907	2000
TA-36-8	907	2000
TA-36-12	2268	5000
TA-39-6	91	200
TA-39-57	227	500
TA-39-88	908	2000
TA-40-4	25	55
TA-40-5	0.45	1
TA-40-8	10	22
TA-40-15	25	55

*Limits away from the runways at R310 and R306 firing areas can be exceeded only with the approval of the DX-4 Group Leader or designee.

These limits may be modified by permission of the DX-4 Group Leader through the SWP process.

6.3.3 Personnel Limits During Firing Operations

The number of personnel present on the firing mound during shot preparation must be minimized, to minimize the number of people injured or killed in an accident and to reduce/disturbance of firing crew.

The maximum number of personnel allowed at the firing site when explosives are present is given in the site specific SOP for each firing site. For stated times and purposes, changes in the personnel limits may be authorized by the DX-4 Group Leader or designee.

6.4 Pre-shot

There are a number of limitations that are determined prior to the firing of a shot. These include identification of the hazard zone, clearance plan, and requirements for Fire Department support.

6.4.1 Hazard Circles

Hazard circles (zones) are pre-defined, and the appropriate size area (not necessarily circular) is chosen for each shot, according to the hazards associated with the size, materials, configuration, and explosives in the shot. The choice of hazard circle dictates the particular Clearance Plan which will be used. The area inside the Hazard circle is cleared before the shot, according to the Clearance Plan for the particular Firing Site. Specifics of clearance plans, and maps of most hazard circles, can be found in site-specific SOPs for the Firing Sites.

6.4.2 Clearance Plans

Clearance Plans have been developed to protect personnel within the hazard zones. Clearance Plans are specified for explosives firing operations, for the production of radiation or pulsed-power discharges, or for shots that may release toxic material.

Specific details of clearance plans are given in Site-specific SOPs for Firing Operations. Each Clearance Plan is based on a defined hazard circle within which all personnel must either be excluded or inside a bunker. Before the shot, a clearance procedure is used to locate personnel within the hazard area, remove them, and then physically block entrance to the area until the shot is done and the area is safe again.

- At TA-15 and 36, Clearance Plans are called A-Minor, A, B, and C, increasing in radius by increments of 250 meters.
- At TA-39, Plans are called levels 1, 2, 3, 4, and 5, and a separate safety gate exists for each level, at greater and greater distances from the Firing Site.
- At TA-40-4, two hazard circles exist.
- At TA-40-5, -8, and -15 and TA-14, a single hazard circle and Clearance Plan is used for every shot at a given Firing Site, based on the largest shot that will normally be fired at that site.

Provision for large shots can be made for any area at any time, using the SWP process.

6.4.3 Clearance Notices

When a shot is planned, a notice will be posted in one of four places, depending on the firing area:

- Area K-I, Area III - in the Access Control Office at TA-15-183
- TA-40 firing area - at both TA-22-90 and TA-40-1
- TA-39 - on the shot board in TA-39-2
- TA-14 - in R183 and the DX-2 Group Office at TA-9-21.

The Access Control Office at R183 will be informed of every shot, or series of shots, regardless of location. The notice will include the firing point, the date and time scheduled for firing, the level of the Clearance Plan, the Firing Leader, shot number, and other pertinent details as appropriate. This notice will remain in place until a safe condition exists.

6.4.4 Clearance Checklists

A Clearance Checklist is used by the Firing Leader and the Access Control Office for each Clearance Plan. Checklists may indicate the area to be cleared, the hazard radius, traffic control requirements, firing data, clearance announcement requirements, the names of the Lead Clearance Patrolman (if applicable) and Firing Leader, and other information about the shot. Clearance checklists are included in Firing Site SOPs. They may be part of the firing checklist.

6.4.5 Fire Department Notices

Fire department access to firing areas is controlled to avoid exposing the firemen to explosive or other hazards, but access must be rapid in case of a fire.

6.4.5.1 The Access Control Office at TA-15-183 will be notified if Fire Department activity is needed at any firing area. Access Control Personnel communicate with and advise the Fire Department when they are needed, and arrange for access to be available, rapid, and safe.

6.4.5.2 When the Fire Department is called to stand by, the hazardous materials in each experiment must be identified, and a packet of MSDS forms prepared, in case of a fire involving the experimental assembly. If the Fire Department is called to fight an unexpected fire that is caused by a shot, it is the Firing Leader's responsibility to inform the Fire Department of the presence and identity of hazardous materials.

6.4.5.3 Fire Department access is discussed in the site specific SOP for each Firing Site.

6.4.5.4 If more than one shot is fired with the Fire Department on standby, the Firing Leaders, Access Control, and the Fire Department will be in agreement that the first shot is complete and the area is safe, before the second shot can proceed.

6.5 Operations with High Explosives

Explosives operations usually begin with the receipt and storage of explosives and explosives-containing devices. Preparations of tests (assembly, gluing, etc.) can then be performed. These operations are described in the SOPs on Packaging and Transportation, Explosive Storage, and Preparation Room Operations.

6.5.1 Handling and Transfer of Explosives

The general precautions for handling HE are given in the General Safety SOP. Particular caution should be exercised in the movement of HE. Explosives will not be transported over walkways which are hazardous because of ice, snow, weed overgrowth, or other adverse conditions. Explosive handling shall be permitted only where handling areas are free of obstructions.

- Shots should be carried to the Firing Point with attention to footing and to tripping hazards such as sand, weeds, and cables.
- Shots must be placed by DX-Division knowledgeable personnel under the direction of the Firing Leader.
- Only qualified crane operators may operate cranes used to place shots. All lifts involving explosives are to be considered high-consequence lifts.

6.5.2 Tools and Materials

Various tools and materials may be used in the assembly of a shot and the associated diagnostics. Equipment and materials not specifically allowed by this and other DX-4 SOPs (with attachments) and SWPs is forbidden. In experiments involving other groups, equipment needed to prepare their part of the experiment is permitted on the firing point only if it is covered by a DX-4 SOP or SWP, or an approved SOP from that group; and if its use is not prohibited by the Firing Leader.

Mechanical

- Ordinary hand tools may be used near the charge, but may not be used to strike, cut, or otherwise work on the charge. The only forming and cutting operations on solid explosives which may be performed as a part of the assembly procedure are the hand forming of Composition C, and the cutting of Primacord and DuPont Detasheet with a razor blade. Bending of DuPont Detasheet explosive is allowed, as long as the radius of the curvature is greater than four times the sheet explosive thickness, to prevent tears.
- A staple gun may be used to secure wires or other non-explosive items to the charge stand or container.
- Equipment listed in Attachment 4 may be used on the firing point during the setting of the shot.
- When any of this equipment is used, appropriate shielding shall be used to prevent sparks, heat, or impact from reaching the explosive.

Electrical

- Any 110 volt alternating current that is used when personnel are present on the firing mound shall be Ground Fault Circuit Interrupt (GFCI) protected, unless GFCI renders the equipment inoperable (e.g. inductive motors). Equipment using a 110 volt alternating current must be kept a minimum of one meter from exposed explosives, or else an SWP will be used. Appropriate measures shall be taken to prevent such equipment from any contact with explosive(s). An insulating barrier such as Plexiglas between the 110V and the explosive allows closer proximity. After the mound area is clear of personnel, a normal 110 volt alternating current circuit may be used.
- No powered hand tool or appliance (except for a soldering gun) shall be used within 60 cm (2 ft) of bare explosive without an SWP. Bare explosive is explosive that is not protected by a barrier that can withstand fragments, sparks, heat, or tool bits (and broken tool bits) from damaging the explosive.
- Soldering may be done with a battery powered soldering gun or a soldering gun that does not remain hot when not in use. The hot tip is always kept at least 30 cm (1 ft) from any bare exposed explosive(s), and is kept one meter (3 ft) or more from any exposed explosive(s) when not in use.

6.5.3 Electronic Devices and Diagnostics

Many shots have electrically charged pins or switches incorporated into the assembly for diagnostic purposes. A variety of pin and gauge diagnostics are used in contact with bare explosive and propellant assemblies. It may be necessary to test experimental equipment and pin circuits with pulse-forming-network (PFN) pin voltage or other electrical sources turned on. General precautions for energizing these devices are given here. Details are specific to individual diagnostics and firing sites.

- Pin circuits may be assembled and attached to the transit-time electrodes with crimp connectors or alligator clips. Pin circuits and potential shorts in explosive monitoring pin and foil circuits may be checked using an approved ohmmeter powered with a 1.5-V battery such as a Simpson 160 or 260. The meter must be certified as specified in DOE *Explosives Safety Manual rev 7*, Chapter II, Section 13.8, and be approved by DX-1.
- Pins that are in direct contact with the explosive (co-ax, foil, painted switches, etc.) are often wired to separate plugs (known as H.E. plugs) so they can be identified and isolated from the PFN voltage supply. These plugs must be specifically labeled and verified by DX staff. These special plugs must never be connected to the PFN when the power is on. Before the firing party retires to the control room for a firing operation, the explosive pin and foil monitors are connected to the PFN with the power off.

- If the voltage and current are limited to less than 5 V and to 200 mA, then the power can be applied to the diagnostics without clearing the firing site.
- If the diagnostic power supply applies voltage greater than 5 V, or current >200 mA, then the supply is controlled by the firing control panel so that voltage cannot be applied to the gauge unless the firing panel/voltage key is used in the test or Fire Mode. If a test mode is available and is used, then the clearance for the shot must be in place, before applying current or voltage to the diagnostic on the bare explosive. After all personnel are in the control room or bunker, the PFN voltage can be turned on. If it is necessary to return to the firing point, the voltage to the HE plugs will be turned off and remain off until everyone has returned to shelter.

6.5.4 Vacuum

Some shot designs call for the use of a vacuum chamber. Any shot that requires a vacuum will comply with the procedures in the DX-4 SOP governing Vacuum Use in Field Tests.

6.5.5 Fissile Material

All weapons-mockup shot assemblies are monitored for fissile material according to pit-verification procedures described in the SOP, "Storage, Handling, and Verification of Uranium." The Firing Leader is responsible for overseeing monitoring. Another member of the firing crew verifies the monitoring.

6.5.6 Gas Handling

If the experiment involves filling a pressure vessel with gas or using methane in a confined assembly, special gas-handling procedures must be followed. These are described in the SOP, "Filling Pits with Gases at Firing Points." All other gas handling operations (e.g. Ar, Xe flashers, X-rays, and low pressure hydrogen fills) will be done in accordance with AR 14-1.

6.5.7 Assembling Experiments on the Firing Mound

Shots may be assembled at the firing mound. Shots delivered as separate components are assembled by the firing crew and placed on the shot stand. The firing crew shall take special care to ensure that all piece numbers have been recorded during assembly to allow accurate and complete reporting of expended materials.

- Ordinarily the firing crew will not bring more explosive to the firing mound than will be fired in one experiment. Extra explosive, or shots in a series, will be kept in a service magazine or a preparation room until the previous shot is complete. Rounds for small arms are an exception.
- Explosives handling on the firing mound should be kept to a minimum.

- All shot assemblies and support stands shall be designed to be stable once the assembly is placed on the shot stand.
- Explosive charges may be assembled on the firing mound or in the charge preparation rooms using approved glues, tapes, clamps and jigs, and chemicals, as described in the DX-4 SOP, "Operation of Charge Preparation Rooms." When necessary, argon, methane, propane, and xenon gases may be used for light generation, intensification or quenching. Chemicals not listed as permitted in preparation rooms require an SWP for use in conjunction with explosives on the firing mound.
- All firing cables, vacuum lines, electrical cables, etc., used in an explosive assembly must be protected and secured so that the shot will not move if anyone accidentally steps on or trips over the lines. It is good practice to route firing cables well away from diagnostic cables.
- Sandbags, shot design, or other measures will be used when necessary to mitigate (or control) blast and fragments per TIC-11268, DOE Manual for the Prediction of Blast and Fragment Loading on Structures, AMCP 706-181 (Army Material Command Pamphlet), and NWC-TP 5780 (Naval Weapons Center-Technical Publication).
- Whenever possible, detonators shall be attached to the explosive as a last step in the assembly of the shot.

6.5.8 Charge Protection from Weather

A cover or tent may be set up on the firing mound to shield the charge and associated equipment from the sun and weather. The Firing Leader will make sure that the cover or tent is secured against wind; if necessary, solid anchors will be used, including the anchor points on the firing chamber.

6.5.9 Unattended Assemblies

Shot assemblies may be left unattended on the firing mound during normal working hours, provided the exclusion area is cleared of all personnel, the safety gate is closed and locked, and the group office as appropriate, see 6.4.3, and Access Control Office are notified. Prudent practice dictates that the number and duration of unattended shot assemblies on the firing mound shall be kept to a minimum.

6.5.10 Working Alone

DX-4 knowledgeable employees may only work alone in an area that has an approved "working alone" procedure in the site-specific SOP for that Firing Site. When working alone with HE, employees will use the "working alone" procedure appropriate for the particular work area. The minimum requirements for working alone are given in the General Safety SOP. Performing firing operations alone has the following requirements:

- Only authorized Firing Leaders may fire explosives alone.
- All operations shall be performed in accordance with existing SOPs/SWPs.
- Working alone on firing operations is permitted only during normal working hours or when Access Control is manned.
- Personnel shall be assigned in a manner such that each worker's presence is periodically monitored via radio or a physical check, in case assistance becomes necessary.
- Any person conducting firing operations alone will be in contact with the Access Control Office.
- A Firing Leader working alone will notify Access Control before taking explosives to the firing mound.
- When a proper clearance can be accomplished and assured, Firing Leaders may conduct firing operations alone.

6.6 Safety Keys

Each safety key described in this section operates a switch that must be in the off or open position before the key can be removed. (The high-voltage disconnect key at R306 and R310 is the sole exception, because it unlocks a padlocked junction box, rather than a switch). The keys and their function described are typical. Detailed descriptions of functions are found in the site-specific SOPs.

> **Keys will never be left in unattended equipment.** This includes portable x-ray machines, 3B and 4 lasers, microwave sources, and other equipment. The Firing Leader will control keys to portable x-ray machines when people are on the firing mound.

- Firing Control Key – Each firing circuit is locked, and each unit can only be operated with the safety key. Only authorized Firing Leaders have keys to these locks. Spare keys are locked in the Access Control key box, and require DX-4 Group Office approval for removal. These keys will be under the control of the Firing Leader during shot assembly.
- CDU Key – The CDU key controls the power supply that furnishes the high voltage to the CDU. The Firing Leader or Chamber Operator has control of the CDU key when personnel are working on or around the firing point when explosives are present.
- Voltage Key – The voltage key(s) control(s) all high voltage to diagnostic circuits on the firing mound.

6.7 Firing Systems

There are several firing systems used at DX-Division firing sites. Although configurations can be quite different, a firing system generally consists of a control system, a power supply (low or high voltage), a CDU, triggering units, and the connections (cables) to the detonators or EEDs. Any changes or modification to firing control equipment must be approved by the "Firing System Safety Review Panel."

6.7.1 Firing Units

Descriptions of the various types with common precautions follow:

6.7.1.1 Category I CDUs. This category is restricted to firing units where both the CDU and the high-voltage supply are located inside the firing bunker, or the CDU is in the CDU bunker. They are designed to fire several detonators on long (>5 m) firing cables. (For example, the standard 50-point unit.) All current firing units in this category attach to an external high-voltage supply. Detonator cable connections are made at the CDU after the hazard zone has been cleared and the bunker door shut, except at TA-40-8 and TA-40-5.

6.7.1.2 Category II CDUs. There are two groups of Category II CDUs, those with the HVPS remote from the firing unit, and those in which the HVPS is incorporated in the unit.

- **Separate HVPS.** Certain detonator types and shot assemblies must be fired with the CDU less than 2 m from the charge. These firing units have the CDU located on the firing mound. The control circuit, and HVPS, triggering unit are usually located in the bunker. The detonator may be connected to the CDU before clearing the hazard zone.
- **Incorporated HVPS.** Firesets with unique applications may have the HVPS incorporated into them. No firesets with self-charging capability will be used unless a site-specific SOP or a current SWP sanctions that use.

6.7.1.3 Low-Voltage Initiator Systems. These specialized systems are generally used to ignite low energy EEDs such as squibs, blasting caps, and ignitors. These operations often require an SWP, although some of these operations are covered under Site-specific SOPs for some firing sites, and do not require an SWP to be used at those sites.

- **Low Voltage CDU.** This is a low-voltage (50-V) CDU system used to ignite pyrofuse initiators, electronically initiated primers, and similar devices. This CDU has an internal supply, but it is powered through relays controlled by the firing key, arming switch, and firing switch.

- **AC Firing Unit.** This is an isolated 115-V ac and 300-V ac firing unit used primarily to operate solenoids that operate mechanical primers to fire guns, and to fire other experiments requiring mechanical initiation. The output is supplied by a relay controlled by the firing key, arming switch, and firing switch so that power cannot accidentally be applied at the output of the firing unit. The firing sequence is identical to that used for high-voltage CDUs. The 115-V ac and 300-V ac outputs use Reynolds 21 and 310 connectors, respectively, so that they cannot be confused with each other or with other connectors.

6.7.2 Firing Cables

Firing Cables must be clearly identified and identifiable. Care will be taken to protect these cables from damage by routing them outside normal walkways (where possible) and avoiding blast mats or other objects with sharp edges. They are separated from other cables associated with the shot as much as possible, to avoid confusion leading to misidentification, and to prevent any possibility of induction of spurious current in diagnostic cables.

- When all firing cables have been laid out, they will be taped to the shot table or otherwise secured to prevent any strain when they are connected to the detonator.
- Firing cables shall not be inserted into the CDU enclosure nor connected to an expendable CDU until people are accounted for and in protected areas, and the Firing Leader is ready to begin the arming process.

6.7.3 Firing System Interlocks

The ability to fire a shot is limited, as a safety measure, by a set of interlocks which assure that doors and gates are closed and other safety measures are met before the shot can be fired. The interlocks operate a relay that activates the high voltage power supply (HVPS) when the interlocks are made. Other interlocks activating the HVPS include a delay siren relay and a foot switch or a second hand switch. A firing key switch controls the high voltage to the firing unit(s). Details of the interlock systems are given in the site-specific SOPs. In general:

- The firing-bunker doors are interlocked with the firing circuit and must remain secured throughout the firing sequence. The sole exceptions are the Control Room doors at TA-40-5 and TA-40-8. If any special firing procedure requires the door to be open, an SWP will be written for each.
- All HVPS units used in the firing system or delivering HV to the mound will be connected to interlocked power.
- All safety systems and devices associated with firing will be checked and documented at least annually. The most recent and best schematic of the firing circuits is to be on file at the site of the operation and will be updated as required.

6.7.4 Bypass Systems

A bypass system exists at some DX Division firing sites. These bypasses may allow the CDUs to be charged and triggered without the usual audible and visual warnings and/or without closing the interlock systems. Extensive constraints on the use of these systems are described in site-specific SOPs for individual Firing Sites.

6.7.5 Final Arming and Energizing

Final arming procedures are specific to each Firing Site and are described in site-specific SOPs.

6.8 Camera and Optical Diagnostics Room

Direct optical access to an experiment can present hazards inside the firing bunker, either from port-glass shards or shot fragments. In general, rooms in which there is line-of sight access to a shot, such as through the port glass in a camera room, should be evacuated and have the door closed during shots, whenever possible. The Firing Leader may prohibit people from entering the optical diagnostics room during any given shot or operation.

6.8.1 Commercial Rotating-Mirror Cameras

Most commercial rotating-mirror cameras used in DX Division will contain any debris from a broken mirror. Even so, it is prudent practice to keep the door to the camera room closed and permit no one in the camera room when the rotating mirror in the camera is operating. This also protects operators from the noise generated by the spinning mirror. Some firing sites do not have a separate camera room, and may use commercial cameras in the bunker.

6.8.2 Home-Made Rotating Mirror Cameras

Home-made rotating mirror cameras used in DX Division are not proven to contain debris from a broken mirror. Therefore, they may only be used in a separate camera room, and it is required to keep the door to the camera room closed and permit no one in the camera room when the rotating mirror in the camera is operating.

6.9 Warning Signals

Warning signals that may consist of lights, horns, and sirens are present at all DX Division firing sites. Site-specific SOPs describe the exact warning to be found at any particular firing site.

- At all firing sites, an audible signal, a horn or siren, is sounded for more than one minute prior to firing. An "all clear" signal of two or more short blasts shall be used to denote the "all clear" condition on all operations involving a siren.

- When warning signals are tested, or if a "nonhazard" test includes warning signals, this should first be announced over the radio and public address (PA) system.

6.10 Explosive Contamination of Firing Point

If the firing point is contaminated with HE by a partial or incomplete detonation, or with pieces or powder from explosives, the point shall be decontaminated before it is used again.

7.0 PROCEDURAL STEPS

7.1 Test Assembly

- Upon delivery of explosive at the site, the Firing Leader shall make sure that the safety keys (at TA-39, the control panel key) are secured in the lock box or under the control of the Firing Leader. Keys will stay secured until the appropriate point in the firing sequence.
- When a charge is on the firing mound, the Firing Leader or an assistant will control access to the firing mound. At least one knowledgeable person shall be present at the firing site and be responsible for (ref. 6.5.9) the explosive while it is on the firing mound, or else the firing site will be closed and appropriate notices posted.

7.2 Fire Department Procedures

For shots requiring the Fire Department, the Firing Leader will contact the Access Control Office at least the day preceding the scheduled shot. The Access Control Office will contact the Fire Department and will notify the DX Division Office of the scheduled firing time and advise them that the Fire Department has been called.

- On the day of a shot, the Access Control Officer will be responsible for maintaining communications with the Fire Department according to the needs of the Firing Leader.
- When the shot is fired and clearance(s) lifted, the Fire Department is allowed to enter the area. A DX Division employee will remain on-site until the Fire Department leaves.
- Fire Department access procedures are discussed in Site specific SOPs for Firing Sites.

7.3 Clearance Procedures

It is imperative that the hazard zone be carefully cleared before any potentially hazardous operation is initiated, because people might mistakenly be within the anticipated hazard area for explosive tests. Only DX Division Knowledgeable Personnel or people accompanied by such will be allowed to remain within the hazard zone. Persons remaining within the hazard zone must be in a firing bunker or designated hardened building, and not in either a magazine or a charge preparation room, unless the preparation room is hardened.

Detailed clearance procedures for each firing site are given in the site-specific SOPs. However, a number of procedural steps and restrictions are common to all DX-Division firing activities:

- The Firing Leader will make every effort to notify the Access Control Office the day before the scheduled firing time. Posting of the Clearance Notice is the first step in assuring safe operations. Explosives shall never be moved to the firing mound for firing without notification of Access Control (if Clearance Notice was not posted).
- The extent of the clearance for a given shot is the responsibility of the Firing Leader conducting the firing operation. A Firing Leader may decide to clear to a larger hazard zone because of a larger explosive mass, a new energetic compound, a special shot configuration or fragment potential, or for any other appropriate reason.
- It is strongly recommended that there be no work done on explosives nor handling of explosives while a shot is being fired nearby.
- Simultaneous firing site clearances are discouraged for nearby firing sites. If operational necessity or efficiency requires, two or more sites may fire under the same clearance operation if the Firing Leaders determine that no unusual hazards will be created by more than one firing operation under a single clearance. However, under no circumstances shall one firing site commence a clearance while a nearby firing site is proceeding with a Firing Sequence if radio net communication may be confused, or clearance personnel may be endangered.
- More than one shot at a firing site may be fired under a single clearance for efficiency. Clearance procedures in this case are site-specific. More than one shot under a single clearance shall not be permitted if a fire is probable.
- If the Fire Department is on standby, the Firing Leaders, Access Control, and the Fire Department will be in agreement that the first shot is complete and the area is safe, before the second shot can proceed.

7.3.1 Steps Before the Clearance

- Selection of clearance plan
- Determination of fire department requirements
- Posting of clearance notice and fire department notice
- Announcement of clearance (site specific)
- Briefing of clearance patrolmen and access control

7.3.2 Clearing the Firing Site (Hazard Zone)

During clearance procedures, the cleared area is established and maintained by using locked gates, interlocked gates, barricades, and/or roadblocks. The emergency warning lights on a roadblock vehicle will be operated throughout the clearance operation. The clearance procedure lists locations and procedures for closing the

hazard zone. The clearance checklist will be filled out as clearance is established. Personnel remaining within the area must take shelter.

In the process of checking and clearing buildings within the hazard area, a building with all of the doors locked or external padlocks in place will be considered empty with exceptions covered in site specific SOPs. The Clearance Patrolman will enter or contact all unlocked buildings and notify the occupants, if any, of the planned shot and that they must either leave the hazard area or remain in a shelter area until the All Clear is sounded. If a building is unlocked and there is no response to hailing, then the door will be locked, if possible, from the outside, and the building will be considered empty. An unattended vehicle will be considered evidence that a person is in the hazard area, and that person must be found and directed to a safe location before the clearance is considered complete. The Clearance Patrolman will report the location(s) of all personnel within the hazard area to the Firing Leader.

When the preparation of the shot is complete, the clearance is started. During the clearance, patrolmen conduct the site-specific plan to assure that personnel are out of the hazard area or otherwise protected, and that no unaccounted for person is in the hazard zone. Specific clearance procedures generally include the following:

- Clearance checklist
- Access Control informed
- Other Firing Leaders informed, if necessary
- Clearance patrolman executes site-specific procedures, usually includes:
    - sweeps, visual and physical
    - closes gates and interlocks
    - establishes roadblocks, barricades
    - informs Firing Leader that tasks are done and the area is cleared

7.3.3 Post-Shot Procedures

- Firing staff waits for area to be cleared of explosive products and shrapnel hazard.
- Firing Leader inspects firing area.
- Firing Leader makes preliminary check for fires.
- Firing Leader declares area safe.

  With regard to explosive hazards.
- All firing staff make a thorough inspection for fires.
- Firing Leader lifts the clearance: informs clearance patrolmen and Access Control of safe area.
- Fire Department and other access allowed.

7.3.4 Unexpected Breaking of a Clearance

7.3.4.1 If anyone passes a roadblock and enters a hazard zone:

- The person manning the roadblock shall immediately notify the Firing Leader to STOP the firing sequence.
- The person manning the roadblock shall remain at his station and shall not attempt to chase the persons who have passed the roadblock.
- The Firing Leader shall immediately discontinue the firing sequence and confirm receipt of the message.

7.3.4.2 If any Firing Point interlock is opened, the Firing Leader must:

- immediately discontinue the firing sequence and investigate.
- reclear the area before restarting the firing sequence.

7.3.5 Clearance Outside Normal Working Hours

- If a shot will be fired outside of the normal work day (8:00 AM to 4:00 PM), or if explosives will be left overnight, the Firing Leader will notify the Access Control Office, Access Control will call DX-DO, PTLA, and EM&R. Clearance procedures modified under an SWP may be used for shots fired outside normal working hours.
- For a late shot, or if explosives are left overnight on a firing pad, the firing area access gate will be left in the closed position. When the hazard zone extends beyond the boundaries of the site at which the shot is to be fired, a more extensive exclusion area will be used.

7.4 Detonator Connections and Arming

Arming begins when any part of the firing system is energized. Arming commences only when clearance procedures are completed.

7.4.1 Continuity Measurement (Resistance Measurement, "DCOing")

Resistance of a detonator is checked only with a meter (DCO) certified by DX-1. This step may also be undertaken before clearance is established.

- **Category I CDUs:** Usually the resistance of the detonator and cable is measured from within the bunker, just before hooking the cables to the CDU. The clearance is in place.
- **Category II CDUs:** The resistance of a detonator and cable is measured on the firing mound, before connection to the fireset or during connection to the fireset (depending on the connector type.)

HV monitor cable is connected to both the CDU and the HV monitor to assure that no HV is on the CDU.

3. With the Firing Leader's authorization, connect the detonator cable to the CDU.
4. After the hazard area has been cleared and the firing sequence started, connect the high-voltage supply to the CDU from within the firing bunker.
5. After the shot, check the high-voltage monitor to ascertain that the CDU is totally discharged. Disconnect the high voltage supply, monitor, and trigger cables.

7.5 General Firing Steps

The following steps illustrate the procedural steps used for firing shots. Exact procedures are found in the site-specific SOPs.

7.5.1 Using a Category I CDU

- exclusion area cleared
- detonators connected to cables (not to CDU)
- final alignment check
- everyone inside, door shut, dropouts set
- interlocks shut, made
- safe condition to fire ascertained (interlocks, observation)
- firing sequence engaged (computer timing sequence, if present)
- DCO
- firing cables connected to Cat. I CDU (CDU inside)
- siren runs for 1 min. or more
- ready-fire switch closed (footswitch or handswitch)
- HV applied to CDU
- Shot is fired
- check that CDU discharged
- allow time for fragments to fall
- disconnect firing cables
- allow prudent time for detonation product gases to clear before going outside.
- all clear- 2 or more short blasts
- complete post shot operations

7.5.2 Using a Category II CDU

- exclusion area cleared
- detonators connected to cables (not to CDU)
- final alignment check
- connect the detonators cables to CDU (with at least one interlock open)
- everyone inside, door shut, dropouts set

- safe condition to fire ascertained
- CDU connected to HVPS and trigger (CDU outside)
- Firing Leader makes connections as last step, then retires to firing bunker.
- computer timing sequence, if present, engaged
- siren runs for 1 min. or more
- ready-fire switch closed (footswitch or handswitch)
- HV applied to CDU
- Shot is fired
- allow time for fragments to fall
- all clear- 2 or more short blasts
- check that CDU discharged, especially if outside
- disconnect firing cables
- allow prudent time for detonation product gases to clear before going outside.
- complete post shot operations

7.6 Special Procedures

The following gives the procedures used for situations that occur occasionally during firing operations.

7.6.1 Misfires

- In case of a misfire, reduce the firing voltage to zero. Check the HV monitor to be sure that the CDU(s) is discharged.
- Turn off the camera/turbine supply (if in use). Once all the circuits are deemed safe and the appropriate firing system cables have been disconnected, personnel shall first attempt to view the firing pad through the optical port or through the camera periscope. Without terminating the firing sequence, look for possible obvious causes (such as an unconnected detonator cable).
- At this time, the firing cable and detonator(s) may be checked for continuity, if possible. This check will be done from within the safety of the bunker. If it is necessary to go to a CDU bunker to do this check, the ten minute wait described below must be completed before the CDU check.
- One or more attempts to fire may be made, at the descretion of the Firing Leader. If the shot still does not fire, inform Access Control and wait ten minutes. Visual inspection may be performed by the person blocking the road, or a person coming from outside the exclusion area to a safe distance from the mound. If it is necessary to go to a CDU bunker to do this check, the Firing Leader and one other person may go, after waiting for ten minutes.
- Be sure the CDU is disarmed before approaching the shot. Before other personnel are allowed to leave the cover of the bunker, one qualified person shall carefully approach and examine the setup to verify that it is safe.

- If an unexpected situation develops on the firing pad posing apparent danger, seek safety inside the bunker then notify the Access Control Office.
- For shots at elevated temperatures, 10 minutes may be an insufficient wait time, and Group Management should be consulted before anyone ventures near the firing mound.

7.6.2 Partial Firings

In the case of known or suspected partial firing, all personnel will remain inside the bunker. Notify the DX-4 Group Office and Access Control. A 30 minute waiting period shall be observed. If the explosive is burning, or if there is smoke in the general vicinity, wait at least 15 minutes after these signs have disappeared before approaching the assembly. The following steps and precautions shall be followed:

- Notify Access Control and the DX-4 Group Office.
- Continue to run siren.
- Disconnect and deenergize all electrical power sources connected to the shot, and turn off the camera/turbine supply (if in use). Disconnect all firing cables (and/or charge and trigger cables) from the CDU, where feasible
- Ensure that all personnel in the hazard area are aware that a failure has occurred and that they must remain under cover until notified otherwise.
- Check all possibilities for the cause of the test failure from inside the bunker. When all circuits are deemed safe, attempt to view the shot via the port glass or camera periscope. Alternately, a person can view the firing mound from a safe distance.
- Before any personnel are permitted to leave the cover of the bunker, a 30-minute waiting period shall be observed.
- A carefully prepared review of the situation in consultation with another knowledgeable person such as line management, a line supervisor, or the ES&H Coordinator should be initiated.
- Before personnel are allowed to leave the cover of the bunker, one qualified person shall carefully approach and examine the setup to verify that it is safe.
- In the event of an expected test failure containing only detonators or actuators and no HE charge, a 5 minute waiting period shall be observed before going out onto the firing mound.

See the DX-4 SOP, "Firing Small- and Large-Bore Guns" for procedures covering shots involving projectiles (bullets, shaped charges, etc.) that are fired into targets containing energetic material.

7.6.3 Disconnecting

- The Firing Leader and no more than one assistant will disarm all shots.

- The Firing Leader and the assistant (if present) will observe and certify on the Firing Point Checklist that all firing cables are disconnected from the CDU. Cables are removed from the CDU chamber or firing bunker (whichever is appropriate).
- If a Category II CDU is being used, disconnect and short the high-voltage supply cable and the trigger cable.

7.6.4 Aborted Shots

Either the experimenter or the Firing Leader decides if a shot should be aborted. Both together determine weather the explosives assembly is safe for return to storage.

7.6.5 Firing Sequence Interrupt or Shutdown

In some cases, it may be necessary for the firing procedure to be interrupted or reversed (e.g. a person intrudes into a hazard area or equipment has malfunctioned). If any of these instances should occur, follow the steps listed in the site-specific SOPs. In general:

- Release the redundant ready-fire switch (foot switch or hand switch).
- First turn off the HV key switch. This allows the voltage to return to zero.
- Check the HV monitor to be sure that the CDU(s) is discharged.
- Disconnect all DET, HV, power supply, and trigger cables going to the firing pad, as appropriate.

Firing will be prevented if the drop-out relay of the firing site safety gate interlock circuit or any other interlock is not in a closed position. This can occur because someone has entered the area after the gate was closed. Do not resume the firing sequence until a complete check of the area inside the gate has been made. After such a check, the interlocks can be reset and the firing procedure repeated.

7.6.6 Rotating Mirror Cameras

In general, it is prudent practice to stay out of the camera room and leave the camera room door shut when the mirror is running and for one minute after the camera air is turned off, or until the mirror has stopped rotating.

Many rotating mirror cameras have mirrors made of beryllium, which is poisonous when present as a dust. If it is determined that a beryllium mirror has broken while in operation, do not open the camera room door or the camera housing. Turn off the camera air and high voltage. Evacuate the building and do not reenter until ESH-5 has evaluated any possible hazards and given permission to reenter. If the housing of the shut down camera needs to be opened to determine that the mirror has failed, leave the room as soon as the failure is apparent.

7.7 Emergency Procedures

7.7.1 Building or Site Emergency

If an emergency situation should occur, follow the Building Emergency Plan (BEP)/Site Emergency Plan (SEP). The BEP/SEP must be available in the building and the operators shall be familiar with its contents.

7.7.2 Personal Injury

In any emergency involving injury to a person or persons, the employee encountering the accident should use good judgment on the procedures to be followed, depending on the circumstances. Decisions made by a DX employee at the scene of an accident will be supported by the DX management. If there is a serious injury or accident, follow this procedure:

1. Dial 911 to contact the Fire Department Rescue Squad and ambulance. Say where the emergency is and stay on the line until the operator has finished getting information from you.

2. Aid victims if possible, but do not endanger them, yourself, or others. Request first aid and CPR help if needed. Take measures necessary to prevent further damage or injury.

3. Dispatch individuals to direct emergency vehicles.

4. Notify the Group Office. The Group Office will:
   - notify the DX Division Office,
   - alert guard stations to expect emergency vehicles and personnel:
   - For TA-15: Station 431 (7-4850)
   - For TA-36: Station 460 (7-4051)
   - For TA-40: Station 431 (7-4850)
   - TA-39 Local Access Office personnel will open the main gate to the site, to allow emergency vehicles to enter.
   - call the FMD (Facility Manager Designee) at 8-1-(505) 699-1765.
   - call the Emergency Management Office to notify them of the incident (7-6211 during working hours, 7-7080 after hours).

5. Inspect the accident site to see if anything might cause injury to rescue personnel. If possible, consult with the Group Leader or other senior DX-4 employees. Otherwise, the people at the accident scene have the authority to proceed or limit access at their discretion. Fires involving explosives, or imminently involving explosives, will not be fought. All personnel will instead seek shelter in a bunker.

6. Continue to give first aid until the Rescue Squad arrives.

7. Record accident details including personnel involved, injuries, property damage, and witnesses.

8. Remain at your regular location if you are not directly providing aid.

9. Do not disturb evidence that may be important for later investigation.

7.7.3 Electrical Shock

Any employee who receives an electrical shock must report to ESH-2 for evaluation.

7.7.4 Lasers

Any employee who receives an injury from a laser must report to ESH-2 for evaluation.

8.0 REQUIRED RECORDS

- Shot request form
- Shot schedule
- Expended materials reports
- Explosives Inventory Reports
- Post-Shot Reports (on file at TA-15-183 Access Control)
- Site Log Books, if applicable
- Clearance checklists (on file at TA-15-183 Access Control)
- Firing checklists

9.0 REFERENCES

- DOE Explosives Safety Manual, DOE M440.1-1, REV 8
- Army Material Command Pamphlet, 706-181 (Blast and Fragments)
- DOE Manual for the Prediction of Blast and Fragment Loading on Structures, TIC-11268
- Naval Weapons Center-Technical Publication, 5780 (Blast and Fragments)
- LANL Electrical Safety Program
- DX Division Operations Manual
- DX Division Training and Qualifications Manual
- Building/Site Emergency Plans
- DX-10: SOP 71, "Exposure of Explosive to Elevated Temperature"
- Los Alamos National Laboratory ES&H Manual
- DX Division SOP 6, Radiological Controls

- SOP DX-11-2.5, "Firing Small- and Large-Bore Guns."
- DX Division SOP 1, Hazardous Waste
- Los Alamos National Laboratory's *Environment, Safety and Health* Manual Administrative Requirement (AR) 6-6, "Explosives," (AR) 12-1, "Personal Protective Equipment," and (AR) 7-1, "LANL Electrical Safety Program."

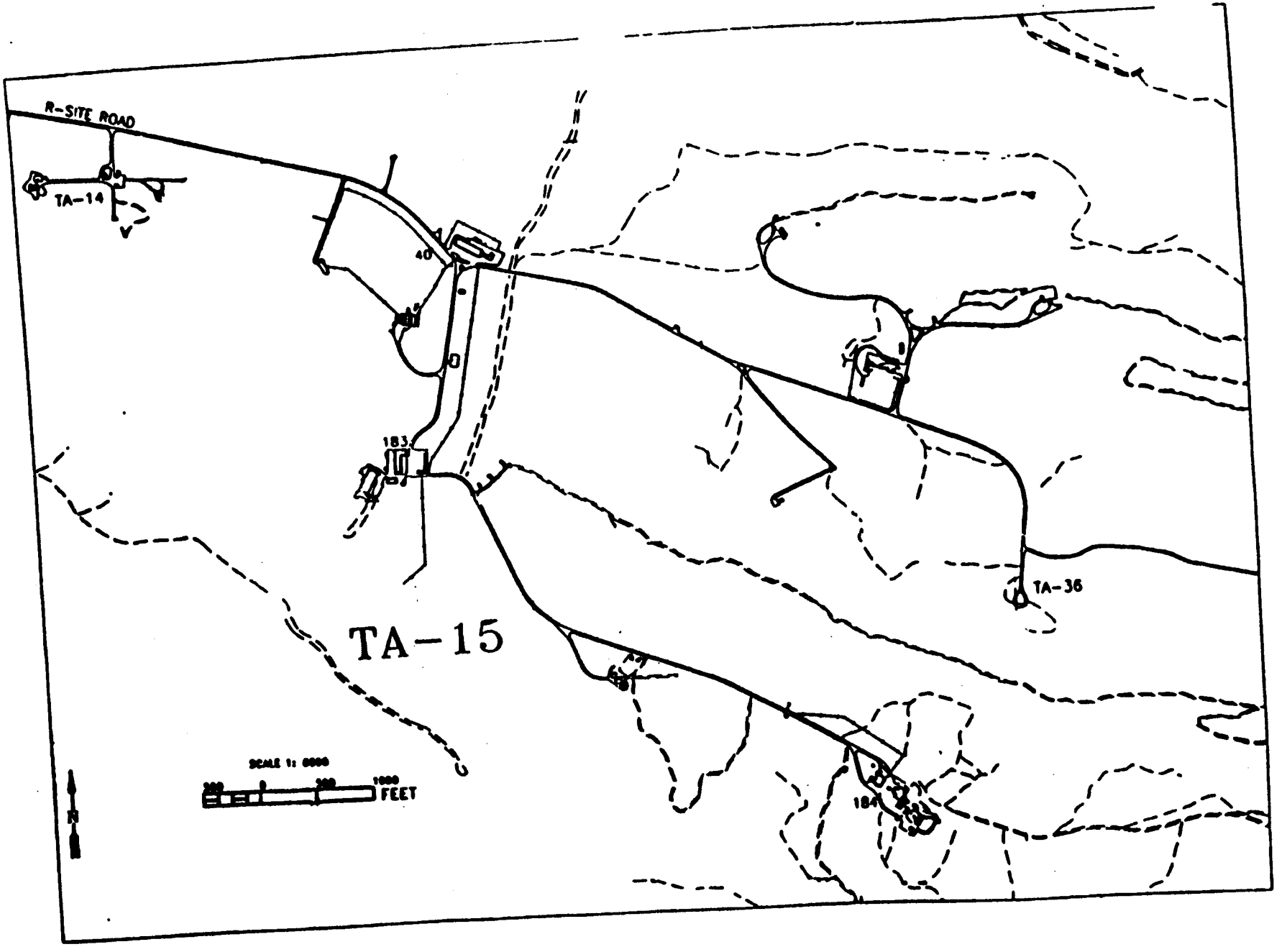
10.0 ATTACHMENTS

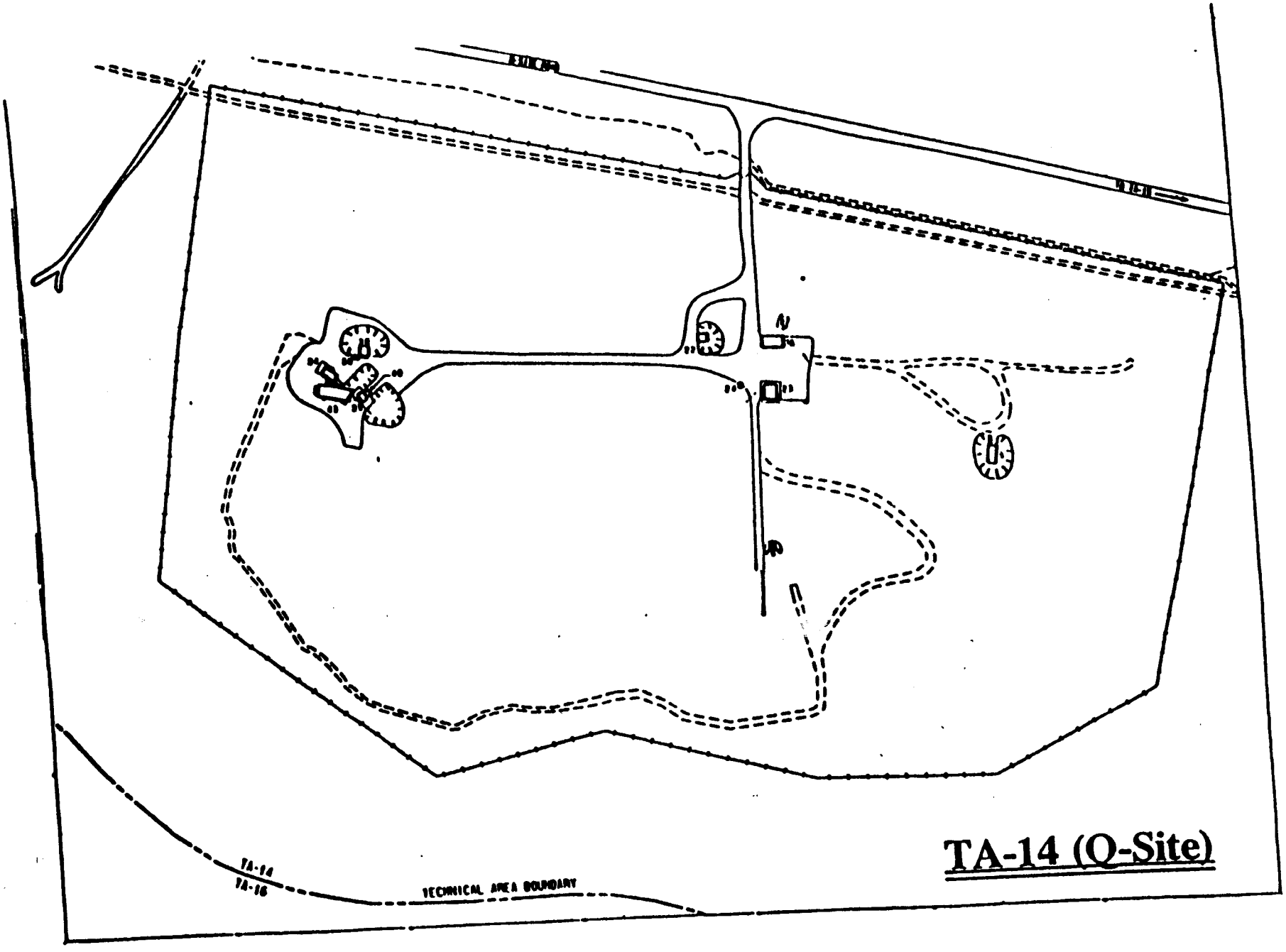
ATTACHMENT 1: Maps
ATTACHMENT 2: Soldering, details of operations
ATTACHMENT 3: Specific Hazard Circles and Clearance Plans
ATTACHMENT 4. Equipment Approved for Use on the Firing Point During the Setting of a Shot

ATTACHMENT 1

Maps

Attached: TA-15
TA-14/16
TA-39
TA-40


R-SITE ROAD
TA-14
40
183
TA-15
TA-36
184
SCALE 1: 6000
FEET
N


TA-14 (Q-Site)
TA-14
TA-16
TECHNICAL AREA BOUNDARY
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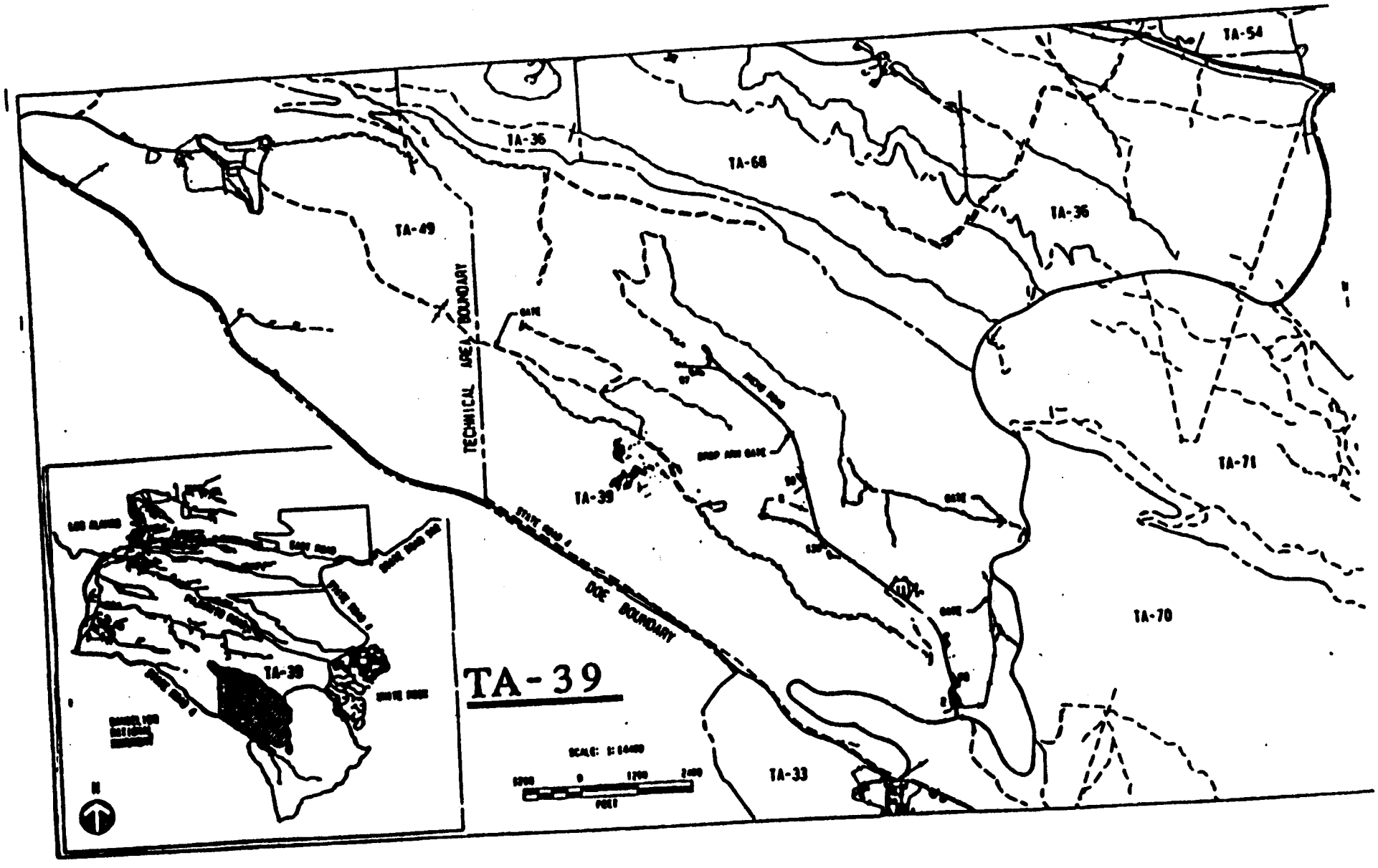
TA-39
TA-54
TA-36
TA-68
TA-36
TA-49
TA-71
TA-39
TA-70
TA-33
TA-39
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SCALE: 1:6400
FEET
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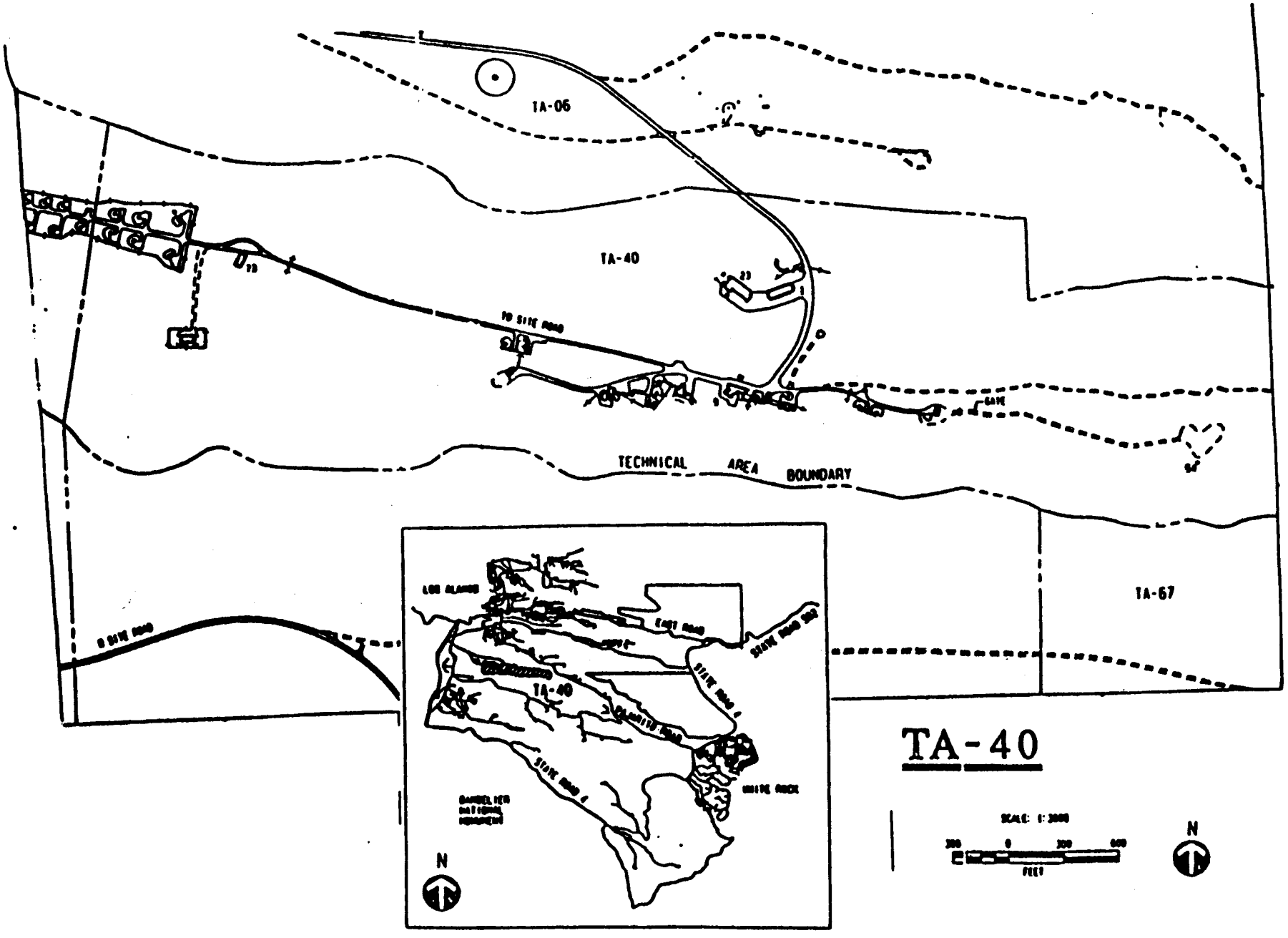
TA-06
TA-40
TECHNICAL AREA BOUNDARY
TA-67
LOS ALAMOS
EAST ROAD
TA-40
BANDELIER NATIONAL MONUMENT
N
SCALE: 1:2000
FEET
N

TA-40

ATTACHMENT 2

Soldering, Details of operations:

As a final step in constructing the shot assembly, it may be necessary to solder electrical leads to it. This operation must be performed carefully, using a soldering gun with a momentary switch, a battery-operated soldering tool, or other soldering gun that does not remain hot when not in use.

The Firing Leader is responsible for ensuring that only proper soldering equipment is used.

The hot tip is always kept at least 30 cm (1 Ft) meters from any bare exposed explosive(s) and is kept one meter or more from any exposed explosive(s) when not in use.

The soldering iron, and especially the flexible cord, must be examined for defects before it is used.

Any AC soldering gun used at a firing site must meet UA and OSHA standards for electrical safety.

All personnel who use soldering equipment near explosives must be aware that heat could reach the explosive by conduction. All soldering operations shall be performed so that material in contact with the explosive never becomes more than warm to the touch.

Interposed barriers must be used to ensure that neither the hot soldering iron nor molten solder dropping from it comes in contact with the explosive.

Soldering directly to pins or other objects that are in contact with explosives and can conduct heat to the explosive is prohibited.

Whenever possible, soldering operations shall be done beside or below the assembly rather than above it.

When soldering is completed, the soldering gun must be unplugged and placed in a stable position at least 60 cm (2 ft) from any exposed explosive.

ATTACHMENT 3

6.2a.5 Table of Hazards and Hazard Circles for Clearance Plans at TA-15 and TA-36

Plan	Hazard Radius	Application
A-Minor	75 m (250 ft)	Contained detonator firing. Pulsed-power discharges. Radiation production. Firing-point access control. Small-arms firing.
A-Minor Special	75 m (250 ft)	Contamination control. Specific to PHERMEX.
A	250 m (1250 ft)	Explosive shots.
B	500 m (1640 ft)	Explosive shots.
C	750 m (2460 ft)	Explosive shots.
C Special	750 m (2460 ft)	Contamination control. Confined shots with potential for a hazardous material release. Specific to PHERMEX.
D	1000 m (3280 ft)	Explosive shots.
E	1250 m (4100 ft)	Explosive shots.

TA-39:

Clearance Plans - Each test using HE must be evaluated by the shot leader to determine its hazard potential and what safety plan must be used The safety plans listed below are in ascending order as risk increases. For new operations, or for those with which we have little experience, the highest reasonable hazard level shall be chosen. Each safety plan uses barriers to control traffic. Barriers may never be crossed without explicit permission of the Firing Leader.

TA-39:

Level-1. Level-1 hazard areas are approximately 46 m (150 ft) from the firing points and have barricade with a sign stating "Level-1 Hazard - Do Not Pass." Operations that do not involve the detonation of HE may be conducted using Level-1 safety plan (see SOP DX-15-55). In general, the firing of detonators requires Level-2 (or higher) safety plan; however capacitor bank operations may use a Level-1 plan. This safety plan is also used to exclude personnel from the firing pad when HE is present and there is no hazardous operation in progress.

Level-2. Gate 2 located 750 m (2460 ft) from Point 57, labeled "Level-2 Hazard Area - Do Not Pass," defines the hazard area for the safety plan available for shots meeting the general criteria or explicitly listed in Attachment 1.

Level-3. Systems that do not meet the criteria for a Level-2 hazard are automatically Level-3 hazard shots. Gate 3 (near the entrance to Firing Point 6) provides a hazard circle of 1350 m (4400 ft). This gate is labeled "Level-3 Hazard - Do Not Pass.

Level -4. Shots that have the following properties should use the gate labeled, "Gate 4 - Do Not Pass," unless there is specific experience with the system or rather extensive shrapnel mitigation techniques are being used.

Confined explosives systems with more than 100-lb. HE and having metal (e.g., steel, Cu) walls of 2 in. thick or more.
Shots with completely random shrapnel containing more than 100 lb. of HE.
Shots with heavy metal shrapnel that must be directed down the canyon.

NOTE: Remember that State Road 4 is closer to the firing points in two locations than Gate 4, and TA-36 firing points are roughly the same distance from Gate 4 but in the opposite direction. If the shrapnel in the specific shot in question cannot be directed away from the road with certainty, extra mitigation for shrapnel in these directions must be used.

Level-5. A final option is to close the gate labeled, "Gate 5 - Do Not Pass." One may utilize this closure option when particle trajectories will be in the direction of the explosive magazines and extensive shrapnel mitigation measures have been taken to protect State Road 4 and TA-36. The shrapnel mitigation measures must be in place before the HE-containing assembly is brought to the firing area, or must be installed simultaneously with the placing of the HE. The closure of Gate 5 provides additional personnel protection within Ancho Canyon. A safety plan using Gate 5 to define the hazard area will be approved by the Group Leader and the Safety Committee

TA-40 Hazard Circles

Chamber 15 The hazard circle for Chamber 15 extends from the safety gate.

Chamber 5 The hazard circle for Chamber 5 is defined by the confinement on the firing pad, because of the very small load limit at this chamber.

Chamber 4 The hazard circle for Chamber 4 extends from the safety gate.

Chamber 8 The hazard circle for Chamber 8 is defined by the Firing Vessel. There is no hazard area outside the Firing Vessel.

ATTACHMENT 4

EQUIPMENT APPROVED FOR USE ON THE FIRING POINT DURING THE SETTING OF A SHOT

1. Portable electric screwdriver or drill motor.
2. Normal hand tools such as hammers, screw drivers, pliers, saws, wrenches, tape measures, and knives.
3. DCO meters approved by DX-1 for checking resistance of detonator bridge-wires.
4. Battery-operated V/Ohm meters to check continuity in cables and circuits isolated from explosive.
5. meters to check for shorts in explosive-monitoring pin and foil circuits.
6. Scintillators with incorporated power supplies.
7. Sources for checking scintillators.
8. Soldering gun (see Attachment 2).
9. Telephone, microphones, and loud speakers.
10. Vacuum pumps and gauges.
11. Pressurized bottled gases, regulators, and gauges.
12. Cameras. (see the DX-4 SOP, " Shot Illumination.")
13. Optical alignment apparatus. Mirrors, lasers up to class 3A.
14. Films, intensifier screens, and cassettes for radiography.
15. Electric water heater (element not exposed).
16. Radios.

Optical equipment, flashlamps and lasers are discussed in detail in the DX-4 SOP on Shot Illumination, or in the DX Division Laser SOP.

General Firing Operations Tools typically used on Firing Mound

Hammers	Crimpers	Cutting Tools
Wrenches	Handsaws	Circular Saw
Socket sets	Files	Jig Saw
Screwdrivers	C-Clamps	Drill Motors
Levels	Tape Measures	Alignment Lasers
Squares	Pry Bars	Impact Wrenches
Chalkline	Chisels	Volt Ohm Meter
Pliers	Micrometers	

DX-4

PREPARATION ROOM OPERATIONS

EXPLOSIVE CHARGE HANDLING

ASSEMBLY

SOP 5

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DX-DO

Controlled Document Number: [ ]

Table of Contents

1.0 INTRODUCTION 4

2.0 PURPOSE 4

3.0 SCOPE 4

4.0 DEFINITIONS 5

5.0 RESPONSIBILITIES 6

5.1 REQUIRED READING 6

5.2 TRAINING 6

5.3 WASTE MINIMIZATION 7

6.0 PRECAUTIONS AND LIMITATIONS 7

6.1 HAZARDS 7

6.2 HANDLING OF EXPLOSIVES: GENERAL PRECAUTIONS 8

6.3 PERSONNEL AND EXPLOSIVES LOAD LIMITS 9

6.3.1 PERSONNEL AND EXPLOSIVE LOAD LIMITS AT TA-15 PREPARATION ROOM 9

6.3.2 PERSONNEL AND EXPLOSIVE LOAD LIMITS AT TA-36 PREPARATION ROOMS 10

6.3.3 PERSONNEL AND EXPLOSIVE LOAD LIMITS AT TA-39 PREPARATION ROOMS 10

6.3.6 DETONATORS AND PELLETS 11

6.4 EXPLOSIVES ALLOWED IN CHARGE PREPARATION ROOMS 11

6.5 COMPATIBLE MATERIALS 11

6.5.1 ADHESIVES AND COATINGS 11

6.5.2 FLAMMABLE SOLVENTS 12

6.6 STORAGE OF EXPLOSIVES IN PREPARATION ROOMS 12

6.6.1 TEMPORARILY STORING ASSEMBLED CHARGES 12

6.6.2 EMPTIED CONTAINERS 12

6.7 SAFETY EQUIPMENT (PERSONAL PROTECTIVE EQUIPMENT) 13

6.7.1 SAFETY GLASSES OR GOGGLES 13

6.7.2 GLOVES 13

6.7.3 PROTECTIVE CLOTHING 13

6.8 APPROVED ELECTRICAL/ELECTRONIC EQUIPMENT 13

6.8.5 CELLULAR PHONES AND OTHER RF EQUIPMENT 14

6.9 SPILLED EXPLOSIVES 14

6.10 EATING 14

6.11 OPERATING VEHICLES NEAR CHARGE PREPARATION ROOMS 15

6.12 WORKING ALONE 15

6.13 LIGHTNING 15

7.0 PROCEDURAL STEPS 15

7.1 ASSEMBLY PRACTICES 15

7.1.1 PERMITTED OPERATIONS IN CHARGE PREPARATION ROOMS 15
7.1.2 CUTTING AND BORING OPERATIONS 16
7.1.3 HOUSEKEEPING 17
7.1.4 HANDLING EXPLOSIVES 17

7.2 UNAPPROVED ADHESIVES 17

7.4 ALLOWABLE MIXTURES WITH NITROMETHANE 18

7.5 ATTACHING DIAGNOSTICS TO CHARGES 18

7.6 APPLYING PROTECTIVE COATINGS 18

7.7 USING HAND TOOLS 18

7.8 PERFORMING CONTINUITY CHECKS 18

7.9 EMERGENCY PROCEDURES 18

7.10 FIRES 19

8.0 REQUIRED RECORDS 19

9.0 REFERENCES 19

10.0 ATTACHMENTS 20

1.0 INTRODUCTION

This SOP describes the methods to be used in the preparation of explosive charges for firing at DX Division firing sites. Explosives handling, assembly, measuring, trimming, and gluing operations are discussed. All requirements of this SOP are in accordance with the DOE Explosives Safety Manual. Long-term storage is described in the DX-4 SOP, "HE Storage."

2.0 PURPOSE

This Standard Operating Procedure (SOP) provides guidelines and rules for the safe performance of the operations used in the preparation and assembly of explosive charges in DX Division charge preparation rooms. It describes the precautions and procedures for safely performing explosive charge preparation operations.

3.0 SCOPE

This SOP covers all explosive assembly and preparation operations at DX Division Preparation Rooms. This SOP applies to all personnel who are authorized to perform operations in DX Division charge preparation rooms.

Location of charge preparation rooms at TA-15 and TA-36:

Building TA-15-242
Building TA-36-4, Room A (Eenie Site)
Building TA-36-5, Room A (Meenie Site)
Building TA-36-7, Room A (Minie Site)
Building TA-36-11, Room A (Lower Slobbovia)
Building TA-36-82 (Daisy Mae-Kup)

Assembly and preparation areas at TA-40:

Building TA-40-14 serves Firing Chamber 15
Building TA-40-11 room 106 is administered by DX-1 as part of crystal growing operation at TA-40-12
Building TA-40-6 serves Firing Chamber 5
Building TA-40-41 serves Firing Chamber 4, and miscellaneous large shots
Building TA-40-3 is administered by DX-1, as a part of gas gun operations.

Assembly and preparation area at TA-14 Q Site is

Building TA-14-23 room 104.

Shot preparation facilities at TA-39 are:

Building TA-39-4	trim shack
Building TA-39-111	shot assembly building
Building TA-39-77	propellant assembly for gas guns, is administered by DX-1.

Ignorance of the contents of an SOP does not excuse any violation. Any confusion regarding an SOP should be clarified before an operation begins.

In situations where an approved SOP cannot or should not be strictly adhered to, the SOP must be revised or a deviation be formally approved in an SWP.

4.0 DEFINITIONS

- **Approved explosive, propellant, or detonator** - Those detonable materials which DX Division allows in magazines, preparation rooms, and operations. Approved explosives are listed in Attachment 1 of this SOP.
- **Assembly** - Operations that involve installing explosives as part of an experimental assembly.
- **Assembly Building** - A large preparation room (TA-39-111) designated for the assembly of large systems containing explosives. The Assembly Building may be used for explosive storage under rigid restrictions. Only the HE for the assembly being worked on may be in the assembly building.
- **EED** - Electroexplosive Device
- **EP** - Explosion Proof
- **ERC** - Explosive Review Committee. A laboratory committee that has final authority on many explosives safety issues within the Laboratory, including acceptance of explosives not on the "Approved Explosives" list.
- **MSDS** - Material Safety Data Sheet
- **Explosives** -- Explosives are defined in the *DOE Explosives Safety Manual* as any chemical compound or mechanical mixture that will burn or explode if heated, exposed to impact, pinched between moving surfaces, or subjected to an electric discharge or strong shock. The term applies to materials that either detonate or deflagrate. Because explosives do not all behave in the same way, they are divided into classes. Those of most interest to DX Division are initiating, boostering, and bursting-charge (secondary) explosives, propellants, and some types of military ammunition. A list of approved explosives is given in Attachment 1.
- **Explosives Allowed Area** - Any area where explosives or explosive-containing components are stored, manipulated, prepared, or set up for firing.
- **Explosives Excluded Area** - An area where no explosive, explosive contamination, or operations with explosives are allowed. Generally, these are firing and diagnostic bunkers, offices, and buildings not specifically designated for explosives use or operations.
- **Explosives Load Limit** - The amount of explosives permitted in a magazine or preparation room, as posted on the building of each magazine or preparation room.
- **HE** - High Explosive

- **Incompatible materials** - Materials that may produce unsafe conditions when in contact with explosives. Glues and solvents are commonly encountered incompatible materials.
- **Knowledgeable Personnel**: A knowledgeable person (includes "knowledgeable visitors") can only be designated by the DX-4 Group Leader or the DX-4 Deputy Group Leader. All other personnel are visitors. Knowledgeable persons have at least four months experience working in a firing area, as verified by the DX-4 Group Leader. They have met the training requirements stipulated by DX-4, and are judged competent to safely perform various assigned tasks. Knowledgeable Personnel are eligible for pictured exchange badges where they are required. All required reading, institutional training and OJT requirements must be completed before becoming a knowledgeable person or employee. These requirements are specified in Site Specific SOPs or the Authorizations and Assignments Document. They may escort visitors.
- **Low Energy EEDs** - Hot-wire initiators, squibs, blasting caps, etc.
- **Magazine, Storage Magazine** - A structure designed for long term storage of explosives. No operations may be carried out in magazines.
- **Personnel Limit** - The number of personnel allowed in a magazine or preparation room for either explosive operations or inspections. The personnel limit is posted on the door of each magazine.
- **Preparation Areas** - Rooms and buildings designated as explosive preparation and assembly areas.
  NOTE: If necessary, the firing pads may be used as preparation areas for final assembly. If this is done, extra caution must be exercised since there are steel floors and uneven surfaces.
- **Storage** - Operations that involve storing explosives until time for its use. During storage, no operation may be done to the HE.
- **Suitable Storage Container** - A container for storing explosives that is constructed according to the DOE Explosives Safety Manual, II.17.5 under "approved containers."

5.0 RESPONSIBILITIES

5.1 Required Reading

5.1.1 Each employee who holds a key to, or uses explosives preparation rooms in DX Division must read this SOP yearly, and should suggest and review revisions to the SOP as required.

5.1.2 Line supervisors will be responsible for determining which SOPs are required for their employees.

5.2 Training

All training is to be in accordance with the DX Division Training and Qualifications Manual.

5.2.1 Personnel Training Requirements. Personnel with less than four months' training with explosives at DX Division may work in a preparation room only under

the direct supervision of a qualified group member who has been granted access to the preparation room.

The DX-4 Group Leader or Deputy Group Leader may waive this requirement for individuals with other pertinent experience and knowledge.

5.2.2 The team leaders will determine, with input from the Group ES&H officer and the Division Training Generalist, what type of training is required for their team members.

5.2.3 Required reading is an important part of each employee's training and qualification. All employees shall be required to read and understand all the appropriate SOPs and other procedures for each assigned task and for each piece of equipment that they use. A required reading list will be maintained for each employee by the Group ES&H Officer and will be part of the employee's qualification, if required.

5.2.4 The line supervisors are responsible for on-the-job-training, detailed instruction, and monitoring of the operators' competence and adherence to instructions.

5.2.5 Documentation of on-the-job-training (OJT), and job-related or job-required training will be maintained by the Division Training Generalist in individual training files.

5.3 Waste Minimization

5.3.1 Waste minimization will be handled according to the Waste Minimization section of the DX Division Operations Manual and the LANL ES&H Manual, AR 10-8.

5.3.2 Waste generated from Prep Room operations must be reduced as much as technically and economically feasible. To meet this objective, the waste minimization practices of frugality, material substitution, and hazard segregation must be incorporated into waste generating activities in Prep Rooms. All operators should make every practical effort to reduce the amount of waste produced.

5.3.3 All waste will be handled according to the DX Division Waste Management SOP, DX Division SOP 6, Rad Con, DX Division SOP 1, Haz Waste, and the LANL ES&H Manual, AR 10-3.

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Hazards

The principle hazards associated with explosive operations are blast, fragment production and propulsion, and rapid deflagration (burning) of the explosive charge or assembly. Explosives can

develop violent chemical reactions from such stimuli as being heated, burned, impacted, or dropped. Even small quantities may pose a life threatening hazard.

Explosives will be protected from abnormal stimuli or environments, including:

- friction forces
- excessive pressures
- impact, shock, pinching
- deformation
- electrical sparks, abrasive or welding sparks, open flame
- contamination.

Explosives may be toxic, irritant, or provoke a skin rash or other physiological effects. In particular, propellants and materials containing nitroglycerine can have a physiological effect, and gloves should be worn when handling these materials. Personnel should contact their supervisor and ESH-2 should symptoms arise. Personnel shall wash their hands after handling explosives, especially before eating or smoking. In addition, when assembling and preparing explosive charges, the potential exists for exposure of personnel to solvents, glues, and other chemicals that may be irritating or harmful. Hazards from contact, ingestion, or inhalation are listed in MSDSs for the explosives and chemicals in question, which are available at the Preparation Rooms. Personnel should be familiar with the MSDSs for the explosives and chemicals they use. These chemicals are used in small quantities which normally do not require ventilation hoods.

Personnel must ensure there is adequate ventilation when required.

6.2 Handling of Explosives: General Precautions

- Handling of HE should be minimized.
- Explosives shall be kept in a stable position, away from the edges of workbenches, tables, and away from other objects which may tip or fall onto them.
- After an operation on an item has been completed, the item must be placed in a secure location and left in a stable configuration. When possible, items should be placed in suitably designed containers. **An item must not be left in any position at any time where it can be easily toppled.**
- Special care shall be taken to prevent and protect explosives from dropping, bumping, or scraping.
- The distance that an item will fall if accidentally dropped must be minimized.
- Floor areas where the handling of HE items is most likely to occur should be covered with an approved tile to reduce the danger in the event of an accidental drop. Floors must be kept clean, to prevent abrasion should a part be dropped.
- Hard surfaces or sharp edges that could be struck by a bare piece of HE in the event of an accidental drop should be padded or otherwise protected.

- The sliding of bare HE on surfaces should be avoided because HE surfaces are relatively susceptible to marring by scratching or slipping. This is important from a quality as well as from a safety standpoint.
- The work area surrounding an HE item that is to be handled shall be kept clear of extraneous tools, components, fixtures, and the like that could interfere with handling operations.
- An explosive sign or placard shall be placed on or next to all unattended explosives.
- All explosives shall be transported in accordance with the DX Division Packaging and Transportation SOP.

Limitations

- Mechanical force cannot be applied in such a manner that stress concentrations are developed in explosive parts, e.g. a sharp object in contact with the explosives.
- Mechanical clamps cannot be used in a manner that creates sufficient tensile stresses within the explosives to cause fracture.
- Abrasion of explosive charges by rough or sharp edges is not allowed.
- Hair felt material is not to be used with Detasheet because it builds static charges.
- Acetone is used directly only on particular explosives, and only with caution. In general, no solvents should ever be poured on explosives.

6.3 Personnel and Explosives Load Limits

Each Explosives Preparation Room has a maximum limit on the amount of explosive that can be present during normal operations. The limits for DX Division Preparation Rooms are listed on the door of the Preparation Room.

Personnel limits are established to prevent crowding of the preparation room from causing an accident, and to limit casualties in case of an accident.

The DX-4 Group Leader may approve a temporary change in occupancy limits.

6.3.1 Personnel and Explosive Load Limits at TA-15 Preparation Room

Building No.	Person Limit operators/casuals	Explosives (lbs)
TA-15- 242	4	200

6.3.2 Personnel and Explosive Load Limits at TA-36 Preparation Rooms

Building No.	Person Limit operators/casuals	Explosives (kg)
TA-36-4	4	100
TA-36- 5	4	100
TA-36- 7	4	100
TA-36-11	5	100
TA-36-82, each room	5	100

If the weight of a single shot exceeds the specified limits or if a shipment must be received that exceeds the specified limits, the DX-4 Group Leader may approve an increase to 250 kg in Buildings 4, 5, 7, and 11 for up to two weeks. These actions must be recorded in the Site Record Log Book.

6.3.3 Personnel and Explosive Load Limits at TA-39 Preparation Rooms

Building	Persons Limit operators/casuals	Explosives (lbs)
TA-39-4 Trim Shack	6	500
TA-39-111 Assembly Building	9	1000

6.3.4 Personnel and Explosive Load Limits TA-40 The personnel and explosive load limits for the Prep Room facilities used by DX-4 are listed below.

Building No.	Person Limit operators/casuals	Explosives (kg)
TA-40-6	5	2
TA-40-11 (room 106)	5	2
TA-40-14	4	25
TA-40-41	5	36

6.3.5 Personnel and Explosive Load Limits TA-14

Building No.	Person Limits operators/casuals	Explosives (lbs)
TA-14-23 room 104	3	50

6.3.6 Detonators and Pellets

- A limit of 150 approved detonators (see Attachment 1, "Allowable Explosives") and 100 booster pellets may be kept in all charge preparation rooms for use in making up charges. **Note: This is 6 trays.**
- Detonators and pellets must not be stored in the same container.
  Each category must be stored in nonpropagating containers approved or supplied by DX-1. These limits do not include detonators or pellets incorporated in charges delivered to the preparation rooms from a source outside DX Division.
- Detonators, pellets, and explosives consumed in shots must be documented on the shot sheet so that HE inventory is always current.

6.4 Explosives Allowed in Charge Preparation Rooms

No explosive powders or primary explosives will be handled by DX-4 without prior approval or appropriate SOPs/SWPs.

All explosives or explosive-containing devices that have been approved by the ERC or listed in (ESA) WX-3: SOP 1.1.0, Tables 1 & 2 may be used at DX-4. See Attachment 1 for a list of Explosives routinely used at DX-4.

- Special allowable explosives that are specifically permitted in Attachment 1 under "Special Explosives Operations," may be kept and handled in the charge preparation rooms.

6.5 Compatible Materials

Compatibility rules must be observed when working with explosives. Substances incompatible with explosives can produce heat or a chemical reaction that leads to a more sensitive or less stable explosive. Only compatible materials can be used in contact with explosives. Group DX-2 approves all materials for compatibility.

6.5.1 Adhesives and Coatings

Only approved adhesives and coatings, listed in Attachments 2 and 3, may be allowed in contact with explosives. Care must be taken in cleaning explosives with solvents, since many explosives will dissolve in common solvents such as acetone.

6.5.2 Flammable solvents

Use of flammable solvents in an explosives area considerably increases the explosive hazard because of the greater ease-of-ignition of the solvent may lead to a fire involving explosives. Therefore, solvent use and evaporation shall be kept to a minimum. Solvent use will take place in well-ventilated areas, or with proper personal protective equipment. Prudent practice dictates storage of no more than one day's supply of solvents and other flammables in a preparation room.

6.6 Storage of Explosives in Preparation Rooms

Preparation areas are not normally used for the storage of explosives. However, prepared assemblies of explosive components and assemblies of explosives and inert materials may be left in preparation areas, provided this is necessary to avoid compromising the integrity of the assembly by moving it or storing it in a magazine. Only HE for the shots being assembled may be kept in the preparation room. Shots under construction or explosives otherwise in process may be kept in the preparation room.

6.6.1 Temporarily Storing Assembled Charges

- If charges are approved for storage in a Preparation room, either they must not interfere with other operations, or else operations will be suspended.
- Every effort should be made to limit the amount of explosives in the Preparation Room to the minimum necessary for the experiment or test being assembled.
- If charges stored in the charge preparation room significantly reduce the available floor space, the DX-4 Group Leader or responsible Firing Leader shall reduce the occupancy limit until the charges are removed. Such explosives should be moved to a magazine, if possible, before this constraint is needed.
- If an experiment is canceled, the charge for that experiment will be disposed of or will be moved to an appropriate storage magazine before a new operation is started.
- Explosive assemblies not scheduled for firing within a reasonable length of time should be moved to an appropriate storage location.

6.6.2 Emptied Containers

Before reusable high explosive storage containers can be returned for reuse, the containers shall be inspected, to be sure they are empty. The inspection requires the removal of all inner liners and packing materials to verify that all high explosives have been removed. An "empty" tag shall be affixed to the empty container after the inspection.

Empty containers should not be stored in preparation areas.

6.7 Safety Equipment (Personal Protective Equipment)

6.7.1 Safety Glasses or Goggles

Safety glasses or goggles (ANSI Z87.1) are to be worn in accordance with DX-4 SOP, "General Safety," except when eye protection must be removed for the use of optical and other inspection devices.

6.7.2 Gloves

Suitable gloves are recommended to be worn when working with solvents and adhesives, unless other means of preventing their contact with the skin are used. In cases where the gloves do not compromise the safety of the operation, surgeons gloves may be worn when handling small or precision pieces of explosive, primarily to keep the explosive free of skin oils, but also to protect the operator against skin rashes that may result from exposure to explosives.

In particular, propellants and materials containing nitroglycerine can have a physiological effect, and gloves should be worn when handling these materials.

6.7.3 Protective Clothing

- Flame-retardant or nonstatic clothing is not required for normal DX-4 operations.
- Personnel working with explosives should wear Laboratory-issued coveralls or laboratory coats, depending on the operation, to prevent contaminating personal apparel.
- Explosive-contaminated clothing shall not be removed from the Explosives Allowed Area except for cleaning or final disposal.
- If protective clothing has been contaminated, or if contamination is suspected, the clothing must be monitored for HE contamination, properly packaged, and delivered to ESA for cleaning.
- When working with DU, see SOP 2.14 DU Components.

6.8 Approved Electrical/Electronic Equipment

6.8.1 Explosion-proof (EP) outlets and equipment will be used in environments that have an explosive atmosphere.

6.8.2 Equipment using a 110 volt alternating current must be kept a minimum of one meter from exposed explosives, or else an SWP will be used. Appropriate measures shall be taken to prevent such equipment from any contact with explosives. An insulating barrier such as plexiglas between the 110V and the explosive allows closer proximity.

6.8.3 Tools producing sparks or high velocity chips or tools with any potential for producing fragments (such as grinding wheels and high speed drill motors) shall not be used around explosives.

6.8.4 Certain electrical equipment not rated NEC Class I or II is permitted for administratively controlled use within the Explosive Preparation Rooms. The equipment listed in Attachment 4 is approved as intrinsically safe when used under the restrictions noted. No electrical equipment may be used unless it is considered NEC Class I or II as modified by the DOE Explosives Safety Manual, or listed in Attachment 4.

6.8.5 Cellular phones and other RF Equipment

Handheld radios and mobile RF transmitters (e.g., cell phones) are generally allowed for use within the Explosives Firing Areas. However, in areas where low energy EEDs are stored or used in assemblies or test devices, special control must be exercised.

Likely restricted areas include:

- TA-22-34,
- TA-22-93,
- TA-22-Magazines
- TA-40-5, 6, and 7,
- TA-36-11,12.

6.8.5.1 Whenever low energy EEDs are present, it shall be the responsibility of the Firing Leader in the potentially restricted areas to inform the appropriate access control personnel that all RF transmitters in these areas are prohibited. This will be accomplished by informing access control personnel in the TA-22 (DX-1) Group Office, the TA-15-183 Access Control Office, or the TA-39-2 Administrative Office, who will then restrict visiting personnel from using RF transmitters. Further, operators will place signs on all routine entrances to these areas informing personnel to turn off all RF transmitting devices before entering these areas. The Firing Leader will assure that all personnel within the restricted area are informed of the prohibitions.

6.9 Spilled Explosives

Spilled explosives shall be cleaned up immediately, then disposed of per the DX Division Waste Management SOP if necessary.

6.10 Eating

Personnel shall not consume any food or drink item in any Preparation Room.

6.11 Operating Vehicles Near Charge Preparation Rooms

Do not drive private or government vehicles that do not have spark arrestors or catalytic converters closer than 25 ft. to any charge preparation building or a charge that is on a firing mound. Turn off the engine before opening any door to a charge preparation area.

Vehicles authorized to carry explosives will comply with all the requirements of the DOE Explosives Safety Manual.

6.12 Working Alone

DX-4 employees with current safety training and who are experienced in explosive operations may work alone under appropriate circumstances, such as assembly, measurement, gluing, inspection, and clamping of certain consolidated explosives and explosive devices.

6.12.1 This working alone procedure authorizes personnel to work alone in DX Division HE Operations. When working alone with HE, employees will use a procedure appropriate for the particular work area. These procedures require Access Control, Local Access Office, or a coworker to have the following information.

- Who is working alone,
- Where they are located,
- How long they will be working alone (with a completion time).

6.12.2 All operations shall be performed in accordance with existing SOPs/SWPs. Personnel shall be assigned in a manner such that each worker's presence is frequently monitored, for example, via radio, or by a physical check. New, special, or nonroutine operations will require a separate assessment and an SWP before being performed by a person working alone.

6.13 Lightning

All operations involving explosives in Preparation Rooms shall be suspended during electrical storms, as described in the DOE Explosive Safety Manual.

7.0 PROCEDURAL STEPS

7.1 Assembly Practices

7.1.1 Permitted Operations in Charge Preparation Rooms

- Gluing of plastic, metal, and other approved materials to explosives is allowed with approved adhesives listed in Attachment 2. Assembly may involve application of metal foils or pins to charges.

- Mechanical fixtures used to hold parts together during the gluing process must be approved by the DX-4 Group Leader or a designee. This approval process may include review by the ERC for novel applications.

- Inclusion of explosive parts in a close tolerance mechanical assembly is allowed, as long as there is no mechanical force brought to bear on the charge.

- Inspection and measurement of explosive pieces and assemblies is permitted, using rulers, local or commercially manufactured micrometers, dial indicators, cathetometers, chemical balances, microscopes, height gauges, and similar measuring equipment.

- Equipment such as microscopes or electronic balances, and approved meters may be used if the electrical wiring is protected from contamination with explosive dust.

- A portable low-voltage (<12-V) flashlight may be used for local illumination during assembly and measurement operations.

- Battery powered soldering pencils with momentary switches may be used, provided the HE is protected from hot solder or the hot iron.

- Working Comp C-4 or XTX by hand is allowed.

- Painting on or spraying on of coatings is allowed. Approved coatings are listed in Attachment 3.

- Cleaning inert portions of an assembly with alcohol or acetone is allowed.

- Cleaning explosives charges with water, alcohol, or a dry tissue is allowed. Acetone may be used if it doesn't dissolve explosive or binder.

- Detonators and boosters may be assembled to a charge in the Preparation Room or on the Firing Pad. It is good practice to attach detonators as late in an operation as possible.

- See Photo and Illumination SOP.

7.1.2 Cutting and Boring Operations

Cutting Primacord, Detasheet, and XTX-8003 with a razor blade or other sharp blade is allowed. Inspect the tool for cleanliness and sharpness before cutting. Cut the Detasheet on a plastic or rubber surface.
Detasheet may also be cut with a cork-boring tool. Use the cork-boring tool only for cutting Detasheet.

Bending or shaping Detasheet is allowed with the following restrictions:

- Curvature must be in one direction only.
- Bend or roll the detasheet to a radius of curvature not less than four times the sheet thickness, to prevent tearing.
- Grinding operations at TA-40-41 will be covered under a separate SOP/SWP.

7.1.3 Housekeeping

Prior to any HE operation, the operators must inspect the floor to ensure that it is free from debris such as coarse sand or larger particles. If the floor is dirty, it must be swept prior to beginning the explosive operation.
Similarly, the benchtops, flats, and other work areas are to be kept free of grit and particles.

7.1.4 Handling Explosives

Charges may be moved by hand within and between buildings in storage containers.

- One person can handle up to 25 kg.
- Two people can handle up to 50 kg.
- Good footing conditions must exist, with no snow, ice, or weeds on the pavement.

7.2 Unapproved Adhesives

To avoid mistakes, do not take unapproved glues into the charge preparation rooms, except for short times on occasions when they will be used. Store these adhesives outside the preparation rooms.

Glues not approved for use on explosives may be used to assemble nonexplosive parts of charge assemblies when

- the glue will not be in contact with explosives, and
- if possible, the gluing should be done elsewhere than the charge preparation room.

These glues must be cured before the assembly is combined with explosives parts.

If a detonator assembly must be sealed so that it can be immersed in water or other liquid, use GE Silicone Rubber RTV 162, 732, Barco Bond, Green Glue, urethane 7200, or Sylgard.

The above materials function with detonators. However, in general, if a liquid smells like vinegar, do not use it on a detonator; there is evidence that acetic acid and other organic vapors may desensitize the PETN in detonators which could negatively affect detonator performance.

Consult Group DX-1 for their recommendation about the suitability of any other glue, even those allowable for HE, for use in assembling detonators.

7.4 Allowable Mixtures with Nitromethane

Nitromethane may be mixed with acetone or toluene, B_4C particles, cabosil or diethylene triamine. Obtain approval from the Group Leader before using any other solvent.

7.5 Attaching Diagnostics to Charges

1. Attach metal foils or pins to charges with glue or tape.
2. Pins may be inserted in Primacord, Detasheet, or plastic explosive.
3. Attach "pin" circuits with clips or crimp connectors, or with a battery-powered soldering pencil with a momentary switch, and test the assembly with a battery-operated volt-ohmmeter certified for use in the charge preparation room by DX-1.

7.6 Applying Protective Coatings

Coat explosives when necessary to protect the surface, to reduce light, and for other purposes. Select coating fluid to be used in contact with explosives from the list in Attachment 3. If a coating fluid is not on the list, it must be approved by the DX-4 Group Leader before it is used.

7.7 Using Hand Tools

Tools producing high velocity chips or tools with any potential for producing fragments (such as grinding wheels and high speed drill motors) should not be used around explosives.

- Do not use tools that are designed to produce sparks, without an SWP.
- Maintain and use hand tools as needed.
- Do not use tools directly on the explosive, except as explicitly described under "cutting and boring" in this procedure.
- Measuring tools such as micrometers may be used with care.

7.8 Performing Continuity Checks

Test the detonator before mounting on the main charge.

- Use a continuity meter supplied or approved by DX-1 to check continuity of detonators.

7.9 Emergency Procedures

7.9.1 In all emergencies, call 911. In the event of an emergency or incident, notify DX-4 management as soon as possible. Follow the DX Division Operations Manual, Section 10.3 to report any incidents or accidents.

7.9.2 The Building/Site Emergency Plan will be followed. It covers what to do, depending on the circumstance.

7.9.3 If a spill occurs, the Building/Site Emergency Plan will be followed, then the Waste Management Coordinators shall be called. The DX Division Waste Handling and Management SOP shall be followed.

7.9.4 In the event of eye damage or suspected eye damage the injured person will be taken to the Occupational Medicine Group (ESH-2) for treatment.

7.9.5 Any person receiving an electrical shock must report to the Occupational Medicine Group (ESH-2) for evaluation and/or treatment.

7.10 Fires

In the event of fire involving or imminently threatening explosives,

CLEAR THE AREA AND REPORT THE FIRE.
DO NOT ATTEMPT TO FIGHT ANY FIRE INVOLVING OR THREATENING EXPLOSIVES IN ANY DX DIVISION EXPLOSIVE AREA.

7.10.1 There shall be no smoking at DX-4 Preparation Rooms. No matches, lighters, or other fire, flame, or spark-producing devices shall be taken into an Explosive Allowed Area, except with written authorization (SWP).

8.0 REQUIRED RECORDS

- Site Record Log Book
- Hazardous Material Transfer form.
- Lists of Allowed Explosives and Adhesives

9.0 REFERENCES

- DX-4 SOP General Safety
- DX-4 SOP, "HE Storage"
- SOP DX-4-1.0, "General Access Control"
- DX Division SOP, " Disposal of Explosive Waste and Explosive Contaminated Waste"
- DX Division Training and Qualifications Manual
- DX Division Operations Manual
- DX Division SOP, "Shipping, Receiving, and Transporting Explosives"
- DOE *Explosives Safety Manual*
- LANL *Environment, Safety and Health Manual*, AR 6-6, "Explosives" and AR 12-1, "Personnel Protective Equipment, and AR 10-3, "Chemical, Hazardous, and Mixed Waste DX-11 SOP: 15-11-4.5, "Loading and Reloading Ammunition"

10.0 ATTACHMENTS

Attachment 1. List of Explosives routinely used at DX Division Firing Areas
Attachment 2. List of Approved Adhesives.
Attachment 3. List of Approved Coating Fluids.
Attachment 4. Allowed Electrical Tools.

Attachment 1

List of Explosives routinely used at DX Division Firing Areas

NORMAL EXPLOSIVES

This list contains the names and identification numbers of all explosives and detonators approved for normal explosives operations. Only explosives on this list may be received or handled by Group DX-4, unless a separate SWP or SOP exists covering the operations, or a request for limited tests is approved.

Primary explosives - Explosives with a sensitivity greater than PETN (for example, lead azide, lead styphnate or mercury fulminate) that are not used by DX-4 except with specially approved procedures.

SINGLE-COMPONENT EXPLOSIVES

Explosives	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev. Period
AN	130LN	Ammonium nitrate	20 years
DATB	1201	diaminotrinitrobenzene	20 years
DINGU		Dinitroglycouril	
DINA		Di(nitroethyl) nitramine, dioxyethyl dinitrate	20 years
EDNA	1101	ethylenedinitramine, Halite	20 years
HMX	03NN	cyclotetramethylenetetranitramine, Octogen	20 years
LAX-112			
NM		Nitromethane	10 years in 55 gal drum
NQ	07NN	Nitroguanidine, Picrite	20 years
NTO		1.2.4-nitro-tiazole-5-one	
PETN	06NN	pentaerythritoltetranitrate	20 years
Picric Acid		1,3,5-trinitrophenol note: Picric acid forms impact-sensitive compounds with metal ions.	2 years
RDX	02NN	cyclo-1,3,5-trimethylene-2,4,6-trinitramine; Hexogen, Cyclonite	20 years
TATB	1701	1,3,5-triamino-2,4,6-trinitrobenzene	20 years
Tetryl*	04NN	2,4,5-trinitrophenylmethylnitramine	20 years
HNS	3001	Hexanitrostilbene	20 years
TNT	010N	2,4,6-trinitrotoluene; Trotyl	20 years

* Tetryl has greater toxicity and greater sensitivity to electric spark than the other permitted explosives

LIQUID EXPLOSIVES

Explosive	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev. Period
FEFO		1,1'-[methylene bis(oxy)]bis[2-fluoro-2,2-dinitroethane]	90 days
Nitromethane		NM, see also under single-component explosives	10 years in 55 gal drum

MIXED EXPLOSIVES INCLUDING CAST AND PRESSED FORMULATIONS

Explosives	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev. Period
ANFO		Ammonium nitrate/fuel oil	90 days
Boracitols		60 wt% boric acid/40 wt% TNT	20 years
Baratol	76NN	76 wt% barium nitrate/24 wt% TNT	20 years
Calcitol		40 wt% TNT/55 60 wt% $CaCO_3$/0 2 wt% talc/1 2 wt%, microballoons, X-0533	90 days

Plastic Bonded Explosives - Formed from one or more of the explosive compounds listed individually in "Single-component Explosives," above, mixed with binders and, in some cases, nonexplosive ingredients. Production forms of plastic bonded explosives are identified in numbered series denoted by the letter "PBX-" (originated by Los Alamos); "LX-" (originated by Lawrence Livermore); "EDC-" (originated by the United Kingdom); and "PBXN-" (originated by the US Navy). Also permitted are experimental plastic bonded formulations originated at Los Alamos and identified by the prefix "X-" and a four-digit number.

MIXED EXPLOSIVES
INCLUDING CAST AND PRESSED FORMULATIONS, Continued

CH-6		97.5 wt% RDX/1.5 wt% calcium stearate/0.5 wt% polyisobutylene/0.5 wt% graphite	20 years
Comp. A			
Comp. A-2			
Comp. A-3	9085	9085, 91 wt% RDX/9 wt% beeswax	20 years
Comp. A-4		97 wt% RDX/3 wt% beeswax	20 years
Comp. A-5		98.5 wt% RDX/1.5 wt% beeswax	20 years
Comp. B	60NN	64 wt% RDX/36 wt% TNT, Comp B, Hexolite, Hexotol	20 years
Comp. B-3	60NN	60 wt% RDX/40 wt% TNT	20 years
Comp. C-3	9080	9080, 88 wt% RDX/12 wt% wax	20 years
Comp. C-4	9081	9081, 91 wt% RDX/2.1 wt% polyisobutylene/ 1.6 wt% motor oil/5.3 wt% di(2-ethylhexyl) sebacate	20 years
Cyclotol 75/25	750N	75 wt% RDX/25 wt% TNT	20 years
Cyclotol 70/30	700N	70 wt% RDX/30 wt% TNT	20 years
Detasheet C	6300	63 wt% PETN/8 wt% NC/29 wt% elastomeric binder	10 years
Detasheet D	6301	75 wt% PETN/25 wt% elastomeric binder NOTE: THIS MATERIAL IS USUALLY RED, BUT IT IS AN EXPLOSIVE, NOT AN INERT	10 years
EDC-8		76.0 wt% PETN/24.0 wt% RTV Silicone	20 years
EDC-28		94wt% RDX/6 wt% FPC 461	20 years
EDC-32		85wt% HMX/15 wt% Viton A	20 years
EDC-37			20 years
EDC-38			20 years
HBX-1		40 wt% RDX/38 wt% TNT/17 wt% Al/4.5 wt% wax/0.5 wt% $CaCl_2$	20 years
LX-04	LX04	85.5 wt% HMX/15.0 wt% Viton	20 years
LX-07	LX07	90 wt% HMX/10 wt% Viton	20 years
LX-10	LX10	95.0 wt% HMX/5.0 wt% Viton A	20 years
LX-14	LX14	95.5 wt% HMX/4.5 wt% Estane 5702-F1 (X-0282)	20 years
MDF		Mild Detonating Fuse	20 years

Nonel		RDX lined metal tubing	20 years
Octogen		94.5 wt% HMX/4.5 wt% wax/1 wt% graphite	20 years
Octol	740N	75 wt% HMX/25 wt% TNT	20 years
PBX 9001	9001	90 wt% RDX/8.5 wt% polystyrene (PS)/ 1.5 wt% dioctyl phthalate (DOP)	20 years
PBX 9007	9007	90 wt% RDX/9.1 wt% polystyrene (PS)/ 0.5 wt% dioctyl phthalate /0.4 wt % resin	20 years
PBX 9010	9010	90 wt% RDX/10 wt% Kel-F 3700	20 years
PBX 9011	9011	90 wt% HMX/10 wt% Estane-5703	20 years
PBX 9205	9205	92 wt% RDX/6 wt% polystyrene (PS)/ 2 wt% dioctyl phthalate (DOP)	20 years
PBX 9206	9206	92 wt% HMX/8 wt% Kel-F elastomer	20 years
PBX 9404	9404	94 wt% HMX/3 wt% NC/3 wt% tris(b-chloroethyl) phosphate (CEF) note: PBX-9404 is unusually sensitive to certain types of impact, in partucular, skidding.	1st period-20 years, 10 years thereafter
PBX 9401	9401	94.2 wt% RDX, 3.6 wt% polystyrene, 2.2 wt% trioctyl phosphate	
PBX 9405	9405	93.7 wt% HMX, 3.15 wt% nitrocelulose, 3.15 wt% tricloroethyl phosphate	20 years
PBX 9407	9407	94 wt% RDX/6 wt% Exon-461	20 years
PBX 9501	9501	95 wt% HMX/2.5 wt% Estane/2.5 wt% BDNPA or BDNPF, X-0242	20 years
PBX 9502	9502	95 wt% TATB/5 wt% Kel-F 800, X-0290	20 years
PBX 9503	9503	80 wt% TATB, superfine/15 wt% HMX/5 wt% Kel-F, X-0351	20 years
PBXN-5		See LX-10	20 years
PBXN-110		88 wt% HMX/5.4 wt% polybutadiene/5 wt% isodecyl pelargonate	20 years
PBXW-113		See PBX N110	
Primacord		Assorted PETN & RDX loaded commercial detonating fuse	20 years
Pentolite	5001	50 wt% PETN/50 wt% TNT	20 years
Tritonal		80 wt% TNT/20 wt% aluminum powder	20 years
X-0208	X-0208	See XTX-8004	20 years
X-0233	X-0233	5-40 wt% HMX; 40-95 wt% tungsten, 0-10 wt% polystyrene, 0-5 wt% plasticizer	90 days
X-0242		See PBX 9501	20 years
X-0282	X-0282	See LX-14	20 years
X-0290	X-0290	See PBX 9502	20 years

X-0309	X-0309	75% TNT, 19% aluminum powder, 5% D-2 wax, 1% acetylene black (carbon)	90 days
X-0351		See PBX 9503	20 years
X-0407	X-0407	69.8 wt% TATB, 25.0 wt% PETN, 0.2 wt% dye, 5 wt% kel F800	90 days
X-0533	X-0533	See Calcitol	90 days
X-0534	X-0534	50 wt% TNT/16 24 wt% $CaCO_3$/25 33 wt% talc/1 2 wt% microballoons	90 days
XTX-8003		80 wt% PETN/20 wt% Sylgard 182	20 years
XTX-8004		80 wt% RDX/20 wt% Sylgard 182, formerly X-0208	20 years

PROPELLANTS

Explosives	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev Period
Black powder		Standard commercial and military grades only	20 years if unopened, 2 years if opened
Benite		Black powder based mixture	2 years
Commer-cial sporting		Any commercially available smokeless gun propellant for sport use is approved	20 years if unopened, 2 years if opened
HARP-1,-2		HARP propellants are Al/AP/HMX composites	2 years
HELP-1, -2		HELP propellants are NC/NG/HMX composites	2 years
Smokeless Powder Single, Double, or Triple Base		Standard military grades. Single or multi-perforated grains of colloided NC. Stabilizers, plasticizers, inorganic nitrates, and other modifying agents may also be present. Military research explosives are specifically not included.	2 years
UTP 25540		HMX based High Energy Propellant	2 years

DETONATORS

The following high-energy detonators have been approved for Group DX-4 use in test devices. All listed detonators have a storage review period of 20 years.

1E23	ER-213	EX-12	SE-1
1E26	ER-235	EX-12B	SE-1/31
1E26B	ER-312		
1E27	ER-312B	MC1991	SC-101
1E29	ER-344	MC2320	
1E30	ER-347	MC2427	
1E31	ER-352		
1E33	ER-353	MK13C	
1E34	ER-370	MK20	
1E36	ER-349	MK22A	
1E38	ER-350		
1E38 T.F.	ER-351	RL1	
	ER-371	RL2	
	ER-377		
	ER-379	RP-1	
	ER-380	RP1/31	
	ER-383	RP-2	
	ER-396A	RP-80	
	ER-396B	RP-83	
	ER-400	RP-84	
	ER-402	RP-87	
	ER-403		

MUNITIONS

Military munitions are allowed if no further assembly or disassembly operations are involved. An adequate description should be in the DX-4 file. Internal devices that contain primary explosive are allowed if they are out-of-line and are not used as the initial initiation point. The initiator must remain in a safe state until the first ignition source is activated following standard operating procedures. Any configuration where the primary explosive unit is external or is to be used as the first initiation or ignition source becomes a special operation requiring a separate SOP or SWP.

Some of the military munitions are listed as rejects or defective lots because they do not meet either physical specifications or performance testing specifications. There are no safety issues related to their rejection. Any arriving munitions marked as rejects will be treated as Storage Compatibility Group L until the reason for rejection is known.

SPECIAL EXPLOSIVES

The use of these explosives is limited to the provisions of the indicated SOPs.

Explosive	Pertinent SOP References	Storage Rev. Period
Liquid Gun Propellant LGP 1846	DX-11 SOP: 15-11-4.20, LGP 1846, TA-36-3	2 years
3E-1 Detonator	3E-1 SWP	20 years

COMPOUNDS FOUND in TA-16 SOP 1.1.0, "Established Explosives at TA-16," but not listed in any DX Division list.

Al-ANFO

BDNPA

BDNPF

BTX (5,7-dinitro-1-picrylbenzotriazole) (transportation only)

DNPA (2,2-dinitropropyl acrylate polymer)

DNT

HBX-1

Methane/ Oxygen mixtures

Nitrocellulose (NC)

PYX (2,6-Bis(picrylkamino0-3,5-dinitropyridine

STRATABLAST C (storage and transportation only)

TAGN (triamino guanadine nitrate)

TAL-1005E (storage and transportation only)

TNS (Trinitrostilbene)

TNT/NC

TPM (tripicryl melamine)

Attachment 2

Adhesives, glues, and coatings routinely used at DX Division Firing Areas.

- Methylmethacrylate/solvent glues (Duco, Testor's model cement, other proprietary materials of equivalent composition).
- 3M Industrial Adhesive-226.
- CTA-2 linoleum cement for Detasheet only.
- Elvanol.
- CPR-1009-78 adhesive.
- Silastic TRV-140, -731, -732, -892, -3145
- Eastman 910, Perma Bond 910 adhesive, Loctite 495 adhesive, and other cyanoacrylate ester adhesives .
- 3M Aerosol spray adhesive.
- Aralhex.
- GE Silicone Rubber RTV 162.
- Polad [10 wt% Polacure-740M diamine (Polaroid Corp.)/38 wt% Adiprene 5333/52 wt% acetone].
- Polyurethane 7200, with sets A and B.

When necessary, the following chemicals and gases may be used for light intensification or quenching.

Aluminum Fluorosilicate **(This is a poison; wash hands after use.)**
Aluminum Oxide
Butane
Krylon Spray Paint
Magnesium Oxide
PETN paint

Approved Glues and Adhesives

- An epoxy -polyamide adhesive know as "Green Glue" and formulated from Epon 828 and Versamid 140 is approved for use in detonator and HE assemblies. This adhesive is covered under Mound Facility's Specification 1-9600.

- Cyanoacrylate adhesives such as Eastman 910 may not be used in direct contract with PETN.

- Devcon 5-minute epoxy is approved for permitted explosives, except TNT and explosive compositions containing TNT, and is permitted for assemblies which will hold liquid explosives after the adhesive is cured.

- Barco Bond 165 and 185 - The curing reaction for this material is exothermic: therefore, the thickness of the adhesive layers must not exceed 1.5mm (1/16 in.).

- Sylgard 182, 184, and 186
- DC 93-119
- GE 630
- CPR-1009-78 + Component "T"

Adhesive	Additive or Catalyst	Remarks
Aerobond 2017	Trimethoxy-boroxine	Compatible with HE. Exothermic reaction. Don't make more than 50 g at a time.
VEEP 1579 VEEP 1579T	Versamid 140 DMP-30	Not compatible with all HE. M be used on PBX 9502, TATB, an mixtures of TATB and inert materials.
Torr Seal	Polyamide	Can be used on HE as described in report #250. Ideal for vacuum applications, sealing leaks.
Polamine 1000		Compatible with HE. Slight foaming cured polyurethanes from moisture. Do not breathe vapors.

Attachment 3

LIST OF APPROVED COATING FLUIDS

Coating fluids used in contact with explosives must be selected from the following list. If a coating fluid is not on this list, it must be approved by the Group Leader before it is used.

Microballoons in silicone, hydrocarbon grease, or in polyvinyl alcohol and water.
Apiezon wax.
Mineral oil.
Petroleum greases and oils.
Glazing compound, modeling clay, and putty.
Krylon or other methylmethacrylate spray.
Isopropyl alcohol or ethyl alcohol.
Silicone grease.
Water.
Acetone.
Aluminized Mylar.

When necessary, the following chemicals and gases may be used for light intensification or quenching.

Aluminum Fluorosilicate **(This is a poison; wash hands after use).**
Aluminum Oxide
Butane
Krylon Spray Paint
Magnesium Oxide
PETN paint

Attachment 4

APPROVED ELECTRICAL EQUIPMENT IN PREPARATION ROOMS

	Restrictions
Bendix height gauge indicator model - BXT-1	(2)
Chicago multi tester	(6)
Fluke Multimeter, Model 8012A/AD	(3)
Fowler 12 calipers	
Fowler depth gauge	
Hewlett Package calculator, model 55	
Laser HE-NE-AERO-Tech. model LSR2P	
Ledu Corp., portable lamp. model 060333	(2)
Mettler Balance, model PE360	(1)
Mettler Scale, model PM-400	(1)
Minolta 35mm camera, model X700	(2)
Minolta Electro Flash, model 280 PX	(2)
Mitutoyo height gauge, model 519-106	(2)
Mitutoyo height gauge, model 519-302	(2)
Mitutoyo height gauge readout, model 122	(2)
Mitutoyo height gauge readout, model 8943G	(2)
Mitutoyo indicator, model ID-ISOE	(2)
Nikon camera, model F	(2)
Ohaus Balance	(1)
Ohaus Scale, model T600S	(1)
Polaroid camera, model Spectra System	(2)
Polaroid camera, model SX70	(2)
Sartorius Scale, model P6	(1)
Sartorius Scale, model P600	(1)
Sunpack Autoflash, model 30DX	(2)
Texas Instruments TI 55III calculator	
Triplet VOM Meter, model 630	(6)
Unitron inverted microscope with light source, model 7530	(2)
WAHL Soldering Station, model 7500	(2)
Weller Soldering Station, model WTCPN	(2)

^^

(1) Balances will be inspected, cleaned, and calibrated biannually.
(2) Not for use at work stations with loose powder.
(3) Approved for use as a Detonator Circuit Ohmmeter (DCO).
(4) Locate illuminator in ventilated enclosure.
(5) For use in a work station with no HE present.
(6) Not approved for DCO use.

DX-4

STANDARD OPERATING PROCEDURE

FOR

Q-SITE EAST (TA-14) FIRING OPERATIONS

SOP 27

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TABLE OF CONTENTS

1.0 INTRODUCTION 4

2.0 PURPOSE 4

3.0 SCOPE 4

3.1 FACILITIES AND USES 4
3.1.1 BUILDING Q-6 4
3.1.2 BUILDING Q-23 4
3.1.2.1 ROOM 101 5
3.1.2.2 ROOM 102 5
3.1.2.3 ROOM 103 5
3.1.2.4 ROOM 104 6
3.1.2.5 IGNITOR BOX 6
3.2 FIRING MOUNDS 6
3.2.1 MOUND 1 7
3.2.2 MOUND 2 7
3.2.3 MOUND 3 7
3.2.4 MOUND 4 8
3.2.5 MOUND 5 8

4.0 DEFINITIONS 8

5.0 RESPONSIBLILITIES 9

5.1 STAFF MEMBER IN CHARGE OF Q-SITE EAST 9
5.2 ALL OTHER RESPONSIBILITIES ARE IDENTIFIED IN DX-4 SOPS 3 & 4 9

6.0 PRECAUTIONS AND LIMITATIONS 9

6.1 ELECTRICAL WORK 9
6.2 EXPLOSIVE LOAD AND PERSONNEL LIMITS FOR BUILDINGS 9
6.2.1 EXPLOSIVE AND PERSONNEL LIMITS FOR MOUNDS 10
6.2.1.1 BARE OR GLASS - OR PLASTIC-CASED EXPLOSIVES 10
6.2.1.2 METAL-CASED EXPLOSIVES 10
6.3 ALLOWED EXPLOSIVES 10
6.4 OPERATIONS LIMITATIONS 10
6.5 SMOKING 11
6.6 FLAME-PRODUCING DEVICES 11
6.7 FIRE PROTECTION 11
6.7.1 Pyrophoric Materials 11
6.7.2. Fire Fighting Equipment 11
6.7.2.1 Fire Extinguishers 11
6.7.2.2 Other Tools 11
6.8 MAINTENANCE 12
6.9 VISITOR AND ADMITTANCE CONTROL 12
6.9.1 Administrative Gate 12
6.9.2 Railroad Gate (Safety Gate) 12
6.9.3 Remote Area Access 12
6.9.3.1 Access to Building Q-5 12
6.10 TRANSPORTATION OF HE 12

6.11 HOUSEKEEPING 13
6.12 DETONATOR CIRCUIT TESTING 13
6.13 DIAGNOSTIC ELECTRONICS TESTING 13
6.14 LOW-VOLTAGE ELECTRO EXPLOSIVE DEVICES (EED'S) 13
6.15 SAFETY FEATURES 14
6.15.1 Railroad Gate 14
6.15.2 Firing Control Unit 14
6.15.2.1 Timing Sequence 14
6.15.2.2 Capacitor Discharge Unit 14
6.16 VIEWING PORTS 15
6.17 MOUND SPACING 15
6.18 SHELTER 15

7.0 PROCEDURAL STEPS 15

7.1 PREPARATION BEFORE FIRING 15
7.2 SETTING UP A TEST 16
7.3 ARMING A TEST 17
7.4 FIRING A TEST 17
7.5 POST-FIRING OPERATIONS 18
7.6 MISFIRES 19
7.7 CLEANING UP CONTAMINATION FROM FIRING OPERATIONS 20
7.7.1 Disposal of HE Operational Waste 20
7.8 EMERGENCY PROCEDURES 21

8.0 REQUIRED RECORDS 21

9.0 REFERENCES 21

10.0 ATTACHMENTS 21

1.0 INTRODUCTION

High-explosive (HE) firing operations are carried out at Q-Site in Technical Area 14 (TA-14). This site is located south of the R-Site Road between TA-9 and R-Site. Q-Site is operated by DX-2 under the auspices of DX-4. Q-Site East is a relatively small area that contains four buildings: one for general storage of equipment, two for storage of HE, and one that consists of the control room, laboratory, and make-up room.

2.0 PURPOSE

This Standard Operating Procedure (SOP) describes methods to be followed for firing tests and related operations at Q-Site East (TA-14), Buildings Q-6, Q-22, Q-23, and Q-24 and outdoor firing areas located south of the control room. Building Q-5 is condemned and is not approved for any operations.

3.0 SCOPE

This document describes the procedures required for personnel to perform tests at Q-Site.

3.1 Facilities and Uses

This SOP covers the facilities in Q-Site East only and does not address the facilities in Q-site West.

3.1.1 Building Q-6

Building Q-6 is a frame structure used to store parts and instruments that are used in various experiments. ***No explosives are permitted in this building***.

3.1.2 Building Q-23

Building Q-23 is a reinforced concentrate structure divided into four rooms (see Figure 1 for floor plan). The south face is protected by ½-inch steel boilerplate. The portholes are protected by sliding steel covers.

Figure 1

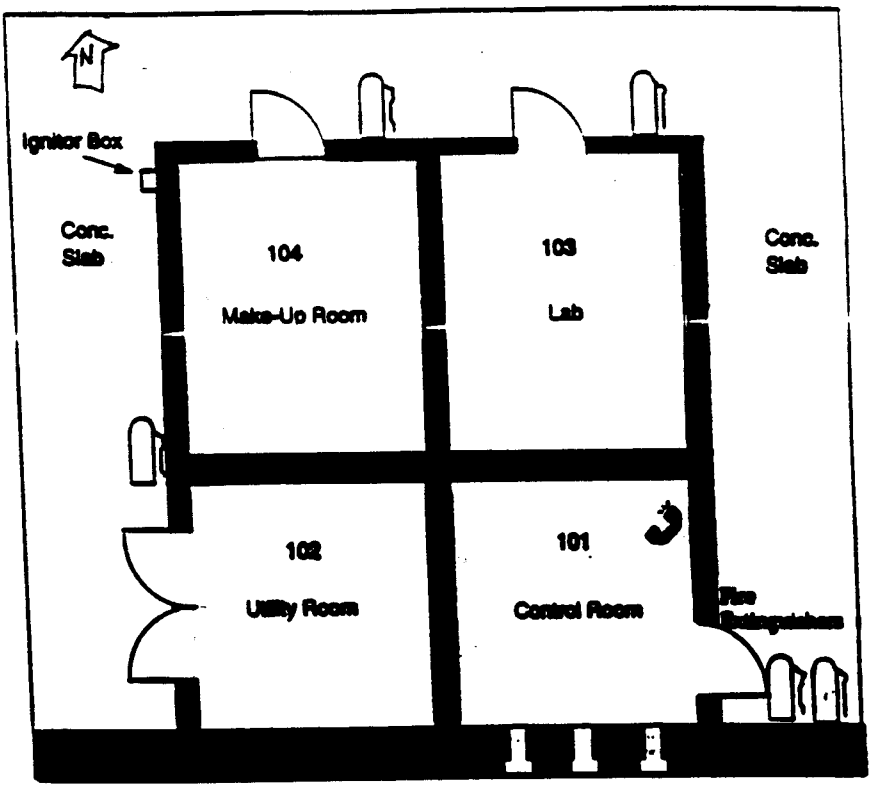

Fig. 1. Floor plan of Building Q-23, TA-14.

3.1.2.1 Room 101

Room 101 is the firing control room. Various items necessary for safe firing (locked capacitor discharge unit (CDU) controls and timed interlocks) and the equipment for recording data from the tests are installed in this room. ***No explosives are allowed in this room at any time.***

3.1.2.2 Room 102

Room 102 is the utility room and is not used for explosives work. This room contains the circuit breaker panels, the hot water tank, and the heating system. It is also used for storage of fire-fighting equipment such as hoses, shovels, and hoes. ***No explosives are permitted in this room.***

3.1.2.3 Room 103

Room 103 is used as a chemical laboratory. This room also contains a hood with water, gas, and vacuum lines. The lights, switches and electrical outlets are explosion proof.

3.1.2.4 Room 104

Room 104 is the make-up room in which test components are made up in preparation for firing. Made-up tests or explosives components may be stored in this room during a firing operation involving a large number of tests that may take several days to fire. No HE is to be stored in this room except for on-going experiments where the HE is part of a set-up that cannot be placed in a magazine. The electrical wiring in the room is explosion proof.

3.1.2.5 Ignitor Box

The ignitor box is a small steel box attached to the west side of this building and is secured by a padlock. This box is used to store ignitors. This box contains only Group B explosives. The key is under the control of the Firing Leader.

3.2 Firing Mounds

Besides the structures described, Q-Site East has five firing mounds located along a conduit system extending toward the South from the firing control room. Each firing mount consists of sand-covered area about 50 ft in diameter. Each mound contains a steel-covered underground box (firing pit) that provides GFCI Protected electrical outlets, telephone connections and space for the high-voltage CDU. Figure 2 shows the layout of Q-Site East, and the firing pits are shown as structure numbers 25, 26, 27, 28, and 29.

Figure 2

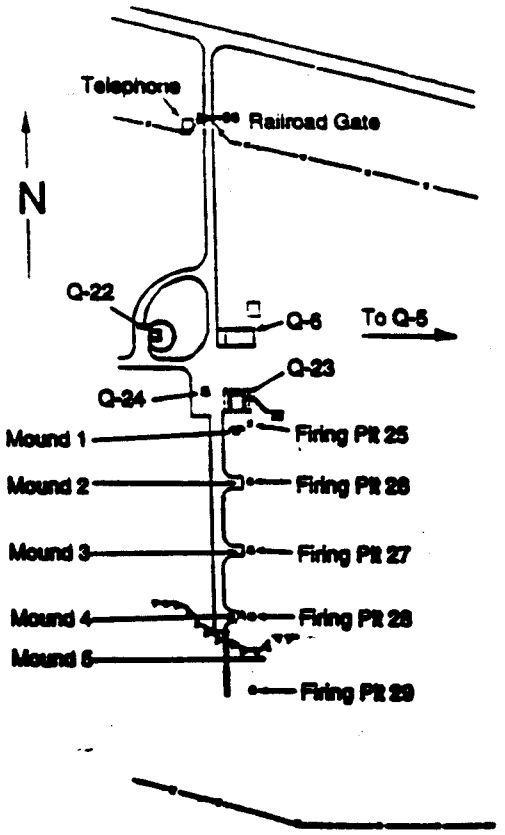

Fig. 1. Q-Site East.

3.2.1 Mound 1

Mound 1 is shielded on three sides with a 3-ft-high, ½-inch steel plate backed with sand. In addition to the 110-volt outlet, Mound 1 also has a 208-volt outlet.

3.2.2 Mound 2

Mound 2 has no shielding but has a heavy steel base plate and is in a direct line with the portholes in building 23.

3.2.3 Mound 3

Mound 3 is an open area used for general firing operations. This is also the location of the OB/OD Thermal Treatment Area.

3.2.4 Mound 4

Mound 4 has a shrapnel barrier constructed of large concrete blocks. This barrier is used for tests that may produce shrapnel or metal fragments.

3.2.5 Mound 5

Mound 5 is located in the canyon and is a reinforced-concrete-lined area cut into the side of the hill, which can be sandbagged on the southern (open) face.

4.0 DEFINITIONS

Energetic Materials	An energetic material is any material that liberates energy with or without oxygen which includes but is not limited to explosives, propellants, pyrotechnics and gas generants.
Firing Leader	A full time DX Division employee, authorized by DX-4 line management to supervise, conduct, and be responsible for operations at the site of the test. This persons accumulated knowledge and experience are crucial to all explosives firing operations.
OB/OD	RCRA Open Burn/Open Detonation.
Staff Member in charge of Q-Site	Oversees Firing Operations and experiments conducted at Q-Site
Tests with Staff	Experimental tests that have not been run before must be supervised by the requesting staff member and require a completed DX-2 Q-Site Test Sheet (Attachment 1), approved by the staff member in charge of Q-Site East.
Tests Without Staff	Tests that have been performed previously can be performed by a technician. It is not necessary that a staff member supervise the operation. This requires prior signature approval, on the test sheet, from the staff member in charge of Q-Site East.

See DX-4 SOP 3 General Safety, DX-4 SOP 4 General Firing Operations, and DX-4 SOP 5 Preparation room Operations and Explosive Charge Handling for further definitions.

5.0 RESPONSIBLILITIES

5.1 Staff Member in Charge of Q-Site East

- Recommends to the DX-4 Group Leader personnel who may be authorized as the Firing Leader.
- Is responsible for experiments conducted at Q-Site.

5.2 All other responsibilities are identified in DX-4 SOPs 3 & 4

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Electrical Work

All electrical work shall be conducted in accordance with the LANL Electrical Safety Program.

6.2 Explosive Load and Personnel Limits for Buildings

Limitations on explosive loads and personnel are given below for the different buildings covered in this SOP.

Location	Explosive Load Limit	Personnel Limit
Room 101 - Control Room	N/A	• 3
Building Q-23 Room 103 - Laboratory	50 lb including no more than 5 lb scrap HE	• If explosives present 3 • If no explosives present, 6
Room 104 - Make-Up Room	50 lb including no more than 5 lb scrap HE	• If explosives present 3 • If no explosives present, 6
Steel Box on NW corner of Building	100 ignitors	N/A
Building Q-6	0 lb	No limit
Personnel limits may be waived by the DX-4 Group Leader, or designee for tests, safety inspections, operational reviews, and demonstrations.		

6.2.1 Explosive and Personnel Limits for Mounds

6.2.1.1 Bare or Glass - or Plastic-Cased Explosives

Mound Number	Explosive Limit (lb)	Personnel Limit (when HE present)
1	5	The minimum required-not to exceed 3
2	5	The minimum required-not to exceed 3
3	20	The minimum required-not to exceed 3
4	30	The minimum required-not to exceed 3
5	30	The minimum required-not to exceed 3

6.2.1.2 Metal-Cased Explosives

Metal-cased/clad tests may be fired within the shrapnel barrier of Mound 4, (See Attachment 4, Bill Davis' Rule for the Evaluation of Fragment Hazards Calculation). Tests may be also be fired at Mound 5, provided the test is sandbagged on the exposed south side. No metal-confined tests are allowed at the other mounds.

6.3 Allowed Explosives

Only explosives that satisfy both of the following criteria can be used in operations at Q-Site East:

- Type 12 Drop-weight Impact > 12 cm
- Spark sensitivity >0.1 J for 3 mil foil

Energetic materials to be tested at Q-Site that have been characterized or are known to be impact or spark sensitive will require that the DX-2 Group Leader, Deputy Group Leader, or Staff Member in charge of Q-Site give written permission (SWP) before the material is taken to Q-Site. The handling procedure and precautions for this material must be stated on the Test Sheet.

6.4 Operations Limitations

No more than one firing operation may be carried out at Q-Site East at any one time.

Before starting a firing operation at Q-Site East, Q-Site West must be checked by doing a sweep of the area. Any personnel not associated with the testing will be escorted out of the area, and re-admitted after test completion.

6.5 Smoking

Smoking is not permitted at any time in or around any of the buildings, grounds, or firing mounds at Q-Site.

6.6 Flame-Producing Devices

No spark - or flame-producing devices, other than those used in firing or burning operations (such as ignitors), will be allowed in the area unless authorization has been given in an approved Special Work Permit (SWP). Firing site personnel are not to fight any fires involving HE.

6.7 Fire Protection

All the explosives processing and storage buildings are of concrete construction. See the restrictions in Section 7.3 of DX-4 SOP 3.0 General Safety.

6.7.1 Pyrophoric Materials

When materials of a pyrophoric nature are part of a test, Q-Site operators request the Fire Department to stand by with the necessary equipment to fight a possible fire in the surrounding woods (see DX-4 SOP 4 General Firing Operations, DX-4 SOP 1.0 General Access Control, Sections 6.3 and 7.1), (see7.1, this SOP "Preparations Before Firing).

6.7.2. Fire Fighting Equipment

6.7.2.1 Fire Extinguishers

Fire extinguishers are mounted on the east, north, and west walls, of Building Q-23 and on the east outside wall of Building Q-6. These fire extinguishers are checked annually by the Fire Department and monthly by the responsible person for Q-Site.

6.7.2.2 Other Tools

Shovels, long hoses, rakes, and hoes are stored in Room 102 of Building Q-23 for emergency fire fighting. This equipment is intended to quench small fires that are considered normal during firing operations. The Firing Leader will call the Access Control for any off-normal fires.

6.8 Maintenance

Weeds and brush are cut and cleared from the firing area and around buildings and magazines when necessary. A standing work order allows this maintenance whenever the brush and weeds present a fire hazard.

6.9 Visitor and Admittance Control

All visitors must check in at TA-9-21 for admittance.

6.9.1 Administrative Gate

This gate will remain locked and closed at all times except during normal firing site operations. The only exception to this will be when an explosive test is left on the firing mound overnight. Then both the Administrative Gate and the Railroad Gate will be closed. In the event of this, the Access Control Office at TA-15-183 should be notified. Access Control will make all necessary notifications. The Firing Leader will post a sign on the Administrative Gate and will notify the DX-2 Group Management.

6.9.2 Railroad Gate (Safety Gate)

A railroad gate, interlocked to the firing power source, is lowered at the entrance to Q-Site during any firing operation. A sign on this gate requires anyone entering the site, either by vehicle or on foot, to phone for entry from the telephone located on a post near the gate. The Q-Site East control room telephone number is 665-1787. Verbal clearance must be obtained from the Firing Leader before entering.

6.9.3 Remote Area Access

6.9.3.1 Access to Building Q-5

A chain gate located between Q-6 and Q-23 controls access to Q-5. When personnel are at Q-5, the chain will be down; when no one is at the site, the chain will be up.

6.10 Transportation of HE

Transportation of HE by vehicles to and within this area is covered by DX-DO SOP 3 Packaging and Transportation of Hazardous Materials.

6.11 Housekeeping

Special care must be taken to see that rooms 103 & 104 are kept free of loose explosive powder or dust that may be spilled during test makeup. After a day's operation, or more often if necessary, these rooms must be swept and the waste deposited in the appropriate HE waste cans.

Only brooms or brushes with no metallic parts and non-metallic dust pans are to be used to clean up spills. If the amount of explosive involved is more than a few grams and/or has an impact sensitivity of less than 10 cm with Type 12 tools and a 3-mil lead foil spark sensitivity of less than 0.05 J, the DX-2 Staff Member for Firing Operations or the Group Leader shall be informed and their advice obtained before the cleaning operation is performed. Attention should be paid to toxic hazards, as well as explosive hazards, and special protective clothing may be required.

6.12 Detonator Circuit Testing

A current-limited detonator current ohm (DCO) meter, meeting criteria set forth in the DOE Explosives Safety Manual, will be used if necessary, to check the resistance of exploding bridge wire detonators (EBWs). The meter shall be labeled "For Use on EBW Detonators Only".

6.13 Diagnostic Electronics Testing

A volt-ohm meter, such as a Fluke 77, will be used. It shall be prominently labeled "For Non-Initiating Circuits Only".

6.14 Low-Voltage Electro Explosive Devices (EED's)

Personnel that will be handling any low-voltage EED's will be properly trained. Training will consist of reading DX-1 SOP 175 and On the Job Training with firing site operations.

All electrical circuits will be grounded and shorted before continuity is established to the low-voltage EED. Personnel will be kept to the minimum needed to perform this operation. All others will remain in the control room during this operation. The procedure for connecting the CDU to the test assembly is as follows:

1. Check the shorting plug with an approved VOM for continuity. The resistance will be approximately 0.2 ohms.
2. Short the CDU end of the detonator cable with the shorting plug.
3. While using a wrist grounding strap, connect the EED to the detonator cable.
4. Attach the EED to the test assembly.

5. Remove the shorting plug from the detonator cable and connect the shorting plug to the load ring on the CDU.
6. Connect the detonator cable to the CDU.
7. Remove the shorting plug.

6.15 Safety Features

6.15.1 Railroad Gate

The railroad gate at the Q-Site entrance must be closed before the interlock on the control room door will close. Until the interlock is closed, no power will be available to the firing control unit.

6.15.2 Firing Control Unit

During a firing operation, the firing control unit in the control room provides built-in safety features through a timing sequence and a mechanism that will automatically stop the operation by grounding and interlocking the system (the CDU) when certain situations occur.

6.15.2.1 Timing Sequence

The power switch to the firing control circuit is a key switch, and when turned on, after the interlocks have been closed the following sequence of events occurs after the "TIMER" button has been pushed.

a. The siren sounds for 30 seconds.
b. The siren is silent for 30 seconds.
c. The siren sounds for 90 seconds.
d. A pilot light indicates "READY".
e. An operator ensures that the proper firing voltage has been selected. For EBWs the voltage is 2000 to 2500 volts DC.
f. The operator may then push the "POWER" and "ARM" buttons and wait for the CDU to charge.
g. The operator ensures that the firing voltage has been attained.
h. The operator may then push the "FIRE" button, and the test will fire. If this button is not pushed within 10 seconds, the entire circuit de-energizes and the cycle must be repeated.

6.15.2.2 Capacitor Discharge Unit

Characteristics of the the CDU are listed below.

a. The CDU may be installed in any one of the firing pits 25 through 29. It is connected to the fire-control unit by a special multiconductor cable.

b. When the "ARM" button on the fire control unit is pushed, power is supplied to the transformer and the rectifier so that the capacitors may charge.

c. A voltage divider network allows the capacitor voltage to be monitored at the fire control station with a 50-mA calibrated meter.

d. After firing or if a power interruption occurs during the firing sequence, the high-voltage capacitor are automatically shorted to ground. The ground circuit is routed through a set of contacts that are normally held closed by a spring. When the power circuit is energized, a solenoid overcomes the spring tension and breaks the ground circuit. The contact assembly is positioned so that, if there is a spring failure and/or a power interruption, the contacts will close and the system will be safely grounded. Timer interlocks prevent the ground circuit from being reopened until the timing and arming sequence has been re-established.

6.16 Viewing Ports

Visual inspection of the firing mounds or the general area may be made through portholes in the firing-room wall facing these mounds. These ports are equipped with three cylinders of 2-inch laminated safety glass to prevent fragments from entering the firing room.

6.17 Mound Spacing

The availability of five firing mounds at various distances from the control building provides safe distances for the tests. The most distant mound is located below ground level of the control room and space is cut into the side of the canyon wall to prevent fragments of from tests from reaching the control room or outside the designated clearance area.

6.18 Shelter

Building Q-23 is constructed of reinforced concrete with ½ inch boilerplate covering the side facing the firing mounds. This type of construction provides more than adequate shelter for personnel from any test fired according to the provisions of this SOP.

7.0 PROCEDURAL STEPS

7.1 Preparation Before Firing

Follow these steps when preparing a test for firing.

Step	Action
1	If a test involves pyrophoric materials,

	• Access Control at TA-15-183 arranges all Fire Department responses, except emergencies.
2	Fill out a DX-2 Q-Site Test Sheet (Attachment 1) and obtain approval from the staff member or the alternate in charge of Q-Site
3	Observe the weather: No firing operations are allowed during electrical storms, or in some cases, high winds.
4	The Firing key remains in the Firing Leaders possession.
5	• Prepare the appropriate firing mound with all the required diagnostics and blast shielding; • Record the diagnostic wiring on the Test Sheet (use additional pages if necessary); and • Make sure all diagnostics are working properly
6	Ensure that • the CDU is in place, • the load ring is shorted, • all necessary cables are connected, and • the detonator cable end is shorted
7	• Lower the (Safety) gate at the entrance to Q-Site and make sure that it is secured. **Note:** The green light on the firing panel will be lit when the gate is properly secured
8	• Clear the area by driving to Q-Site West (TA-14-34). Check the lower area (Mound 5) to make sure that no unauthorized personnel are within the site. • Alert all personnel at Q-Site West that a firing is to occur and escort them out of the area.
9	Take a head count to be sure all personnel are accounted for.
10	• Make certain that all diagnostic and initiating cables, wires, and connectors do not have any electrical potential. • Check all connections inside the control room, making sure that *no* cables or wires are hooked up to electrical generating devices.
11	• Check the firing mound for any potential structural or mechanical hazards. • Make sure that the mound is safe and stable.
12	• Instruct all personnel to stay in the control room in Building Q-23.

7.2 Setting Up a Test

To set up a test use the following steps.

Step	Action
1	Take the test to be fired out to the appropriate mound.

	Note: When the test is being set up on the mound, only the minimum number of personnel are allowed on the mound. All other personnel must stay in Building Q-23 Control room 101.
2	Attach all diagnostic cables (not firing cables) and wires to the test. If an ohm meter is required, make sure it has been approved for explosives use.
3	Once the test has been set up, casuals and observers may inspect the test under supervision of the firing site leader or operator.

7.3 Arming a Test

The Firing Leader or Operator should follow these steps when arming a test.

Step	Action
1	Initiate all tests with EBW detonators; other detonators will require an SWP.
2	• - Have all personnel go into Building Q-23, Room 101. • - Account for all personnel.
3	Bring the detonator out to the appropriate mound unless the test set-up requires earlier installation.
4	Perform one final check of the test and mound (see Steps 7, 11, and 12 in Section 7.1 above).
5	Instruct all remaining personnel to go into Building Q-23, Room 101. Note: Only the Firing Leader, who has the firing key in his possession, does not have to be in the Building.
6	Check to make sure shorting plug is on CDU before attaching detonator cable.
7	Connect the detonator cable to the detonator.
8	• - Make sure the detonator and the receptacle are free from any debris (sand, grit). • Attach the detonator to the test by screwing down the locking nut, but only finger tight. • Make sure the detonator is in contact with the booster explosive.
9	Remove the shorting plug from the CDU.
10	Go into the control room.

7.4 Firing a Test

The Firing Site Leader or Operator should follow the steps listed below when firing a test.

Step	Action
1	Review the firing check list (see Attachment III).
2	Close the control room door.

3	Unlock the firing control box.
4	• Start the semiautomatic firing sequence. • Continually monitor the fire-control system during the sequence until the capacitors are charged to at least 2000 volts (unless specified otherwise). IF: there is a malfunction — THEN: stop the firing sequence by interrupting the power. IF: the Firing Leader, operator or staff member feels there is a potentially unsafe situation — THEN: the Firing supervisor or operator will stop all firing operations
5	When the capacitors are charged, • push the "FIRE" button within 10 seconds, thereby firing the test.

7.5 Post-Firing Operations

After firing the test, the Firing Leader should follow the procedures below.

Step	Who Does It	Action
1	Firing Leader	• Decides when it is safe to leave the shelter after the test.
2	Firing Leader	• Sounds the "All Clear" with two 5-second blasts of the siren.
3	Firing Leader	• Approaches the test area, • Ensures that area is safe, and • Notifies others in shelter of safe condition and that they may approach the area.
4	Firing Leader or Designee	• Pick up and place scrap and undetonated explosives in the approved HE waste container in Room 103 of Building Q-23. • Inspect entire firing area for explosives scrap at the end of the day's firing.
5	Firing Leader	At day's end, • lock all the buildings, and • check doors.

7.6 Misfires

In the event of a misfire, follow the procedure listed below.

Step	Who Does It	Action
1	All participants, including observers	Do NOT leave the control room.
2	Firing Leader	Checks all electrical connections to the power supply in the control room.
3	Firing Leader	Attempts to fire the test again, if it seems appropriate.
4	Firing Leader	If the test still fails to fire, • turn off all power to the power supply.
5	Firing Leader	Establishes a waiting period-at least 30 minutes if the cause of failure is not obvious.
6	Firing Leader	Observe the test assembly through the viewing ports in the control room, if possible, during the waiting period.
7	Firing Leader	If no activity in the test assembly is evident during this time, • carefully approaches the firing mound.
8	Firing Leader	Disarms the test by disconnecting the detonator cable at the CDU, if possible, or by removing the detonator from the charge or cutting its leads.

<table>
<tr><td>9</td><td>Firing Leader</td><td>Checks the leads for continuity and electrical connections to the firing unit using an approved DCO after disarming the test.
<table>
<tr><th>IF the trouble</th><th>THEN</th></tr>
<tr><td>has been located and fixed</td><td>check the operation of the unit by firing one or more detonators.</td></tr>
<tr><td>cannot be located</td><td>• secure the site, leaving the barricade down, and
• contact the Group Leader or the DX-2 Staff Member for Firing Operations for further instructions.</td></tr>
</table></td></tr>
</table>

7.7 Cleaning Up Contamination from Firing Operations

Sometimes normal firing activities will result in the incomplete detonation of the explosive and hence in the scattering of explosive in the area next to the test. For example, the standard gap test, by its inherent nature, will result in half of the tests scattering explosive.

The following steps are taken to minimize the contamination and to reduce the hazard from it.

Step	Action
1	The HE is collected from the test area after each test and put in the approved HE waste container kept in Room 104 of Building Q-23.
2	The entire firing area is inspected for explosives at the end of each day's firing.
3	The area is posted with a sign warning unauthorized personnel to remain out of the explosives-contaminated area.
4	No work is permitted in the posted area by service personnel without permission of the area coordinator and the firing leader or Group management.

7.7.1 Disposal of HE Operational Waste

The HE waste accumulated at Q-Site is disposed of in two ways,

(1) by arranging with the DX-Division Waste Coordinator to take away and dispose of such waste and

(2) by disposal at Q-Site

Waste minimization will be handled according to Section 13 of the DX-Division Operations Manual.

7.8 Emergency Procedures

The Building Emergency Plan (BEP) posted in Q-23 in TA-14 shall be followed in the event of an emergency situation. The BEP shall be available in the building, and the operators shall be familiar with its contents.

8.0 REQUIRED RECORDS

- Q-Site Test Sheet
- DX-2 Q-Site Firing Check List
- Adhesive and Potting Materials List
- Waiver of Personnel Limits at Q-Site
- Expended Material List

9.0 REFERENCES

- LANL Electrical Safety Program
  LIR402-600-01.0 "Electrical Safety"
  LIG402-600-01.0 "Electrical Safety Implementation Guide"
- DOE Explosives Safety Manual, DOE M440.1-1 Rev. 8
- Los Alamos Environment, Safety, and Health Manual
- DX-Division Operations Manual
- DX-1 SOP 175 Manufacture Handling, and Inspection of Low Energy EEDs
- DX-4 SOP 3.0 General Safety
- DX-4 SOP 4.0 General Firing Operations
- DX-4 SOP 5.0 Preparation Room Operations Explosive Charge Handling & Assembly
- DX-DO SOP 01 Waste Management in DX-DO
- DX-DO SOP 03 Packaging and Transportation of Hazardous Materials
- DX-DO SOP 06 Radiological Controls
- DX-DO SOP 08 HE Storage

10.0 ATTACHMENTS

1. DX-2 Q-Site Test Sheet
2. Adhesive and Potting Materials List
3. DX-2 Q-Site Firing Checklist
4. Evaluation of Fragment Hazards

Attachment 1

DX-2 Q-Site Test Sheet

Date _____

Type of Test _____ Time _____

Purpose of shot _____

_____

Experimenter (s) _____ Program Code _____

Technicians (s) _____ Disk Name _____

Detonator _____

Booster _____ Dimensions _____

_____

Mound Location _____

Weight (grams) _____

Toxic or Radioactive Materials _____

(D-38, Lead, Tritium, Beryllium, etc.)

Fire Dept. Requested Yes No

If yes, why? _____

ESH Requested Yes No

If yes, why? _____

Special Procedures or requirements _____

_____

Diagnostics Used (Scope, TIM, Pulse Amp., DDG, Fanout, etc.)

_____

Approved by (Staff Member in charge of Q-Site East or alternate) _____

(Use back of sheet for results and comments)

Attachment II

ADHESIVES AND POTTING MATERIALS

Category	Adhesive	Additive or Catalyst	HE Comp. Report #	Remarks
Epoxy	Aerobond 2017	Trimethoxy-boroxine	198	Compatible with HE. Exothermic reaction. Don't make more than 50 g at a time.
	Barco Bond 165 165, 185	Boron trifluoride complex	229	Due to its fast curing reaction this material becomes hot if used in thick sections. It should not be used for potting and large fillets should be avoided.
	VEEP 1579 VEEP 1579T	Versamid 140 DMP-30*	232	Not compatible with all HE. May be used on PBX 9502, TATB, and mixtures of TATB and inert materials.
	Epon 828	Versamid 125		Not to be used on HE materials. Exothermic.
	Epon 815	DETA (Diethylene-triamine)		Not to be used on HE materials. Exothermic.
	Torr Seal	Polyamide	250	Can be used on HE as described in report #250. Ideal for vacuum applications, sealing leaks.
Poly-Urethane	Aralhex spray brush, putty, or fillet.	Ferricacetyl-acetonate	223	Compatible with HE. Used for cover bonding. Exother-mic in fillet form

ADHESIVES AND POTTING MATERIALS (Cont)

Category	Adhesive	Additive or Catalyst	HE Comp. Report #	Remarks
	Urethane Encapsulant 7200	Component "B" (polyol mix)	224	Compatible with HE 100% solids. Moisture contamination will cause severe foaming.
	Polad	Adiprene 5333	243	Compatible with HE. Adhesive of choice with Comp. B. Acetone diluent avoids sparks. Do not breathe vapors.
	Polamine 1000 cured polyurethanes		266	Compatible with HE. Slight foaming from moisture. Do not breathe vapors.
	Polycure cured polyurethanes		243	Compatible with HE. Slight foaming from moisture. Do not breathe vapors.
	Cyanacure cured polyurethanes		242	Compatible with HE. Slight foaming from moisture. Do not breathe vapors.
Cyano-acrylate	Eastman 910		67	Compatible with HE. Thin-film activated.
	Eastman 910 with accelerator	Phenylethyl-ethanolamine (chlorothene)	182	Can be used on HE as described in Report #182. Accelerator solution is applied to one surface and left 30 s for chlorothene to evaporate.
	Superadhesive 414, 416, 420, 430, and 495		67	Compatible with HE. Limited to 0.004-inch gap fill.

ADHESIVES AND POTTING MATERIALS (Cont)

Category	Adhesive	Additive or Catalyst	HE Comp. Report #	Remarks
	Superbonder 414, 416, 420, 430, and 495			Not approved for HE compatibility. Up to 0.020-inch gap fill with accelerator.
	Threadlocker 242	May use Primer T		Not approved for HE compatibility. Limited to 0.005-inch gap fill.
	Threadlocker 290	May use Primer N		Not approved for HE compatibility. Limited to 0.005-inch gap fill.
Anaerobic	Speedbonder 326 and 325	Activator 707		Not approved for HE compatibility. Up to 0.040-inch gap fill.
	Loctite Depend	Depend. Activator		Not approved for HE compatibility. Up to 0.030-inch gap fill.
Rubber	Bondmaster G458			Not to be used on HE. Will bond polystyrene and polyurethane foams. Contains volatile solvents
	Dow Corning 281		138	Compatible with HE. May be thinned with toluene.
RTV Silicones	DC 731, 732 GE 162	Moisture in air	48, 49	Compatible with HE.
	DC 3110 Rubber	S catalyst or F catalyst	144	Compatible with HE. Store in refrigerator.
	Kerr Denture Elasticon	Mixture of stannous octoate and zinc octoate	259	Compatible with HE.

ADHESIVES AND POTTING MATERIALS (Cont)

Category	Adhesive	Additive or Catalyst	HE Comp. Report #	Remarks
	DC Sylgard 184 186; DC Silastic J, E; GE RTV 615 McGhan-Nusil CF7-2615	Pt catalyst	149, 257	Compatible with HE. Store in refrigerator.
Spray	Photo Mount Spra Mount		220	Compatible with HE.
Dry Film	3M 465 and 920		227	Compatible with HE.
General Purpose	Duco Cement		57, 66	Compatible with HE.

Attachment III

DX-2 Q-Site Firing Checklist

Requester _____ Charge Code _____ Date Fired _____

N/A	OK		
	❑	1)	Ensure Q-Site shot sheet is completed.
❑	❑	2)	Notify Access Control 7-6742 to arrange for Fire Department standby if pyrotechnics are involved in the shot.
	❑	3)	Notify Access Control of all shots.
	❑	4)	Lower TA-14 gate and clear the area.
	❑	5)	Move all personnel into Bldg. Q-23 and establish a head count.
❑	❑	6)	Ensure that there is no electrical potential to the firing mound and check all cables and connections.
❑	❑	7)	Take photos as necessary.
❑	❑	8)	Verify CDU is shorted with the shorting plug, then arm the shot.
❑	❑	9)	Remove CDU shorting plug.
❑	❑	10)	Retake head count and start firing sequence.
	❑	11)	Set correct firing voltage on the Control Panel.
❑	❑	12)	Ensure shot diagnostics and rack are powered and in a ready state:

OFF	ON	
❑	❑	DC Power Supply voltage set and connected.
❑	❑	Oscilloscope programmed and reset (recheck after charging).
❑	❑	TIM's, DDG's and Pulse Amplifiers programmed and reset.
❑	❑	VCR programmed and recording.

❑	❑	14)	Record shot time on shot sheet.
❑	❑	15)	Charge CDU and recheck diagnostics.
❑	❑	16)	Fire the shot.
❑	❑	17)	Record data from shot diagnostics.
❑	❑	18)	Check the area for shot-induced fire.
❑	❑	19)	Verify a safe condition on the mound and short CDU.
❑	❑	20)	Sound "all clear" when it is safe to leave Bldg. Q-23.
❑	❑	21)	Police the area for any unconsumed HE or hazardous debris and dispose of appropriately.

Signature: _____ Date _____

Firing Leader

DX-2 Q-Site Firing Checklist (Cont)

In the event of a misfire the following procedure will be followed:

N/A	OK		
	❑	1)	DO NOT LEAVE CONTROL ROOM
❑	❑	2)	Check all electrical connections and firing voltage in the control room.
❑	❑	3)	Attempt to fire the shot again.
❑	❑	4)	If the shot still does not fire, turn off all power to firing system.
❑	❑	5)	Wait a time considered appropriate by Firing Leader (nominally 30 minutes) observing the shot for any signs of smoke or activity.
❑	❑	6)	If during the waiting period no activity is observed, <u>one</u> person shall approach the firing mound pit and disconnect the detonator cable from the CDU.
❑	❑	7)	Remove or disconnect the detonator from the shot.
❑	❑	8)	Check detonator leads and cable for continuity with an approved DCO.
❑	❑	9)	If the problem has been identified and corrected, firing operations may be checked by firing one or more detonators.
❑	❑	10)	If the problem cannot be identified, notify the DX-2 Group Office 7-4411), secure the area, and await further instructions.

Attachment IV

Evaluation of Fragment Hazards

BILL DAVIS' RULE

$$\text{Fragment Distance} = \frac{\text{Density of Fragment}}{\text{Density of Air}} \times \text{Thickness of Fragment /(Ft.) in direction of travel} \times \text{Safety factor}$$

where:

Density of Air = 10^{-3} g/cm3 at Los Alamos altitude

Safety Factor: 5 for cars, and buildings
8 for people

FOR TYPICAL FRAGMENTS (NO BARRIER OR BARRICADES)

Material	Density g/cm3	Fragment Thickness (in.)	Fragment Distance (Ft.) (Safety Factor = 8)
Aluminum	2.7	¼"	450
		½"	900
		1"	1800
Brass	8.4	¼"	1400
		½"	2800
		1"	5600
DU	18.7	¼"	3116
		½"	6233
		1"	12,466 (2.3 miles)

Appendix D

Background Sample Data and Locations from "Environmental Surveillance at Los Alamos During 1995"

LA-13210-ENV

UC-902
Issued: October 1996

Environmental Surveillance at Los Alamos during 1995

Environmental Surveillance Program:
Air Quality, ESH-17
Water Quality and Hydrology, ESH-18
Hazardous and Solid Waste, ESH-19
Ecology, ESH-20

Los Alamos
NATIONAL LABORATORY

Los Alamos, New Mexico 87545

Tables 6-3. Total Recoverable Trace and Heavy Metals (µg/g) in Soils Collected in 1995[a]

Location	Ag	As	Ba	Be	Cd	Cr	Hg	Ni	Pb	Sb	Se	Tl
Off-Site Regional (Background) Stations:												
Rio Chama	3.1	0.9	36.0	<0.08[b]	<0.4	2.8	0.04	2.9	<8.0	<0.3	0.2	<0.3
Embudo	<3.0	2.0	120.0	0.44	<0.4	11.0	0.05	7.8	<14.0	<0.3	0.5	<0.3
Otowi	<3.0	2.0	150.0	0.37	<0.4	9.2	0.04	5.1	18.0	<0.3	0.5	<0.3
Santa Cruz	<3.0	4.0	140.0	0.47	<0.4	13.0	0.04	9.0	12.0	<0.3	0.6	<0.3
Cochiti	<3.0	3.0	110.0	0.30	<0.4	8.0	0.04	5.0	9.8	<0.3	0.4	<0.3
Bernalillo	<3.0	4.0	160.0	0.63	<0.4	13.0	0.05	9.9	16.0	<0.3	0.8	<0.3
Jemez	<3.0	3.0	86.0	0.32	<0.4	8.4	0.05	4.0	<14.0	<0.3	0.4	<0.3
Mean (±2SD)	<3.0 (0.1)	2.6 (2.8)	114.6 (85.7)	<0.37 (0.34)	<0.4 (0.0)	9.3 (7.1)	0.04 (0.01)	6.2 (5.3)	<13.1 (6.9)	<0.3 (0.0)	0.5 (0.4)	<0.3 (0.0)
RSRL[c]	<4.4	6.0	220.0	<0.90	<0.5	17.4	<0.05	<14.8	<21.8	<0.4	<2.0	<2.4
SAL[d]	400.0	6.0	5,600.0	0.90	80.0	400.0	24.00	1,600.0	500.0	32.0	400.0	6.4
Off-Site Perimeter Stations:												
Sportsman's Club	<3.0	4.0	120.0	0.56	<0.4	11.0	0.05	6.0	19.0	<0.3	0.5	<0.3
North Mesa	<4.0	4.0	120.0	0.64	<0.4	13.0	0.06[e]	<3.0	26.0[e]	<0.3	0.5	<0.3
TA-8	<3.0	4.0	76.0	0.40	<0.4	10.0	0.06[e]	3.4	25.0[e]	<0.3	0.4	<0.3
TA-49	<3.0	4.0	150.0	0.63	<0.4	12.0	0.04	6.2	22.0[e]	<0.3	0.4	<0.3
White-Rock	<3.0	3.0	120.0	0.79	<0.4	12.0	0.04	6.7	19.0	<0.3	0.5	<0.3
Tsankawi	<3.0	1.0	47.0	0.68	<0.4	5.3	<0.40	<2.0	25.0[e]	<0.3	0.3	<0.3
Mean (±2SD)	<3.2 (0.8)	3.3 (2.4)	105.5 (74.3)	0.62 (0.26)[f]	<0.4 (0.0)	10.6 (5.5)	<0.05 (0.02)	<4.6 (4.0)	22.7 (6.3)[f]	<0.3 (0.0)	0.4 (0.2)	<0.3 (0.0)
On-Site Stations:												
TA-21	<3.0	3.0	91.0	0.74	<0.4	11.0	0.05	5.1	40.0[e]	<0.3	0.4	<0.3
East of TA-53	3.5	1.0	22.0	0.27	<0.4	2.7	0.04	<2.0	19.0	<0.3	0.3	<0.3
TA-50	<3.0	3.0	110.0	0.53	<0.4	8.6	0.07[e]	3.7	15.0	<0.3	0.4	<0.3
2-Mile Mesa	<3.0	4.0	81.0	0.47	<0.4	9.6	0.05	4.6	22.0[e]	<0.3	0.4	<0.3
East of TA-54	<3.0	2.0	92.0	0.65	<0.4	8.4	0.04	2.9	13.0	<0.3	0.4	<0.3
R-Site-RD-E	<4.0	4.0	170.0	0.74	<0.4	11.0	0.05	<6.0	21.0	<0.3	0.4	<0.3
Potrillo-DR	<3.0	4.0	150.0	0.93[e]	<0.4	14.0	0.05	9.2	21.0	0.3	0.4	<0.3
S-Site	<4.0	3.0	150.0	0.74	<0.4	8.8	0.05	4.3	14.0	<0.3	0.5	<0.3
Near Well D-T9	<4.0	3.0	120.0	0.73	<0.4	10.0	0.05	5.7	14.0	<0.3	0.4	<0.3
Near TA-33	<4.0	3.0	110.0	0.54	<0.4	8.2	0.04	7.8	21.0	<0.3	0.4	<0.3
Mean (±2SD)	<3.5 (1.0)	3.0 (1.9)	109.6 (84.8)	0.63 (0.37)[f]	<0.4 (0.0)	9.2 (5.8)	0.05 (0.02)	<5.1 (4.3)	20.0 (15.7)[f]	<0.3 (0.0)	0.4 (0.1)	<0.3 (0.0)

[a] Analysis by EPA Method 3051 for total recoverable metals.
[b] The less than symbol (<) means the analysis was below the specified detection limit of the analytical method.
[c] Regional Statistical Reference Level; this is the upper-limit background concentration (mean + 2 std dev) from Fresquez 1995.
[d] SAL (Los Alamos National Laboratory Screening Action Level).
[e] Higher than the RSRL.
[f] Statistically significant mean from background mean using a Wilcoxon Rank Sum test at the 0.05 probability level.

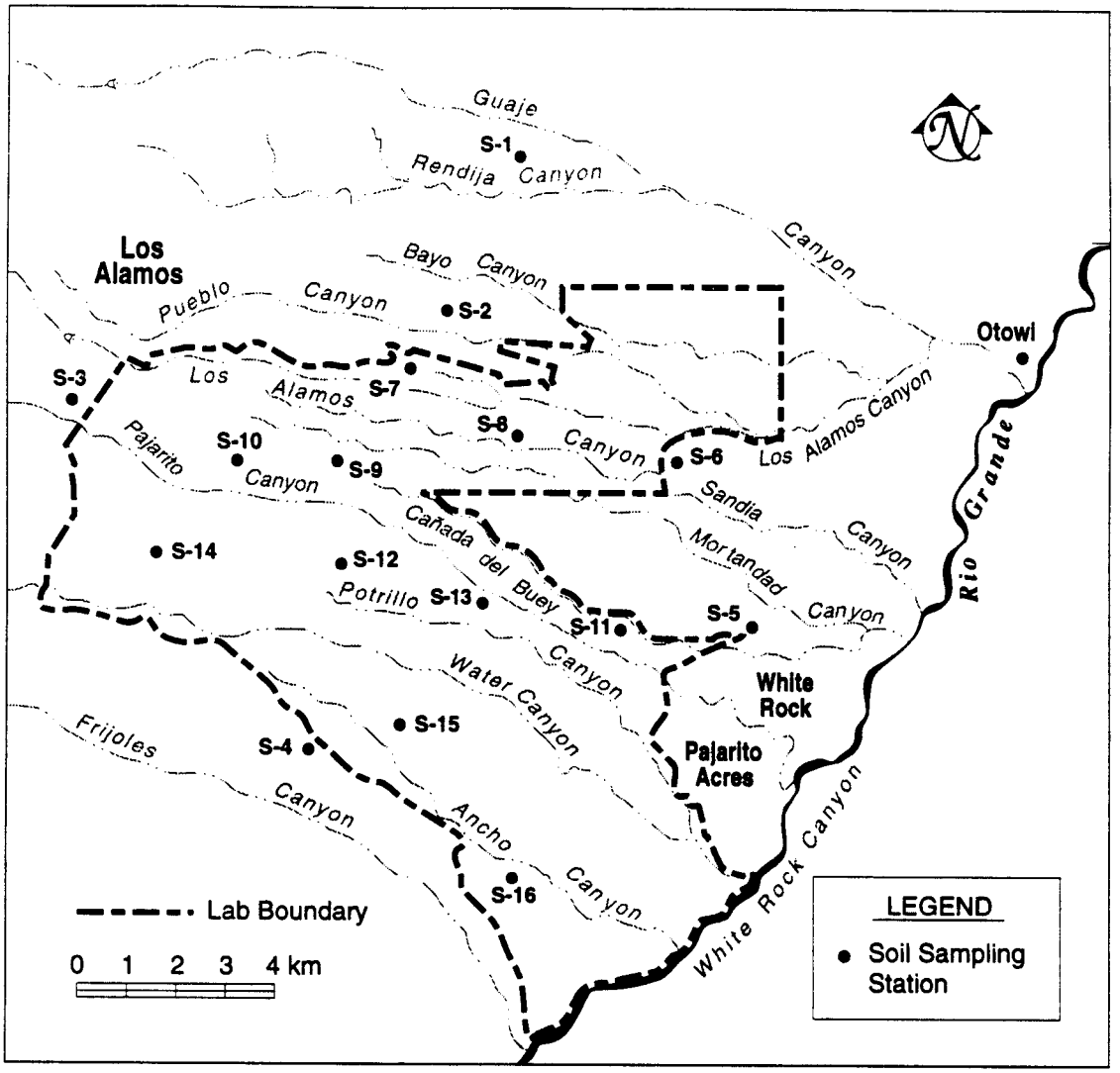

Figure 6-2. Off-site perimeter and on-site Laboratory soil sampling locations. (Map denotes general locations only. Refer to Table 6-1 for specific coordinates.)

D. Tables

Table 6-1. Location of Soil Sampling Stations[a]

Location	Map Denotation	Northing Coordinate[b]	Easting Coordinate[b]
Regional			
Rio Chama		1844693.096	1677875.228
Embudo		1816440.315	1744693.086
Otowi		1777182.637	1668721.670
Near Santa Cruz		1816438.561	1744700.759
Cochiti		1644216.892	1647114.194
Bernalillo		1572864.707	1549601.021
Jemez		1719495.437	1502276.101
Perimeter			
L.A. Sportsman Club	S1	1788136.211	1636493.387
North Mesa	S2	1780072.446	1630330.015
Near TA-8 (GT Site)	S3	1768805.627	1609433.446
Near TA-49	S4	1755456.289	1620318.345
White Rock (East)	S5	1758301.447	1655116.466
Tsankawi	S6	1768110.302	1647985.099
On-Site			
TA-21 (DP Site)	S7	1774989.218	1631266.389
East of TA-53	S8	1772914.010	1629196.631
TA-50	S9	1769548.575	1626390.047
Two-Mile Mesa	S10	1769494.453	1615386.422
East of TA-54	S11	1757882.733	1645162.755
R-Site Road East	S12	1761923.229	1625863.108
Potrillo Drive	S13	1759475.770	1635153.829
S-Site (TA-16)	S14	1759328.803	1618868.688
Near Test Well DT-9	S15	1752337.978	1629594.961
Near TA-33	S16	1740806.015	1638487.987

[a]Soil sampling locations are given in Figures 6-1 and 6-2.
[b]New Mexico State Planar Coordinates, NAD 1983.

Appendix E

Analytical Data for Soil Samples Collected Near Technical Area 14, Building 23

of
N1 5/02
766969.10
Rec'd from
Tony Greggs (ESIHA)
th 6/27/97

EM-9 SEMIVOLATILE ORGANIC ANALYSIS
SUMMARY OF ANALYTICAL RESULTS

TO: Philip R. Fresquez
FROM: Bridgid Brug, EM-9 Organic section
THROUGH: Chris Leibman, EM-9 Organic section leader
Anthony Lombardo, EM-9 Organic section 5/26
REQUEST NUMBER: 14401
MATRIX: Soil
SUMMARY DATE: May 4, 1993

	SAMPLE ID	TARGET COMPOUNDS FOUND	AMOUNT (ug/Kg) ppb	LOQ (ug/Kg)	TICs	
	93.04902 (Blank)	NONE	<330	330	N	
	93.04903 (Blank)	NONE	<330	330	N	
	93.04845	NONE	<330	330	Y	
	93.04846	NONE	<330	330	Y	
	93.04847	NONE	<330	330	N	
E-25	93.04848	BIS-2-ETHYLHEXYLPHTHALATE	690	330	Y	< 50 ppm ok
		DI-N-OCTYPHTHALATE	690			< 9 to 60,000 ppm ok
E-50	93.04849*	BIS-2-ETHYLHEXYLPHTHALATE	1100	330	N	ok
	93.04850	NONE	<330	330	Y	
	93.04851	NONE	<330	330	Y	
	93.04852	NONE	<330	330	Y	
	93.04853*	NONE	<330	330	Y	
	93.04854	NONE	<330	330	Y	
SE-50	93.04855*	BIS-2-ETHYLHEXYLPHTHALATE	870	330	Y	ok
	93.04856	NONE	<330	330	Y	
	93.04857*	NONE	<330	330	Y	
	93.04858	NONE	<330	330	Y	
	93.04859	NONE	<3300	3300	N	
	93.04860*	NONE	<330	330	N	
	93.04861	NONE	<330	330	N	
	93.04862*	NONE	<330	330	Y	
	93.04863	NONE	<330	330	Y	
	93.04864	NONE	<330	330	Y	
S-50	93.04865*	PYRENE	3800	3300	N	< 80 ppm
	93.04866	NONE	<330	330	Y	
	93.04867*	NONE	<3300	3300	N	
U.D.	93.04868	BIS-2-ETHYLHEXYLPHTHALATE	540	330	Y	ok
L.D.	93.04869*	NONE	<330	330	Y	

LOQ: Limit Of Quantitation
TICs: Tentatively identified compounds
*: Low internal standard responses (confirmed by reanalysis)

Samples were extracted by mixing approximately 30 grams of sample with 60 grams of sodium sulfate and sonicating with 100 ml of methylene chloride. The methylene chloride was separated from the solids and sonication was repeated with two additional 100 ml aliquot of methylene chloride. Most of he sample extracts were combined and concentrated to 1.0 ml final volume.

The following samples were combined and concentrated to 10.0 ml final volume: 93.04859, S93.04865, M93.04865, D93.04865, and S93.04867. Appropriate surrogate standards were added prior to extraction. Analysis was performed by capillary column GC/MS methods. Extraction and analysis methods are consistent with EPA SW-846 methods 3500 and 8270. Analytical column used was a J&W scientific DB5.625 30 M X .25 mm ID.

Some of the samples were found to contain HSL target compounds above the specified limit of quantitation (see above). Non-target peaks were not identified or quantitated for this request.

Surrogate recoveries were within EPA criteria for all analyses. Many of the samples had low internal standard responses. All of these samples were analyzed twice in order to confirm matrix interference.

All analytical hold times were met for this request. If you have any question regarding this data, please call either Anthony Lombardo or Laura Kelly at 667-5889.

LOS ALAMOS NATIONAL LABORATORY
HEALTH, SAFETY AND ENVIRONMENT DIVISION
HSE-9
SURROGATE RECOVERIES FOR SEMI-VOLATILES
IN SOIL TYPE MATRICES

REQUEST #: 14401

NUMBER OF SAMPLES: 22
MATRIX S
ANALYST: AJL
Date: 05/14/93

SURROGATE RECOVERIES

SURROGATE
RECOVERIES IN PERCENT (%)

	SAMPLE NUMBERS	TYPE	2-FLUORO-PHENOL	PHENOL (D6)	NITRO-BENZENE (D5)	2-FLUORO-BIPHENYL	2,4,6-TRIBROMO-PHENOL	TERPHENYL (D14)
1	B93.04903	BLANK	19 *	24	26	35	64	89
2	B93.04902	BLANK	18 *	29	36	48	71	95
3	S93.04899	SAMPLE	63	73	75	74	89	88
4	S93.04900	SAMPLE	56	67	64	69	85	78
5	M93.04845	MATRIX SPIK	54	74	67	76	94	86
6	D93.04845	MATRIX SP-D	41	63	55	67	86	85
	S93.04845	SAMPLE	30	48	46	66	82	78
	S93.04846	SAMPLE	38	58	52	68	88	86
	S93.04847	SAMPLE	39	61	52	75	91	96
10	S93.04848	SAMPLE	31	54	46	63	89	102
11	S93.04849	SAMPLE	43	69	61	95	108	123
12	S93.04850	SAMPLE	28	48	43	60	92	100
13	S93.04851	SAMPLE	38	57	54	69	76	89
14	S93.04852	SAMPLE	42	66	58	73	93	98
15	S93.04853	SAMPLE	40	55	54	66	78	90
16	S93.04854	SAMPLE	41	63	53	71	90	94
17	S93.04855	SAMPLE	36	65	52	80	110	108
18	S93.04856	SAMPLE	41	61	53	66	95	87
19	S93.04857	SAMPLE	54	75	71	91	115	115
20	S93.04858	SAMPLE	52	78	64	81	101	85
21	S93.04859	SAMPLE	60	82	74	83	102	93
22	S93.04860	SAMPLE	58	78	68	82	106	109
	Average % Surrogate Recovery...		39	55	52	64	84	88
	Defined Lower QC Limits (%)....		23	24	23	30	19	18
	Defined Upper QC Limits (%)....		121	113	120	115	122	137
	Observed Lower QC Limits (%)...		18	24	26	35	64	78
	Observed Upper QC Limits (%)...		63	74	75	76	94	102

* If % Surrogate Recovery is Followed by a "*", it is out of QC Limits.

Re By:

LOS ALAMOS NATIONAL LABORATORY
HEALTH, SAFETY AND ENVIRONMENT DIVISION
HSE-9
SURROGATE RECOVERIES FOR SEMI-VOLATILES
IN SOIL TYPE MATRICES

REQUEST #: 14401

NUMBER OF SAMPLES: 11
MATRIX S
ANALYST: AJL
Date: 05/14/93

SURROGATE RECOVERIES

SURROGATE
RECOVERIES IN PERCENT (%)

	SAMPLE NUMBERS	TYPE	2-FLUORO-PHENOL	PHENOL (D6)	NITRO-BENZENE (D5)	2-FLUORO-BIPHENYL	2,4,6-TRIBROMO-PHENOL	TERPHENYL (D14)
1	M93.04865	MATRIX SPIK	73	90	79	88	83	113
2	D93.04865	MATRIX SP-D	73	93	78	92	90	116
3	S93.04861	SAMPLE	36	51	44	57	93	88
4	S93.04862	SAMPLE	56	80	68	80	90	104
5	S93.04863	SAMPLE	46	65	61	86	124 *	122
6	S93.04864	SAMPLE	67	84	82	89	101	127
	S93.04865	SAMPLE	72	86	84	84	81	114
	S93.04866	SAMPLE	43	59	54	65	94	95
	S93.04867	SAMPLE	79	88	75	90	97	118
10	S93.04868	SAMPLE	67	86	74	85	109	95
11	S93.04869	SAMPLE	83	99	90	91	115	117
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								

Average % Surrogate Recovery...	61	78	70	82	96	109
Defined Lower QC Limits (%)....	23	24	23	30	19	18
Defined Upper QC Limits (%)....	121	113	120	115	122	137
Observed Lower QC Limits (%)...	36	51	44	57	81	88
Observed Upper QC Limits (%)...	79	93	84	92	124	127

"*" If % Surrogate Recovery is Followed by a "*", it is out of QC Limits.

Re By:

LOS ALAMOS NATIONAL LABORATORY
HEALTH, SAFETY AND ENVIRONMENT DIVISION
HSE-9
MATRIX SPIKE RECOVERIES FOR SEMI-VOLATILES

		DRY WT/VOL (G or L)		AMOUNT SPIKED IN UG/KG ACIDS	BASES	LOQ (UG/KG)
REQUEST #:	14401					
NUMBER OF SAMPLES:	22					
SPIKE ID: (STARTS M OR E)	M93.04845	SPIKE	28.662	3489	1744	330
SPIKE DUP ID: (STARTS D OR F)	D93.04845	SPIKE-DUP	28.277	3536	1768	330
RAW DATA WITH:	14401					
ANALYST:	AJL					

	SPIKE REC.	SPIKE-DUP REC.	SPIKE % REC.	SPIKE-DUP % REC.	RPD	LOW. REC. LIM.	UPP. REC. LIM.	RPD LIM.
	2300	1900	66%	54%	20%	26	90	35
2-[illegible]OROPHENOL	2400	1900	69%	54%	25%	25	102	50
1,4-DICHLOROBENZENE	1100	870	63%	49%	25%	28	104	27
N-NITROSO-DI-N-PROPYLAMINE	1300	1100	75%	62%	18%	41	126	38
1,2,4-TRICLOROBENZENE	1200	950	69%	54%	25%*	38	107	23
4-CHLORO-3-METHYLPHENOL	2300	2200	66%	62%	6%	26	103	33
ACENAPHTHENE	1300	1200	75%	68%	9%	31	137	19
4-NITROPHENOL	2500	2600	72%	74%	3%	11	114	50
2,4-DINITROTOLUENE	1400	1300	80%	74%	9%	28	89	47
PENTACHLOROPHENOL	3000	2800	86%	79%	8%	17	109	47
PYRENE	1500	1500	86%	85%	1%	35	142	36

If % Matrix Recovery is Followed by a "*", it is out of QC Limits.

Reviewed By:

LOS ALAMOS NATIONAL LABORATORY
HEALTH, SAFETY AND ENVIRONMENT DIVISION
HSE-9
MATRIX SPIKE RECOVERIES FOR SEMI-VOLATILES

		DRY WT/VOL (G or L)		AMOUNT SPIKED IN UG/KG ACIDS	BASES	LOQ (UG/KG)
REQUEST #:	14401					
NUMBER OF SAMPLES:	11					
SPIKE ID: (STARTS M OR E)	M93.04865	SPIKE	27.931	3580	1790	3300
SPIKE DUP ID: (STARTS D OR F)	D93.04865	SPIKE-DUP	27.493	3637	1819	3300
RAW DATA WITH:	14401					
ANALYST:	AJL					

	SPIKE REC.	SPIKE-DUP REC.	SPIKE % REC.	SPIKE-DUP % REC.	RPD	LOW. REC. LIM.	UPP. REC. LIM.	RPD LIM.
	<LOQ	<LOQ	0%*	0%*	ERR **	26	90	35
2-CHLOROPHENOL	<LOQ	<LOQ	0%*	0%*	ERR **	25	102	50
1,4-DICHLOROBENZENE	<LOQ	<LOQ	0%*	0%*	ERR **	28	104	27
N-NITROSO-DI-N-PROPYLAMINE	<LOQ	<LOQ	0%*	0%*	ERR **	41	126	38
1,2,4-TRICLOROBENZENE	<LOQ	<LOQ	0%*	0%*	ERR **	38	107	23
4-CHLORO-3-METHYLPHENOL	<LOQ	<LOQ	0%*	0%*	ERR **	26	103	33
ACENAPHTHENE	<LOQ	<LOQ	0%*	0%*	ERR **	31	137	19
4-NITROPHENOL	<LOQ	<LOQ	0%*	0%*	ERR **	11	114	50
2,4-DINITROTOLUENE	<LOQ	<LOQ	0%*	0%*	ERR **	28	89	47
PENTACHLOROPHENOL	<LOQ	<LOQ	0%*	0%*	ERR **	17	109	47
PYRENE	<LOQ	<LOQ	0%*	0%*	ERR **	35	142	36

* If % Matrix Recovery is Followed by a "*", it is out of QC Limits.

Reviewed By:

EM-9 SEMIVOLATILE ORGANIC ANALYSIS
SUMMARY OF ANALYTICAL RESULTS

TO: Philip R. Fresquez
FROM: Bridgid Brug, EM-9 Organic section
THROUGH: Chris Leibman, EM-9 Organic section leader
Anthony Lombardo, EM-9 Organic section TL 5/19/93
REQUEST NUMBER: 14401
MATRIX: Water
SUMMARY DATE: May 4, 1993

SAMPLE ID	TARGET COMPOUNDS FOUND	AMOUNT (ug/L)	LOQ (ug/L)	TICs (Y/N)
93.05027 (Blank)	NONE	<10	10	Y
93.04870	BENZOIC ACID	58	10	Y

LOQ: Limit Of Quantitation
TIC: Tentatively Identified Compound

Samples were extracted by liquid-liquid extraction method. Methylene chloride was used as the extraction solvent. Sample extracts were then concentrated to 1.0 ml final volume. Appropriate surrogate standards were added prior to extraction. Analysis was performed by capillary column GC/MS methods. Extraction and analysis methods are consistent with EPA SW-846 methods 3520 and 8270. Analytical column used was a J&W Scientific DB.625 30M by 0.25 mm ID, 0.5 micron film.

The sample extract was found to contain HSL target compounds above the specified limit of quantitation (see above). Non-target compounds were not identified or quantitated for this request.

Surrogate recoveries were within EPA criteria for all analyses. Internal standard responses were within criteria for all analyses.

All analytical hold times were met for this request. If you have any questions regarding this data, please call either Anthony Lombardo or Laura Kelly at 667-5889.

LOS ALAMOS NATIONAL LABORATORY
HEALTH, SAFETY AND ENVIRONMENT DIVISION
HSE-9
SURROGATE RECOVERIES FOR SEMI-VOLATILES
IN WATER

REQUEST #: 14401

NUMBER OF SAMPLES: 5
MATRIX W
ANALYST: AJL
Date: 05/26/93

SURROGATE RECOVERIES

SURROGATE
RECOVERIES IN PERCENT (%)

	SAMPLE NUMBERS	TYPE	2-FLUORO-PHENOL	PHENOL (D6)	NITRO-BENZENE (D5)	2-FLUORO-BIPHENYL	2,4,6-TRIBROMO-PHENOL	TERPHENYL (D14)
1	B93.05027	BLANK	57	72	63	57	52	86
2	S93.04762	SAMPLE	40	52	47	53	58	81
3	E93.04764	BLANK SPIKE	30	35	56	56	40	77
4	F93.04764	BLANK SP-DU	26	35	36	42 *	42	86
5	S93.04870	SAMPLE	54	67	72	72	96	30 *
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
Average % Surrogate Recovery...			41	52	55	56	58	72
Defined Lower QC Limits (%)....			21	10	35	43	10	33
Defined Upper QC Limits (%)....			100	94	114	116	123	141
Observed Lower QC Limits (%)...			26	35	36	42	40	30
Observed Upper QC Limits (%)...			57	72	72	72	96	86

'f % Surrogate Recovery is Followed by a "*", it is out of QC Limits.

Re\ By:

LOS ALAMOS NATIONAL LABORATORY
HEALTH, SAFETY AND ENVIRONMENT DIVISION
HSE-9
MATRIX SPIKE RECOVERIES FOR SEMI-VOLATILES

		DRY WT/VOL (G or L)		AMOUNT SPIKED (50 OR 100 ug/ml) IN UG/KG or UG/L ACIDS	BASES	LOQ (UG/KG)
REQUEST #:	14401					
NUMBER OF SAMPLES:	5					
SPIKE ID: (STARTS M OR E)	E93.04764	SPIKE	1	100	50	10
SPIKE DUP ID: (STARTS D OR F)	F93.04764	SPIKE-DUP	1	100	50	10
RAW DATA WITH:	14388					
ANALYST:	AJL					

	SPIKE REC.	SPIKE-DUP REC.	SPIKE % REC.	SPIKE-DUP % REC.	RPD	LOW. REC. LIM.	UPP. REC. LIM.	RPD LIM.
	35	36	35%	36%	3%	12	89	42
2-[illegible]ROPHENOL	36	32	36%	32%	12%	27	123	40
1,4-DICHLOROBENZENE	22	14	44%	28%*	44%*	36	97	28
N-NITROSO-DI-N-PROPYLAMINE	31	20	62%	40%*	43%*	41	116	38
1,2,4-TRICLOROBENZENE	23	15	46%	30%*	42%*	39	98	28
4-CHLORO-3-METHYLPHENOL	44	41	44%	41%	7%	23	97	42
ACENAPHTHENE	31	24	62%	48%	25%	46	118	31
4-NITROPHENOL	31	<LOQ	31%	0%*	200%*	10	80	50
2,4-DINITROTOLUENE	39	15	78%	30%	89%*	24	96	38
PENTACHLOROPHENOL	47	<LOQ	47%	0%*	200%*	9	103	50
PYRENE	43	46	86%	92%	7%	26	127	31

If % Matrix Recovery is Followed by a "*", it is out of QC Limits.

Reviewed By:

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 26-May-1993

REQUEST NUMBER: 14401 MATRIX: W ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 39

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04870 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/05/93 Date Analyzed: 4/28/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-RIN	93.04870	83329	< 10.		UG/L	5/25/93		Acenaphthene
14-35-RIN	93.04870	208968	< 10.		UG/L	5/25/93		Acenaphthylene
14-35-RIN	93.04870	62533	< 10.		UG/L	5/25/93		Aniline
14-35-RIN	93.04870	120127	< 10.		UG/L	5/25/93		Anthracene
14-35-RIN	93.04870	103333	< 10.		UG/L	5/25/93		Azobenzene
14-35-RIN	93.04870	92875	< 10.		UG/L	5/25/93		m-Benzidine
14-35-RIN	93.04870	56553	< 10.		UG/L	5/25/93		Benzo[a]anthracene
14-35-RIN	93.04870	50328	< 10.		UG/L	5/25/93		Benzo[a]pyrene
14-35-RIN	93.04870	205992	< 10.		UG/L	5/25/93		Benzo[b]fluoranthene
14-35-RIN	93.04870	191242	< 10.		UG/L	5/25/93		Benzo[g,h,i]perylene
14-35-RIN	93.04870	207089	< 10.		UG/L	5/25/93		Benzo[k]fluoranthene
14-35-RIN	93.04870	65850	58.	17.4	UG/L	5/25/93		Benzoic acid
14-35-RIN	93.04870	100516	< 10.		UG/L	5/25/93		Benzyl alcohol
14-35-RIN	93.04870	111911	< 10.		UG/L	5/25/93		Bis(2-chloroethoxy)methane
14-35-RIN	93.04870	111444	< 10.		UG/L	5/25/93		Bis(2-chloroethyl)ether
14-35-RIN	93.04870	108601	< 10.		UG/L	5/25/93		Bis(2-chloroisopropyl)ether
14-35-RIN	93.04870	117817	< 10.		UG/L	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-RIN	93.04870	101553	< 10.		UG/L	5/25/93		4-Bromophenylphenyl ether
14-35-RIN	93.04870	85687	< 10.		UG/L	5/25/93		Butyl benzyl phthalate
14-35-RIN	93.04870	59507	< 10.		UG/L	5/25/93		4-Chloro-3-methylphenol
14-35-RIN	93.04870	106478	< 10.		UG/L	5/25/93		4-Chloroaniline
14-35-RIN	93.04870	91587	< 10.		UG/L	5/25/93		2-Chloronaphthalene
14-35-RIN	93.04870	95578	< 10.		UG/L	5/25/93		o-Chlorophenol
14-35-RIN	93.04870	7005723	< 10.		UG/L	5/25/93		4-Chlorophenylphenyl ether
14-35-RIN	93.04870	218019	< 10.		UG/L	5/25/93		Chrysene
14-35-RI[illegible]	[illegible].04870	84742	< 10.		UG/L	5/2[illegible]		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-RIN	93.04870	117840	< 10.		UG/L	5/25/93		Di-n-octyl phthalate
14-35-RIN	93.04870	53703	< 10.		UG/L	5/25/93		Dibenzo[a,h]anthracene
14-35-RIN	93.04870	132649	< 10.		UG/L	5/25/93		Dibenzofuran
14-35-RIN	93.04870	95501	< 10.		UG/L	5/25/93		o-Dichlorobenzene (1,2)
14-35-RIN	93.04870	541731	< 10.		UG/L	5/25/93		m-Dichlorobenzene (1,3)
14-35-RIN	93.04870	106467	< 10.		UG/L	5/25/93		p-Dichlorobenzene (1,4)
14-35-RIN	93.04870	91941	< 10.		UG/L	5/25/93		3,3'-Dichlorobenzidine
14-35-RIN	93.04870	120832	< 10.		UG/L	5/25/93		2,4-Dichlorophenol
14-35-RIN	93.04870	84662	< 10.		UG/L	5/25/93		Diethyl phthalate
14-35-RIN	93.04870	131113	< 10.		UG/L	5/25/93		Dimethyl phthalate
14-35-RIN	93.04870	105679	< 10.		UG/L	5/25/93		2,4-Dimethylphenol
14-35-RIN	93.04870	51285	< 10.		UG/L	5/25/93		2,4-Dinitrophenol
14-35-RIN	93.04870	121142	< 10.		UG/L	5/25/93		2,4-Dinitrotoluene
14-35-RIN	93.04870	606202	< 10.		UG/L	5/25/93		2,6-Dinitrotoluene
14-35-RIN	93.04870	206440	< 10.		UG/L	5/25/93		Fluoranthene
14-35-RIN	93.04870	86737	< 10.		UG/L	5/25/93		Fluorene
14-35-RIN	93.04870	118741	< 10.		UG/L	5/25/93		Hexachlorobenzene
14-35-RIN	93.04870	87683	< 10.		UG/L	5/25/93		Hexachlorobutadiene
14-35-RIN	93.04870	77474	< 10.		UG/L	5/25/93		Hexachlorocyclopentadiene
14-35-RIN	93.04870	67721	< 10.		UG/L	5/25/93		Hexachloroethane
14-35-RIN	93.04870	193395	< 10.		UG/L	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-RIN	93.04870	78591	< 10.		UG/L	5/25/93		Isophorone
14-35-RIN	93.04870	534521	< 10.		UG/L	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-RIN	93.04870	91576	< 10.		UG/L	5/25/93		2-Methylnaphthalene
14-35-RIN	93.04870	95487	< 10.		UG/L	5/25/93		2-Methylphenol
14-35-RIN	93.04870	106445	< 10.		UG/L	5/25/93		4-Methylphenol
14-35-RIN	93.04870	91203	< 10.		UG/L	5/25/93		Naphthalene
14-35-RIN	93.04870	88744	< 10.		UG/L	5/25/93		2-Nitroaniline
14-35-RIN	93.04870	99092	< 10.		UG/L	5/25/93		3-Nitroaniline
14-35-RIN	93.04870	100016	< 10.		UG/L	5/25/93		4-Nitroaniline
14-35-RIN	93.04870	98953	< 10.		UG/L	5/25/93		Nitrobenzene
14-35-RIN	93.04870	88755	< 10.		UG/L	5/25/93		2-Nitrophenol
14-35-RIN	93.04870	100027	< 10.		UG/L	5/25/93		4-Nitrophenol
14-35-RIN	93.04870	621647	< 10.		UG/L	5/25/93		N-Nitrosodi-n-propylamine
14-35-RIN	93.04870	62759	< 10.		UG/L	5/25/93		N-Nitrosodimethylamine
14-35-RIN	93.04870	86306	< 10.		UG/L	5/25		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-RIN	93.04870	87865	< 10.		UG/L	5/25/93		Pentachlorophenol
14-35-RIN	93.04870	85018	< 10.		UG/L	5/25/93		Phenanthrene
14-35-RIN	93.04870	108952	< 10.		UG/L	5/25/93		Phenol
14-35-RIN	93.04870	129000	< 10.		UG/L	5/25/93		Pyrene
14-35-RIN	93.04870	120821	< 10.		UG/L	5/25/93		1,2,4-Trichlorobenzene
14-35-RIN	93.04870	95954	< 10.		UG/L	5/25/93		2,4,5-Trichlorophenol
14-35-RIN	93.04870	88062	< 10.		UG/L	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04870

none

********** EM-9 QUALITY ASSURANCE REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 26-May-1993

REQUEST NUMBER: 14401 MATRIX: W ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 39

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QA SAMPLES RUN WITH THIS BATCH

There were no open (non-blind) Quality Control materials run with the samples reported above for one of the following reasons:

____ Only qualitative data requested

____ Only Blind QC samples run with this batch.

____ No QC samples run with this sample batch.

____ No QC samples for this constituent and matrix type available within EM-9

********** EM-9 QUALITY ASSURANCE REPORT **********

SUMMARY OF CONTROL STATUS OF BLANK QC SAMPLES RUN WITH THIS BATCH

Blank Results, Sample # 93.05027 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/05/93 Date Analyzed: 4/28/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20226	93.05027	83329	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Acenaphthene
00.20226	93.05027	208968	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Acenaphthylene
00.20226	93.05027	62533	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Aniline
00.20226	93.05027	120127	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Anthracene
00.20226	93.05027	103333	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Azobenzene
00.20226	93.05027	92875	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	m-Benzidine
00.20226	93.05027	56553	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzo[a]anthracene
00.20226	93.05027	50328	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzo[a]pyrene
00.20226	93.05027	205992	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzo[b]fluoranthene
00.20226	93.05027	191242	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzo[g,h,i]perylene
00.20226	93.05027	207089	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzo[k]fluoranthene
00.20226	93.05027	65850	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzoic acid
00.20226	93.05027	100516	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzyl alcohol
00.20226	93.05027	111911	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethoxy)methane
00.20226	93.05027	111444	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethyl)ether
00.20226	93.05027	108601	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroisopropyl)ether
00.20226	93.05027	117817	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Bis(2-ethylhexyl)phthalate
00.20226	93.05027	101553	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Bromophenylphenyl ether
00.20226	93.05027	85687	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Butyl benzyl phthalate
00.20226	93.05027	59507	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Chloro-3-methylphenol
00.20226	93.05027	106478	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Chloroaniline

********** EM-9 QUALITY ASSURANCE REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20226	93.05027	91587	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2-Chloronaphthalene
00.20226	93.05027	95578	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	o-Chlorophenol
00.20226	93.05027	7005723	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Chlorophenylphenyl ether
00.20226	93.05027	218019	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Chrysene
00.20226	93.05027	84742	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Di-n-butyl phthalate
00.20226	93.05027	117840	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Di-n-octyl phthalate
00.20226	93.05027	53703	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Dibenzo[a,h]anthracene
00.20226	93.05027	132649	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Dibenzofuran
00.20226	93.05027	95501	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	o-Dichlorobenzene (1,2)
00.20226	93.05027	541731	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	m-Dichlorobenzene (1,3)
00.20226	93.05027	106467	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	p-Dichlorobenzene (1,4)
00.20226	93.05027	91941	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	3,3'-Dichlorobenzidine
00.20226	93.05027	120832	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,4-Dichlorophenol
00.20226	93.05027	84662	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Diethyl phthalate
00.20226	93.05027	131113	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Dimethyl phthalate
00.20226	93.05027	105679	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,4-Dimethylphenol
00.20226	93.05027	51285	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrophenol
00.20226	93.05027	121142	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrotoluene
00.20226	93.05027	606202	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,6-Dinitrotoluene
00.20226	93.05027	206440	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Fluoranthene
00.20226	93.05027	86737	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Fluorene
00.20226	93.05027	118741	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Hexachlorobenzene
00.20226	93.05027	87683	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Hexachlorobutadiene
00.20226	93.05027	77474	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Hexachlorocyclopentadiene
00.20226	93.05027	67721	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Hexachloroethane
00.20226	93.05027	193395	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Indeno[1,2,3-cd]pyrene
00.20226	93.05027	78591	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Isophorone
00.20226	93.05027	534521	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2-Methyl-4,6-dinitrophenol
00.20226	93.05027	91576	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2-Methylnaphthalene
00.20226	93.05027	95487	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2-Methylphenol
00.20226	93.05027	106445	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Methylphenol
00.20226	93.05027	91203	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Naphthalene
00.20226	93.05027	88744	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2-Nitroaniline
00.20226	93.05027	99092	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	3-Nitroaniline
00.20226	93.05027	100016	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Nitroaniline
00.20226	93.05027	98953	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Nitrobenzene

********** EM-9 QUALITY ASSURANCE REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20226	93.05027	88755	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2-Nitrophenol
00.20226	93.05027	100027	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Nitrophenol
00.20226	93.05027	621647	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	N-Nitrosodi-n-propylamine
00.20226	93.05027	62759	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	N-Nitrosodimethylamine
00.20226	93.05027	86306	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	N-Nitrosodiphenylamine
00.20226	93.05027	87865	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Pentachlorophenol
00.20226	93.05027	85018	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Phenanthrene
00.20226	93.05027	108952	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Phenol
00.20226	93.05027	129000	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Pyrene
00.20226	93.05027	120821	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	1,2,4-Trichlorobenzene
00.20226	93.05027	95954	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,4,5-Trichlorophenol
00.20226	93.05027	88062	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,4,6-Trichlorophenol

********** EM-9 QUALITY ASSURANCE REPORT **********

Blank Spike Results, Sample # 93.04764 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/05/93 Date Analyzed: 4/28/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20226	93.04764	83329	50.	31.	UG/L	0.0		5/25/93		Acenaphthene
00.20226	93.04764	59507	100.	44.	UG/L	0.0		5/25/93		4-Chloro-3-methylphenol
00.20226	93.04764	95578	100.	36.	UG/L	0.0		5/25/93		o-Chlorophenol
00.20226	93.04764	106467	50.	22.	UG/L	0.0		5/25/93		p-Dichlorobenzene (1,4)
00.20226	93.04764	121142	50.	40.	UG/L	0.0		5/25/93		2,4-Dinitrotoluene
00.20226	93.04764	100027	100.	31.	UG/L	0.0		5/25/93		4-Nitrophenol
00.20226	93.04764	621647	50.	31.	UG/L	0.0		5/25/93		N-Nitrosodi-n-propylamine
00.20226	93.04764	87865	100.	47.	UG/L	0.0		5/25/93		Pentachlorophenol
00.20226	93.04764	108952	100.	35.	UG/L	0.0		5/25/93		Phenol
00.20226	93.04764	129000	50.	43.	UG/L	0.0		5/25/93		Pyrene
00.20226	93.04764	120821	50.	23.	UG/L	0.0		5/25/93		1,2,4-Trichlorobenzene

********** EM-9 QUALITY ASSURANCE REPORT **********

Blank Spike Duplicate Results, Sample # 93.04764 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/05/93 Date Analyzed: 4/28/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20226	93.04764	83329	50.	24.	UG/L	0.0		5/25/93		Acenaphthene
00.20226	93.04764	59507	100.	41.	UG/L	0.0		5/25/93		4-Chloro-3-methylphenol
00.20226	93.04764	95578	100.	32.	UG/L	0.0		5/25/93		o-Chlorophenol
00.20226	93.04764	106467	50.	14.	UG/L	0.0		5/25/93		p-Dichlorobenzene (1,4)
00.20226	93.04764	121142	50.	15.	UG/L	0.0		5/25/93		2,4-Dinitrotoluene
00.20226	93.04764	100027	100.	10.	UG/L	0.0		5/25/93		4-Nitrophenol
00.20226	93.04764	621647	50.	20.	UG/L	0.0		5/25/93		N-Nitrosodi-n-propylamine
00.20226	93.04764	87865	100.	10.	UG/L	0.0		5/25/93		Pentachlorophenol
00.20226	93.04764	108952	100.	36.	UG/L	0.0		5/25/93		Phenol
00.20226	93.04764	129000	50.	46.	UG/L	0.0		5/25/93		Pyrene
00.20226	93.04764	120821	50.	15.	UG/L	0.0		5/25/93		1,2,4-Trichlorobenzene

********** EM-9 QUALITY ASSURANCE REPORT **********

SUMMARY OF CONTROL STATUS OF BLIND QA SAMPLES RUN WITH THIS BATCH

Blind QC Results, Sample # 93.04762 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/05/93 Date Analyzed: 4/28/93

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND-NAME
93.04762	83329	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Acenaphthene
93.04762	208968	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Acenaphthylene
93.04762	62533	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Aniline
93.04762	120127	59.	17.7	UG/L	78.	4.	5/10/93	UNDER CONTROL	Anthracene
93.04762	103333	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Azobenzene
93.04762	92875	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	m-Benzidine
93.04762	56553	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzo[a]anthracene
93.04762	50328	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzo[a]pyrene
93.04762	205992	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzo[b]fluoranthene
93.04762	191242	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzo[g,h,i]perylene
93.04762	207089	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzo[k]fluoranthene
93.04762	65850	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzoic acid
93.04762	100516	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzyl alcohol
93.04762	111911	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Bis(2-chloroethoxy)methane
93.04762	111444	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Bis(2-chloroethyl)ether
93.04762	108601	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Bis(2-chloroisopropyl)ether
93.04762	117817	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Bis(2-ethylhexyl)phthalate
93.04762	101553	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	4-Bromophenylphenyl ether
93.04762	85687	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Butyl benzyl phthalate
93.04762	59507	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	4-Chloro-3-methylphenol
93.04762	106478	65.	19.5	UG/L	84.	4.	5/10/93	UNDER CONTROL	4-Chloroaniline
93.04762	91587	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2-Chloronaphthalene
93.04762	95578	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	o-Chlorophenol
93.04762	7005723	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	4-Chlorophenylphenyl ether
93.04762	218019	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Chrysene
93.04762	742	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Di-n-butyl phthalate

93.04762	117840	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Di-n-octyl phthalate
93.04762	53703	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Dibenzo[a,h]anthracene
93.04762	132649	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Dibenzofuran
93.04762	95501	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	o-Dichlorobenzene (1,2)
93.04762	541731	27.	8.1	UG/L	80.	4.	5/10/93	OUT OF CONTROL	m-Dichlorobenzene (1,3)
93.04762	106467	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	p-Dichlorobenzene (1,4)
93.04762	91941	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	3,3'-Dichlorobenzidine
93.04762	120832	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2,4-Dichlorophenol
93.04762	84662	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Diethyl phthalate
93.04762	131113	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Dimethyl phthalate
93.04762	105679	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2,4-Dimethylphenol
93.04762	51285	81.	24.3	UG/L	102.	5.	5/10/93	UNDER CONTROL	2,4-Dinitrophenol
93.04762	121142	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2,4-Dinitrotoluene
93.04762	606202	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2,6-Dinitrotoluene
93.04762	206440	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Fluoranthene
93.04762	86737	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Fluorene
93.04762	118741	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Hexachlorobenzene
93.04762	87683	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Hexachlorobutadiene
93.04762	77474	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Hexachlorocyclopentadiene
93.04762	67721	34.	10.2	UG/L	103.	5.	5/10/93	OUT OF CONTROL	Hexachloroethane
93.04762	193395	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Indeno[1,2,3-cd]pyrene
93.04762	78591	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Isophorone
93.04762	534521	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2-Methyl-4,6-dinitrophenol
93.04762	91576	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2-Methylnaphthalene
93.04762	95487	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2-Methylphenol
93.04762	106445	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	4-Methylphenol
93.04762	91203	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Naphthalene
93.04762	88744	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2-Nitroaniline
93.04762	99092	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	3-Nitroaniline
93.04762	100016	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	4-Nitroaniline
93.04762	98953	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Nitrobenzene
93.04762	88755	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2-Nitrophenol
93.04762	100027	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	4-Nitrophenol
93.04762	621647	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	N-Nitrosodi-n-propylamine
93.04762	62759	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	N-Nitrosodimethylamine
93.04762	86306	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	N-Nitrosodiphenylamine
93.04762	87865	66.	19.8	UG/L	97.	5.	5/10/93	UNDER CONTROL	Pentachlorophenol
93.04762	85018	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Phenanthrene
93.04762	108952	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Phenol
93.04762	129000	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Pyrene
93.04762	120821	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	1,2,4-Trichlorobenzene
93.04762	95954	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2,4,5-Trichlorophenol
93.04762	88062	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2,4,6-Trichlorophenol

********** EM-9 QUALITY ASSURANCE REPORT **********

SURROGATE RESULTS FOR EPA SEMIVOLATILES

Surrogate 1 = 2-Fluorophenol (CAS # = 367124)
Surrogate 2 = Phenol-d5 (CAS # = 4165622)
Surrogate 3 = Nitrobenzene-d5 (CAS # = 4165600)
Surrogate 4 = 2-Fluorobiphenyl (CAS # = 321608)
Surrogate 5 = 2,4,6-Tribromophenol (CAS # = 118796)
Surrogate 6 = p-Terphenyl-d14 (CAS # =)

SAMPLE NUMBER	UNITS	Surrogate 1	Surrogate 2	Surrogate 3	Surrogate 4	Surrogate 5	Surrogate 6	COMPLETION DATE
93.04762	%	40.15	52.24	46.8	52.9	58.12	80.66	10-May-1993
93.04764	%	29.8	34.91	56.42	55.6	39.79	76.8	25-May-1993
93.04764	%	25.54	35.36	35.86	41.98	42.4	85.76	25-May-1993
93.04870	%	53.55	66.69	71.66	72.04	95.85	30.18	25-May-1993
93.05027	%	57.14	71.66	63.16	56.92	51.74	86.38	25-May-1993
EPA Limits:								
Water	%	21 - 100	10 - 94	35 - 114	43 - 116	10 - 123	33 - 141	
Soil	%	25 - 121	24 - 113	23 - 120	30 - 115	19 - 122	18 - 137	

REPORT NUMBER: 18672

Analyst	Reviewer	Section Leader	QA Officer
5/26/93	5/26/93	5/26/93	5/26/93
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in
'ity Assurance for Health and Environmental Chemistry: 1986,' LA-1111' pp. 3-4.

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04845 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-0-0	93.04845	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-0-0	93.04845	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-0-0	93.04845	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-0-0	93.04845	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-0-0	93.04845	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-0-0	93.04845	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-0-0	93.04845	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-0-0	93.04845	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-0-0	93.04845	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-0-0	93.04845	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-0-0	93.04845	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-0-0	93.04845	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-0-0	93.04845	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-0-0	93.04845	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-0-0	93.04845	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-0-0	93.04845	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-0-0	93.04845	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-0-0	93.04845	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-0-0	93.04845	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-0-0	93.04845	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-0-0	93.04845	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-0-0	93.04845	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-0-0	93.04845	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-0-0	93.04845	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-0-0	93.04845	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-0-0	93.04845	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-0-0	93.04845	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-0-0	93.04845	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-0-0	93.04845	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-0-0	93.04845	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-0-0	93.04845	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-0-0	93.04845	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-0-0	93.04845	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-0-0	93.04845	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-0-0	93.04845	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-0-0	93.04845	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-0-0	93.04845	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-0-0	93.04845	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-0-0	93.04845	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-0-0	93.04845	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-0-0	93.04845	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-0-0	93.04845	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-0-0	93.04845	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-0-0	93.04845	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-0-0	93.04845	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-0-0	93.04845	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-0-0	93.04845	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-0-0	93.04845	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-0-0	93.04845	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-0-0	93.04845	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-0-0	93.04845	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-0-0	93.04845	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-0-0	93.04845	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-0-0	93.04845	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-0-0	93.04845	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-0-0	93.04845	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-0-0	93.04845	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-0-0	93.04845	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-0-0	93.04845	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-0-0	93.04845	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-0-0	93.04845	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-0-0	93.04845	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-0-0	93.04845	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-0-0	93.04845	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-0-0	93.04845	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-0-0	93.04845	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-0-0	93.04845	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-0-0	93.04845	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-0-0	93.04845	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04845

none

********** EM-9 ANALYTICAL REPORT **********

Matrix Spike Results for Sample # 93.04845 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-0-0	93.04845	83329	1744.42	1300.	UG/KG	5/25/93		Acenaphthene
14-35-0-0	93.04845	59507	3488.84	2300.	UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-0-0	93.04845	95578	3488.84	2400.	UG/KG	5/25/93		o-Chlorophenol
14-35-0-0	93.04845	106467	1744.42	1100.	UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-0-0	93.04845	121142	1744.42	1400.	UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-0-0	93.04845	100027	3488.84	2500.	UG/KG	5/25/93		4-Nitrophenol
14-35-0-0	93.04845	621647	1744.42	1300.	UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-0-0	93.04845	87865	3488.84	3000.	UG/KG	5/25/93		Pentachlorophenol
14-35-0-0	93.04845	108952	3488.84	2300.	UG/KG	5/25/93		Phenol
14-35-0-0	93.04845	129000	1744.42	1500.	UG/KG	5/25/93		Pyrene
14-35-0-0	93.04845	120821	1744.42	1200.	UG/KG	5/25/93		1,2,4-Trichlorobenzene

Matrix Spike Duplicate Results for Sample # 93.04845 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-0-0	93.04845	83329	1768.22	1200.	UG/KG	5/25/93		Acenaphthene
14-35-0-0	93.04845	59507	3536.44	2200.	UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-0-0	93.04845	95578	3536.44	1900.	UG/KG	5/25/93		o-Chlorophenol
14-35-0-0	93.04845	106467	1768.22	870.	UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-0-0	93.04845	121142	1768.22	1300.	UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-0-0	93.04845	100027	3536.44	2600.	UG/KG	5/25/93		4-Nitrophenol
14-35-0-0	93.04845	621647	1768.22	1100.	UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-0-0	93.04845	87865	3536.44	2800.	UG/KG	5/25/93		Pentachlorophenol
14-35-0-0	93.04845	108952	3536.44	1900.	UG/KG	5/25/93		Phenol
14-35-0-0	93.04845	129000	1768.22	1500.	UG/KG	5/25/93		Pyrene
14-35-0-0	93.04845	120821	1768.22	950.	UG/KG	5/25/93		1,2,4-Trichlorobenzene

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04846 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/04/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-5	93.04846	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-E-5	93.04846	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-E-5	93.04846	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-E-5	93.04846	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-E-5	93.04846	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-E-5	93.04846	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-E-5	93.04846	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-E-5	93.04846	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-E-5	93.04846	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-E-5	93.04846	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-E-5	93.04846	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-E-5	93.04846	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-E-5	93.04846	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-E-5	93.04846	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-E-5	93.04846	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-E-5	93.04846	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-E-5	93.04846	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-E-5	93.04846	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-E-5	93.04846	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-E-5	93.04846	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-E-5	93.04846	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-E-5	93.04846	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-E-5	93.04846	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-E-5	93.04846	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-E-5	93.04846	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-E-5	93.04846	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-5	93.04846	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-E-5	93.04846	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-E-5	93.04846	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-E-5	93.04846	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-E-5	93.04846	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-E-5	93.04846	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-E-5	93.04846	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-E-5	93.04846	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-E-5	93.04846	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-E-5	93.04846	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-E-5	93.04846	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-E-5	93.04846	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-E-5	93.04846	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-E-5	93.04846	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-E-5	93.04846	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-E-5	93.04846	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-E-5	93.04846	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-E-5	93.04846	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-E-5	93.04846	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-E-5	93.04846	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-E-5	93.04846	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-E-5	93.04846	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-E-5	93.04846	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-E-5	93.04846	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-E-5	93.04846	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-E-5	93.04846	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-E-5	93.04846	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-E-5	93.04846	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-E-5	93.04846	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-E-5	93.04846	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-E-5	93.04846	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-E-5	93.04846	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-E-5	93.04846	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-E-5	93.04846	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-E-5	93.04846	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-E-5	93.04846	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-5	93.04846	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-E-5	93.04846	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-E-5	93.04846	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-E-5	93.04846	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-E-5	93.04846	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-E-5	93.04846	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-E-5	93.04846	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04846

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04847 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-10	93.04847	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-E-10	93.04847	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-E-10	93.04847	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-E-10	93.04847	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-E-10	93.04847	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-E-10	93.04847	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-E-10	93.04847	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-E-10	93.04847	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-E-10	93.04847	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-E-10	93.04847	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-E-10	93.04847	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-E-10	93.04847	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-E-10	93.04847	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-E-10	93.04847	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-E-10	93.04847	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-E-10	93.04847	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-E-10	93.04847	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-E-10	93.04847	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-E-10	93.04847	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-E-10	93.04847	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-E-10	93.04847	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-E-10	93.04847	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-E-10	93.04847	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-E-10	93.04847	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-E-10	93.04847	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-E-10	93.04847	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-10	93.04847	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-E-10	93.04847	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-E-10	93.04847	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-E-10	93.04847	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-E-10	93.04847	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-E-10	93.04847	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-E-10	93.04847	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-E-10	93.04847	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-E-10	93.04847	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-E-10	93.04847	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-E-10	93.04847	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-E-10	93.04847	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-E-10	93.04847	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-E-10	93.04847	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-E-10	93.04847	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-E-10	93.04847	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-E-10	93.04847	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-E-10	93.04847	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-E-10	93.04847	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-E-10	93.04847	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-E-10	93.04847	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-E-10	93.04847	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-E-10	93.04847	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-E-10	93.04847	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-E-10	93.04847	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-E-10	93.04847	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-E-10	93.04847	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-E-10	93.04847	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-E-10	93.04847	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-E-10	93.04847	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-E-10	93.04847	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-E-10	93.04847	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-E-10	93.04847	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-E-10	93.04847	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-E-10	93.04847	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-E-10	93.04847	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-10	93.04847	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-E-10	93.04847	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-E-10	93.04847	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-E-10	93.04847	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-E-10	93.04847	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-E-10	93.04847	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-E-10	93.04847	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04847

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04848 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-25	93.04848	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-E-25	93.04848	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-E-25	93.04848	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-E-25	93.04848	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-E-25	93.04848	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-E-25	93.04848	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-E-25	93.04848	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-E-25	93.04848	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-E-25	93.04848	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-E-25	93.04848	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-E-25	93.04848	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-E-25	93.04848	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-E-25	93.04848	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-E-25	93.04848	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-E-25	93.04848	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-E-25	93.04848	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-E-25	93.04848	117817	690.	207.	UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-E-25	93.04848	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-E-25	93.04848	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-E-25	93.04848	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-E-25	93.04848	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-E-25	93.04848	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-E-25	93.04848	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-E-25	93.04848	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-E-25	93.04848	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-E-25	93.04848	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-25	93.04848	117840	690.	207.	UG/KG	5/25/93		Di-n-octyl phthalate
14-35-E-25	93.04848	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-E-25	93.04848	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-E-25	93.04848	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-E-25	93.04848	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-E-25	93.04848	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-E-25	93.04848	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-E-25	93.04848	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-E-25	93.04848	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-E-25	93.04848	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-E-25	93.04848	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-E-25	93.04848	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-E-25	93.04848	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-E-25	93.04848	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-E-25	93.04848	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-E-25	93.04848	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-E-25	93.04848	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-E-25	93.04848	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-E-25	93.04848	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-E-25	93.04848	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-E-25	93.04848	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-E-25	93.04848	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-E-25	93.04848	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-E-25	93.04848	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-E-25	93.04848	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-E-25	93.04848	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-E-25	93.04848	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-E-25	93.04848	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-E-25	93.04848	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-E-25	93.04848	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-E-25	93.04848	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-E-25	93.04848	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-E-25	93.04848	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-E-25	93.04848	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-E-25	93.04848	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-E-25	93.04848	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-25	93.04848	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-E-25	93.04848	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-E-25	93.04848	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-E-25	93.04848	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-E-25	93.04848	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-E-25	93.04848	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-E-25	93.04848	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04848

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04849 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/03/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-50	93.04849	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-E-50	93.04849	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-E-50	93.04849	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-E-50	93.04849	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-E-50	93.04849	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-E-50	93.04849	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-E-50	93.04849	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-E-50	93.04849	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-E-50	93.04849	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-E-50	93.04849	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-E-50	93.04849	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-E-50	93.04849	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-E-50	93.04849	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-E-50	93.04849	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-E-50	93.04849	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-E-50	93.04849	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-E-50	93.04849	117817	1100.	330.	UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-E-50	93.04849	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-E-50	93.04849	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-E-50	93.04849	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-E-50	93.04849	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-E-50	93.04849	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-E-50	93.04849	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-E-50	93.04849	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-E-50	93.04849	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-E	93.04849	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-50	93.04849	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-E-50	93.04849	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-E-50	93.04849	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-E-50	93.04849	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-E-50	93.04849	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-E-50	93.04849	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-E-50	93.04849	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-E-50	93.04849	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-E-50	93.04849	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-E-50	93.04849	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-E-50	93.04849	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-E-50	93.04849	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-E-50	93.04849	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-E-50	93.04849	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-E-50	93.04849	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-E-50	93.04849	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-E-50	93.04849	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-E-50	93.04849	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-E-50	93.04849	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-E-50	93.04849	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-E-50	93.04849	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-E-50	93.04849	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-E-50	93.04849	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-E-50	93.04849	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-E-50	93.04849	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-E-50	93.04849	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-E-50	93.04849	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-E-50	93.04849	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-E-50	93.04849	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-E-50	93.04849	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-E-50	93.04849	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-E-50	93.04849	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-E-50	93.04849	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-E-50	93.04849	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-E-50	93.04849	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-E-50	93.04849	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-50	93.04849	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-E-50	93.04849	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-E-50	93.04849	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-E-50	93.04849	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-E-50	93.04849	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-E-50	93.04849	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-E-50	93.04849	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04849

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04850 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-100	93.04850	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-E-100	93.04850	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-E-100	93.04850	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-E-100	93.04850	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-E-100	93.04850	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-E-100	93.04850	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-E-100	93.04850	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-E-100	93.04850	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-E-100	93.04850	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-E-100	93.04850	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-E-100	93.04850	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-E-100	93.04850	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-E-100	93.04850	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-E-100	93.04850	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-E-100	93.04850	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-E-100	93.04850	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-E-100	93.04850	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-E-100	93.04850	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-E-100	93.04850	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-E-100	93.04850	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-E-100	93.04850	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-E-100	93.04850	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-E-100	93.04850	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-E-100	93.04850	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-E-100	93.04850	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-E-100	93.04850	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-100	93.04850	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-E-100	93.04850	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-E-100	93.04850	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-E-100	93.04850	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-E-100	93.04850	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-E-100	93.04850	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-E-100	93.04850	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-E-100	93.04850	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-E-100	93.04850	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-E-100	93.04850	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-E-100	93.04850	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-E-100	93.04850	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-E-100	93.04850	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-E-100	93.04850	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-E-100	93.04850	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-E-100	93.04850	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-E-100	93.04850	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-E-100	93.04850	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-E-100	93.04850	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-E-100	93.04850	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-E-100	93.04850	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-E-100	93.04850	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-E-100	93.04850	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-E-100	93.04850	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-E-100	93.04850	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-E-100	93.04850	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-E-100	93.04850	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-E-100	93.04850	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-E-100	93.04850	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-E-100	93.04850	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-E-100	93.04850	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-E-100	93.04850	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-E-100	93.04850	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-E-100	93.04850	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-E-100	93.04850	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-E-100	93.04850	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-100	93.04850	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-E-100	93.04850	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-E-100	93.04850	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-E-100	93.04850	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-E-100	93.04850	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-E-100	93.04850	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-E-100	93.04850	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04850

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04851 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-10R	93.04851	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-E-10R	93.04851	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-E-10R	93.04851	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-E-10R	93.04851	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-E-10R	93.04851	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-E-10R	93.04851	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-E-10R	93.04851	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-E-10R	93.04851	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-E-10R	93.04851	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-E-10R	93.04851	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-E-10R	93.04851	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-E-10R	93.04851	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-E-10R	93.04851	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-E-10R	93.04851	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-E-10R	93.04851	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-E-10R	93.04851	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-E-10R	93.04851	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-E-10R	93.04851	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-E-10R	93.04851	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-E-10R	93.04851	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-E-10R	93.04851	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-E-10R	93.04851	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-E-10R	93.04851	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-E-10R	93.04851	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-E-10R	93.04851	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-E-10R	93.04851	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-10R	93.04851	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-E-10R	93.04851	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-E-10R	93.04851	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-E-10R	93.04851	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-E-10R	93.04851	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-E-10R	93.04851	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-E-10R	93.04851	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-E-10R	93.04851	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-E-10R	93.04851	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-E-10R	93.04851	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-E-10R	93.04851	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-E-10R	93.04851	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-E-10R	93.04851	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-E-10R	93.04851	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-E-10R	93.04851	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-E-10R	93.04851	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-E-10R	93.04851	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-E-10R	93.04851	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-E-10R	93.04851	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-E-10R	93.04851	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-E-10R	93.04851	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-E-10R	93.04851	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-E-10R	93.04851	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-E-10R	93.04851	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-E-10R	93.04851	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-E-10R	93.04851	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-E-10R	93.04851	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-E-10R	93.04851	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-E-10R	93.04851	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-E-10R	93.04851	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-E-10R	93.04851	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-E-10R	93.04851	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-E-10R	93.04851	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-E-10R	93.04851	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-E-10R	93.04851	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-E-10R	93.04851	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-10R	93.04851	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-E-10R	93.04851	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-E-10R	93.04851	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-E-10R	93.04851	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-E-10R	93.04851	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-E-10R	93.04851	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-E-10R	93.04851	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04851

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04852 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-5	93.04852	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SE-5	93.04852	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SE-5	93.04852	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SE-5	93.04852	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SE-5	93.04852	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SE-5	93.04852	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SE-5	93.04852	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SE-5	93.04852	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SE-5	93.04852	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SE-5	93.04852	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SE-5	93.04852	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SE-5	93.04852	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SE-5	93.04852	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SE-5	93.04852	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SE-5	93.04852	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SE-5	93.04852	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SE-5	93.04852	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SE-5	93.04852	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SE-5	93.04852	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SE-5	93.04852	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SE-5	93.04852	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SE-5	93.04852	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SE-5	93.04852	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SE-5	93.04852	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SE-5	93.04852	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SE-5	93.04852	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-5	93.04852	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SE-5	93.04852	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SE-5	93.04852	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SE-5	93.04852	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SE-5	93.04852	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SE-5	93.04852	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SE-5	93.04852	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SE-5	93.04852	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SE-5	93.04852	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SE-5	93.04852	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SE-5	93.04852	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SE-5	93.04852	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SE-5	93.04852	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SE-5	93.04852	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SE-5	93.04852	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SE-5	93.04852	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SE-5	93.04852	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SE-5	93.04852	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SE-5	93.04852	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SE-5	93.04852	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SE-5	93.04852	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SE-5	93.04852	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SE-5	93.04852	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SE-5	93.04852	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SE-5	93.04852	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SE-5	93.04852	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SE-5	93.04852	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SE-5	93.04852	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SE-5	93.04852	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SE-5	93.04852	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SE-5	93.04852	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SE-5	93.04852	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SE-5	93.04852	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SE-5	93.04852	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SE-5	93.04852	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SE-5	93.04852	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-5	93.04852	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SE-5	93.04852	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SE-5	93.04852	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SE-5	93.04852	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SE-5	93.04852	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SE-5	93.04852	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SE-5	93.04852	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04852

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04853 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-10	93.04853	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SE-10	93.04853	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SE-10	93.04853	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SE-10	93.04853	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SE-10	93.04853	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SE-10	93.04853	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SE-10	93.04853	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SE-10	93.04853	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SE-10	93.04853	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SE-10	93.04853	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SE-10	93.04853	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SE-10	93.04853	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SE-10	93.04853	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SE-10	93.04853	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SE-10	93.04853	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SE-10	93.04853	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SE-10	93.04853	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SE-10	93.04853	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SE-10	93.04853	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SE-10	93.04853	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SE-10	93.04853	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SE-10	93.04853	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SE-10	93.04853	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SE-10	93.04853	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SE-10	93.04853	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SE-10	93.04853	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-10	93.04853	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SE-10	93.04853	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SE-10	93.04853	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SE-10	93.04853	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SE-10	93.04853	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SE-10	93.04853	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SE-10	93.04853	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SE-10	93.04853	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SE-10	93.04853	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SE-10	93.04853	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SE-10	93.04853	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SE-10	93.04853	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SE-10	93.04853	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SE-10	93.04853	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SE-10	93.04853	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SE-10	93.04853	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SE-10	93.04853	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SE-10	93.04853	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SE-10	93.04853	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SE-10	93.04853	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SE-10	93.04853	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SE-10	93.04853	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SE-10	93.04853	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SE-10	93.04853	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SE-10	93.04853	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SE-10	93.04853	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SE-10	93.04853	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SE-10	93.04853	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SE-10	93.04853	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SE-10	93.04853	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SE-10	93.04853	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SE-10	93.04853	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SE-10	93.04853	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SE-10	93.04853	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SE-10	93.04853	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SE-10	93.04853	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-10	93.04853	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SE-10	93.04853	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SE-10	93.04853	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SE-10	93.04853	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SE-10	93.04853	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SE-10	93.04853	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SE-10	93.04853	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04853

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04854 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-25	93.04854	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SE-25	93.04854	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SE-25	93.04854	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SE-25	93.04854	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SE-25	93.04854	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SE-25	93.04854	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SE-25	93.04854	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SE-25	93.04854	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SE-25	93.04854	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SE-25	93.04854	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SE-25	93.04854	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SE-25	93.04854	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SE-25	93.04854	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SE-25	93.04854	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SE-25	93.04854	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SE-25	93.04854	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SE-25	93.04854	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SE-25	93.04854	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SE-25	93.04854	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SE-25	93.04854	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SE-25	93.04854	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SE-25	93.04854	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SE-25	93.04854	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SE-25	93.04854	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SE-25	93.04854	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SE-25	93.04854	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-25	93.04854	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SE-25	93.04854	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SE-25	93.04854	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SE-25	93.04854	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SE-25	93.04854	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SE-25	93.04854	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SE-25	93.04854	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SE-25	93.04854	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SE-25	93.04854	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SE-25	93.04854	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SE-25	93.04854	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SE-25	93.04854	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SE-25	93.04854	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SE-25	93.04854	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SE-25	93.04854	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SE-25	93.04854	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SE-25	93.04854	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SE-25	93.04854	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SE-25	93.04854	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SE-25	93.04854	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SE-25	93.04854	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SE-25	93.04854	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SE-25	93.04854	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SE-25	93.04854	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SE-25	93.04854	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SE-25	93.04854	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SE-25	93.04854	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SE-25	93.04854	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SE-25	93.04854	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SE-25	93.04854	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SE-25	93.04854	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SE-25	93.04854	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SE-25	93.04854	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SE-25	93.04854	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
35-SE-25	93.04854	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SE-25	93.04854	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-25	93.04854	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SE-25	93.04854	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SE-25	93.04854	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SE-25	93.04854	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SE-25	93.04854	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SE-25	93.04854	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SE-25	93.04854	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04854

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04855 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/03/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-50	93.04855	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SE-50	93.04855	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SE-50	93.04855	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SE-50	93.04855	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SE-50	93.04855	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SE-50	93.04855	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SE-50	93.04855	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SE-50	93.04855	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SE-50	93.04855	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SE-50	93.04855	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SE-50	93.04855	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SE-50	93.04855	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SE-50	93.04855	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SE-50	93.04855	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SE-50	93.04855	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SE-50	93.04855	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SE-50	93.04855	117817	870.	261.	UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SE-50	93.04855	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SE-50	93.04855	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SE-50	93.04855	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SE-50	93.04855	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SE-50	93.04855	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SE-50	93.04855	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SE-50	93.04855	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SE-50	93.04855	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SE-50	93.04855	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-50	93.04855	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SE-50	93.04855	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SE-50	93.04855	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SE-50	93.04855	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SE-50	93.04855	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SE-50	93.04855	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SE-50	93.04855	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SE-50	93.04855	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SE-50	93.04855	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SE-50	93.04855	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SE-50	93.04855	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SE-50	93.04855	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SE-50	93.04855	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SE-50	93.04855	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SE-50	93.04855	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SE-50	93.04855	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SE-50	93.04855	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SE-50	93.04855	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SE-50	93.04855	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SE-50	93.04855	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SE-50	93.04855	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SE-50	93.04855	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SE-50	93.04855	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SE-50	93.04855	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SE-50	93.04855	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SE-50	93.04855	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SE-50	93.04855	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SE-50	93.04855	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SE-50	93.04855	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SE-50	93.04855	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SE-50	93.04855	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SE-50	93.04855	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SE-50	93.04855	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SE-50	93.04855	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SE-50	93.04855	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SE-50	93.04855	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-50	93.04855	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SE-50	93.04855	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SE-50	93.04855	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SE-50	93.04855	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SE-50	93.04855	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SE-50	93.04855	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SE-50	93.04855	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04855

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04856 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/04/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-100	93.04856	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SE-100	93.04856	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SE-100	93.04856	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SE-100	93.04856	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SE-100	93.04856	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SE-100	93.04856	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SE-100	93.04856	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SE-100	93.04856	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SE-100	93.04856	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SE-100	93.04856	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SE-100	93.04856	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SE-100	93.04856	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SE-100	93.04856	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SE-100	93.04856	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SE-100	93.04856	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SE-100	93.04856	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SE-100	93.04856	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SE-100	93.04856	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SE-100	93.04856	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SE-100	93.04856	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SE-100	93.04856	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SE-100	93.04856	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SE-100	93.04856	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SE-100	93.04856	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SE-100	93.04856	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SE-100	93.04856	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-100	93.04856	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SE-100	93.04856	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SE-100	93.04856	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SE-100	93.04856	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SE-100	93.04856	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SE-100	93.04856	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SE-100	93.04856	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SE-100	93.04856	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SE-100	93.04856	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SE-100	93.04856	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SE-100	93.04856	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SE-100	93.04856	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SE-100	93.04856	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SE-100	93.04856	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SE-100	93.04856	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SE-100	93.04856	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SE-100	93.04856	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SE-100	93.04856	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SE-100	93.04856	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SE-100	93.04856	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SE-100	93.04856	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SE-100	93.04856	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SE-100	93.04856	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SE-100	93.04856	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SE-100	93.04856	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SE-100	93.04856	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SE-100	93.04856	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SE-100	93.04856	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SE-100	93.04856	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SE-100	93.04856	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SE-100	93.04856	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SE-100	93.04856	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SE-100	93.04856	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SE-100	93.04856	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SE-100	93.04856	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SE-100	93.04856	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-100	93.04856	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SE-100	93.04856	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SE-100	93.04856	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SE-100	93.04856	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SE-100	93.04856	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SE-100	93.04856	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SE-100	93.04856	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04856

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04857 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/03/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-5	93.04857	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SW-5	93.04857	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SW-5	93.04857	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SW-5	93.04857	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SW-5	93.04857	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SW-5	93.04857	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SW-5	93.04857	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SW-5	93.04857	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SW-5	93.04857	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SW-5	93.04857	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SW-5	93.04857	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SW-5	93.04857	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SW-5	93.04857	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SW-5	93.04857	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SW-5	93.04857	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SW-5	93.04857	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SW-5	93.04857	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SW-5	93.04857	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SW-5	93.04857	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SW-5	93.04857	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SW-5	93.04857	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SW-5	93.04857	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SW-5	93.04857	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SW-5	93.04857	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SW-5	93.04857	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SW-5	93.04857	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-5	93.04857	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SW-5	93.04857	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SW-5	93.04857	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SW-5	93.04857	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SW-5	93.04857	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SW-5	93.04857	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SW-5	93.04857	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SW-5	93.04857	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SW-5	93.04857	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SW-5	93.04857	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SW-5	93.04857	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SW-5	93.04857	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SW-5	93.04857	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SW-5	93.04857	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SW-5	93.04857	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SW-5	93.04857	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SW-5	93.04857	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SW-5	93.04857	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SW-5	93.04857	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SW-5	93.04857	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SW-5	93.04857	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SW-5	93.04857	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SW-5	93.04857	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SW-5	93.04857	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SW-5	93.04857	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SW-5	93.04857	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SW-5	93.04857	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SW-5	93.04857	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SW-5	93.04857	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SW-5	93.04857	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SW-5	93.04857	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SW-5	93.04857	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SW-5	93.04857	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SW-5	93.04857	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SW-5	93.04857	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SW-5	93.04857	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-5	93.04857	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SW-5	93.04857	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SW-5	93.04857	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SW-5	93.04857	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SW-5	93.04857	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SW-5	93.04857	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SW-5	93.04857	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04857

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04858 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/12/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-10	93.04858	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SW-10	93.04858	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SW-10	93.04858	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SW-10	93.04858	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SW-10	93.04858	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SW-10	93.04858	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SW-10	93.04858	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SW-10	93.04858	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SW-10	93.04858	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SW-10	93.04858	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SW-10	93.04858	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SW-10	93.04858	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SW-10	93.04858	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SW-10	93.04858	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SW-10	93.04858	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SW-10	93.04858	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SW-10	93.04858	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SW-10	93.04858	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SW-10	93.04858	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SW-10	93.04858	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SW-10	93.04858	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SW-10	93.04858	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SW-10	93.04858	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SW-10	93.04858	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SW-10	93.04858	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SW-10	93.04858	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-10	93.04858	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SW-10	93.04858	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SW-10	93.04858	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SW-10	93.04858	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SW-10	93.04858	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SW-10	93.04858	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SW-10	93.04858	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SW-10	93.04858	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SW-10	93.04858	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SW-10	93.04858	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SW-10	93.04858	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SW-10	93.04858	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SW-10	93.04858	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SW-10	93.04858	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SW-10	93.04858	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SW-10	93.04858	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SW-10	93.04858	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SW-10	93.04858	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SW-10	93.04858	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SW-10	93.04858	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SW-10	93.04858	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SW-10	93.04858	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SW-10	93.04858	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SW-10	93.04858	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SW-10	93.04858	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SW-10	93.04858	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SW-10	93.04858	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SW-10	93.04858	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SW-10	93.04858	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SW-10	93.04858	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SW-10	93.04858	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SW-10	93.04858	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SW-10	93.04858	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SW-10	93.04858	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SW-10	93.04858	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SW-10	93.04858	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-10	93.04858	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SW-10	93.04858	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SW-10	93.04858	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SW-10	93.04858	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SW-10	93.04858	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SW-10	93.04858	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SW-10	93.04858	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04858

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04859 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/12/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-25	93.04859	83329	< 3300.		UG/KG	5/25/93		Acenaphthene
14-35-SW-25	93.04859	208968	< 3300.		UG/KG	5/25/93		Acenaphthylene
14-35-SW-25	93.04859	62533	< 3300.		UG/KG	5/25/93		Aniline
14-35-SW-25	93.04859	120127	< 3300.		UG/KG	5/25/93		Anthracene
14-35-SW-25	93.04859	103333	< 3300.		UG/KG	5/25/93		Azobenzene
14-35-SW-25	93.04859	92875	< 3300.		UG/KG	5/25/93		m-Benzidine
14-35-SW-25	93.04859	56553	< 3300.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SW-25	93.04859	50328	< 3300.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SW-25	93.04859	205992	< 3300.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SW-25	93.04859	191242	< 3300.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SW-25	93.04859	207089	< 3300.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SW-25	93.04859	65850	< 3300.		UG/KG	5/25/93		Benzoic acid
14-35-SW-25	93.04859	100516	< 3300.		UG/KG	5/25/93		Benzyl alcohol
14-35-SW-25	93.04859	111911	< 3300.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SW-25	93.04859	111444	< 3300.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SW-25	93.04859	108601	< 3300.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SW-25	93.04859	117817	< 3300.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SW-25	93.04859	101553	< 3300.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SW-25	93.04859	85687	< 3300.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SW-25	93.04859	59507	< 3300.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SW-25	93.04859	106478	< 3300.		UG/KG	5/25/93		4-Chloroaniline
14-35-SW-25	93.04859	91587	< 3300.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SW-25	93.04859	95578	< 3300.		UG/KG	5/25/93		o-Chlorophenol
14-35-SW-25	93.04859	7005723	< 3300.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SW-25	93.04859	218019	< 3300.		UG/KG	5/25/93		Chrysene
14-35-SW-25	93.04859	84742	< 3300.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-25	93.04859	117840	< 3300.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SW-25	93.04859	53703	< 3300.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SW-25	93.04859	132649	< 3300.		UG/KG	5/25/93		Dibenzofuran
14-35-SW-25	93.04859	95501	< 3300.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SW-25	93.04859	541731	< 3300.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SW-25	93.04859	106467	< 3300.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SW-25	93.04859	91941	< 3300.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SW-25	93.04859	120832	< 3300.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SW-25	93.04859	84662	< 3300.		UG/KG	5/25/93		Diethyl phthalate
14-35-SW-25	93.04859	131113	< 3300.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SW-25	93.04859	105679	< 3300.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SW-25	93.04859	51285	< 3300.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SW-25	93.04859	121142	< 3300.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SW-25	93.04859	606202	< 3300.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SW-25	93.04859	206440	< 3300.		UG/KG	5/25/93		Fluoranthene
14-35-SW-25	93.04859	86737	< 3300.		UG/KG	5/25/93		Fluorene
14-35-SW-25	93.04859	118741	< 3300.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SW-25	93.04859	87683	< 3300.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SW-25	93.04859	77474	< 3300.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SW-25	93.04859	67721	< 3300.		UG/KG	5/25/93		Hexachloroethane
14-35-SW-25	93.04859	193395	< 3300.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SW-25	93.04859	78591	< 3300.		UG/KG	5/25/93		Isophorone
14-35-SW-25	93.04859	534521	< 3300.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SW-25	93.04859	91576	< 3300.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SW-25	93.04859	95487	< 3300.		UG/KG	5/25/93		2-Methylphenol
14-35-SW-25	93.04859	106445	< 3300.		UG/KG	5/25/93		4-Methylphenol
14-35-SW-25	93.04859	91203	< 3300.		UG/KG	5/25/93		Naphthalene
14-35-SW-25	93.04859	88744	< 3300.		UG/KG	5/25/93		2-Nitroaniline
14-35-SW-25	93.04859	99092	< 3300.		UG/KG	5/25/93		3-Nitroaniline
14-35-SW-25	93.04859	100016	< 3300.		UG/KG	5/25/93		4-Nitroaniline
14-35-SW-25	93.04859	98953	< 3300.		UG/KG	5/25/93		Nitrobenzene
14-35-SW-25	93.04859	88755	< 3300.		UG/KG	5/25/93		2-Nitrophenol
14-35-SW-25	93.04859	100027	< 3300.		UG/KG	5/25/93		4-Nitrophenol
14-35-SW-25	93.04859	621647	< 3300.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SW-25	93.04859	62759	< 3300.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SW-25	93.04859	86306	< 3300.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-25	93.04859	87865	< 3300.		UG/KG	5/25/93		Pentachlorophenol
14-35-SW-25	93.04859	85018	< 3300.		UG/KG	5/25/93		Phenanthrene
14-35-SW-25	93.04859	108952	< 3300.		UG/KG	5/25/93		Phenol
14-35-SW-25	93.04859	129000	< 3300.		UG/KG	5/25/93		Pyrene
14-35-SW-25	93.04859	120821	< 3300.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SW-25	93.04859	95954	< 3300.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SW-25	93.04859	88062	< 3300.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04859

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04860 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-50	93.04860	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SW-50	93.04860	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SW-50	93.04860	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SW-50	93.04860	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SW-50	93.04860	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SW-50	93.04860	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SW-50	93.04860	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SW-50	93.04860	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SW-50	93.04860	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SW-50	93.04860	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SW-50	93.04860	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SW-50	93.04860	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SW-50	93.04860	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SW-50	93.04860	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SW-50	93.04860	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SW-50	93.04860	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SW-50	93.04860	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SW-50	93.04860	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SW-50	93.04860	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SW-50	93.04860	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SW-50	93.04860	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SW-50	93.04860	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SW-50	93.04860	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SW-50	93.04860	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SW-50	93.04860	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SW-50	93.04860	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-50	93.04860	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SW-50	93.04860	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SW-50	93.04860	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SW-50	93.04860	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SW-50	93.04860	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SW-50	93.04860	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SW-50	93.04860	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SW-50	93.04860	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SW-50	93.04860	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SW-50	93.04860	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SW-50	93.04860	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SW-50	93.04860	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SW-50	93.04860	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SW-50	93.04860	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SW-50	93.04860	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SW-50	93.04860	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SW-50	93.04860	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SW-50	93.04860	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SW-50	93.04860	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SW-50	93.04860	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SW-50	93.04860	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SW-50	93.04860	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SW-50	93.04860	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SW-50	93.04860	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SW-50	93.04860	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SW-50	93.04860	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SW-50	93.04860	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SW-50	93.04860	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SW-50	93.04860	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SW-50	93.04860	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SW-50	93.04860	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SW-50	93.04860	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SW-50	93.04860	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SW-50	93.04860	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SW-50	93.04860	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SW-50	93.04860	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-50	93.04860	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SW-50	93.04860	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SW-50	93.04860	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SW-50	93.04860	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SW-50	93.04860	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SW-50	93.04860	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SW-50	93.04860	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04860

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04861 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/04/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-100	93.04861	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SW-100	93.04861	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SW-100	93.04861	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SW-100	93.04861	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SW-100	93.04861	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SW-100	93.04861	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SW-100	93.04861	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SW-100	93.04861	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SW-100	93.04861	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SW-100	93.04861	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SW-100	93.04861	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SW-100	93.04861	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SW-100	93.04861	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SW-100	93.04861	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SW-100	93.04861	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SW-100	93.04861	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SW-100	93.04861	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SW-100	93.04861	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SW-100	93.04861	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SW-100	93.04861	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SW-100	93.04861	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SW-100	93.04861	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SW-100	93.04861	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SW-100	93.04861	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SW-100	93.04861	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SW-100	93.04861	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-100	93.04861	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SW-100	93.04861	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SW-100	93.04861	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SW-100	93.04861	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SW-100	93.04861	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SW-100	93.04861	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SW-100	93.04861	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SW-100	93.04861	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SW-100	93.04861	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SW-100	93.04861	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SW-100	93.04861	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SW-100	93.04861	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SW-100	93.04861	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SW-100	93.04861	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SW-100	93.04861	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SW-100	93.04861	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SW-100	93.04861	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SW-100	93.04861	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SW-100	93.04861	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SW-100	93.04861	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SW-100	93.04861	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SW-100	93.04861	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SW-100	93.04861	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SW-100	93.04861	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SW-100	93.04861	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SW-100	93.04861	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SW-100	93.04861	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SW-100	93.04861	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SW-100	93.04861	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SW-100	93.04861	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SW-100	93.04861	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SW-100	93.04861	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SW-100	93.04861	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SW-100	93.04861	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SW-100	93.04861	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SW-100	93.04861	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-100	93.04861	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SW-100	93.04861	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SW-100	93.04861	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SW-100	93.04861	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SW-100	93.04861	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SW-100	93.04861	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SW-100	93.04861	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04861

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04862 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-5	93.04862	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-S-5	93.04862	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-S-5	93.04862	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-S-5	93.04862	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-S-5	93.04862	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-S-5	93.04862	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-S-5	93.04862	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-S-5	93.04862	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-S-5	93.04862	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-S-5	93.04862	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-S-5	93.04862	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-S-5	93.04862	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-S-5	93.04862	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-S-5	93.04862	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-S-5	93.04862	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-S-5	93.04862	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-S-5	93.04862	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-S-5	93.04862	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-S-5	93.04862	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-S-5	93.04862	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-5	93.04862	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-S-5	93.04862	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-S-5	93.04862	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-S-5	93.04862	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-S-5	93.04862	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-S-5	93.04862	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-5	93.04862	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-S-5	93.04862	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-S-5	93.04862	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-S-5	93.04862	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-S-5	93.04862	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-S-5	93.04862	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-5	93.04862	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-S-5	93.04862	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-S-5	93.04862	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-S-5	93.04862	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-S-5	93.04862	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-S-5	93.04862	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-S-5	93.04862	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-5	93.04862	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-S-5	93.04862	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-S-5	93.04862	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-S-5	93.04862	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-S-5	93.04862	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-S-5	93.04862	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-S-5	93.04862	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-S-5	93.04862	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-S-5	93.04862	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-S-5	93.04862	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-S-5	93.04862	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-S-5	93.04862	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-S-5	93.04862	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-S-5	93.04862	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-S-5	93.04862	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-S-5	93.04862	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-S-5	93.04862	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-S-5	93.04862	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-S-5	93.04862	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-S-5	93.04862	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-S-5	93.04862	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-5	93.04862	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-S-5	93.04862	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-5	93.04862	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-S-5	93.04862	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-S-5	93.04862	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-S-5	93.04862	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-S-5	93.04862	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-S-5	93.04862	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-S-5	93.04862	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04862

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04863 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/04/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-10	93.04863	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-S-10	93.04863	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-S-10	93.04863	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-S-10	93.04863	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-S-10	93.04863	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-S-10	93.04863	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-S-10	93.04863	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-S-10	93.04863	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-S-10	93.04863	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-S-10	93.04863	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-S-10	93.04863	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-S-10	93.04863	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-S-10	93.04863	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-S-10	93.04863	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-S-10	93.04863	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-S-10	93.04863	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-S-10	93.04863	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-S-10	93.04863	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-S-10	93.04863	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-S-10	93.04863	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-10	93.04863	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-S-10	93.04863	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-S-10	93.04863	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-S-10	93.04863	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-S-10	93.04863	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-S-10	93.04863	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-10	93.04863	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-S-10	93.04863	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-S-10	93.04863	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-S-10	93.04863	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-S-10	93.04863	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-S-10	93.04863	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-10	93.04863	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-S-10	93.04863	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-S-10	93.04863	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-S-10	93.04863	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-S-10	93.04863	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-S-10	93.04863	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-S-10	93.04863	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-10	93.04863	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-S-10	93.04863	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-S-10	93.04863	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-S-10	93.04863	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-S-10	93.04863	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-S-10	93.04863	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-S-10	93.04863	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-S-10	93.04863	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-S-10	93.04863	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-S-10	93.04863	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-S-10	93.04863	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-S-10	93.04863	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-S-10	93.04863	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-S-10	93.04863	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-S-10	93.04863	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-S-10	93.04863	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-S-10	93.04863	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-S-10	93.04863	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-S-10	93.04863	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-S-10	93.04863	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-S-10	93.04863	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-10	93.04863	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-S-10	93.04863	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-10	93.04863	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-S-10	93.04863	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-S-10	93.04863	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-S-10	93.04863	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-S-10	93.04863	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-S-10	93.04863	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-S-10	93.04863	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04863

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04864 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/03/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-25	93.04864	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-S-25	93.04864	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-S-25	93.04864	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-S-25	93.04864	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-S-25	93.04864	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-S-25	93.04864	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-S-25	93.04864	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-S-25	93.04864	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-S-25	93.04864	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-S-25	93.04864	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-S-25	93.04864	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-S-25	93.04864	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-S-25	93.04864	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-S-25	93.04864	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-S-25	93.04864	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-S-25	93.04864	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-S-25	93.04864	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-S-25	93.04864	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-S-25	93.04864	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-S-25	93.04864	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-25	93.04864	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-S-25	93.04864	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-S-25	93.04864	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-S-25	93.04864	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-S-25	93.04864	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-S-25	93.04864	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-25	93.04864	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-S-25	93.04864	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-S-25	93.04864	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-S-25	93.04864	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-S-25	93.04864	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-S-25	93.04864	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-25	93.04864	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-S-25	93.04864	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-S-25	93.04864	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-S-25	93.04864	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-S-25	93.04864	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-S-25	93.04864	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-S-25	93.04864	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-25	93.04864	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-S-25	93.04864	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-S-25	93.04864	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-S-25	93.04864	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-S-25	93.04864	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-S-25	93.04864	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-S-25	93.04864	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-S-25	93.04864	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-S-25	93.04864	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-S-25	93.04864	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-S-25	93.04864	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-S-25	93.04864	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-S-25	93.04864	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-S-25	93.04864	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-S-25	93.04864	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-S-25	93.04864	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-S-25	93.04864	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-S-25	93.04864	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-S-25	93.04864	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-S-25	93.04864	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-S-25	93.04864	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-25	93.04864	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-S-25	93.04864	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-25	93.04864	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-S-25	93.04864	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-S-25	93.04864	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-S-25	93.04864	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-S-25	93.04864	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-S-25	93.04864	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-S-25	93.04864	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04864

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04865 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-50	93.04865	83329	< 3300.		UG/KG	5/25/93		Acenaphthene
14-35-S-50	93.04865	208968	< 3300.		UG/KG	5/25/93		Acenaphthylene
14-35-S-50	93.04865	62533	< 3300.		UG/KG	5/25/93		Aniline
14-35-S-50	93.04865	120127	< 3300.		UG/KG	5/25/93		Anthracene
14-35-S-50	93.04865	103333	< 3300.		UG/KG	5/25/93		Azobenzene
14-35-S-50	93.04865	92875	< 3300.		UG/KG	5/25/93		m-Benzidine
14-35-S-50	93.04865	56553	< 3300.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-S-50	93.04865	50328	< 3300.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-S-50	93.04865	205992	< 3300.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-S-50	93.04865	191242	< 3300.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-S-50	93.04865	207089	< 3300.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-S-50	93.04865	65850	< 3300.		UG/KG	5/25/93		Benzoic acid
14-35-S-50	93.04865	100516	< 3300.		UG/KG	5/25/93		Benzyl alcohol
14-35-S-50	93.04865	111911	< 3300.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-S-50	93.04865	111444	< 3300.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-S-50	93.04865	108601	< 3300.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-S-50	93.04865	117817	< 3300.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-S-50	93.04865	101553	< 3300.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-S-50	93.04865	85687	< 3300.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-S-50	93.04865	59507	< 3300.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-50	93.04865	106478	< 3300.		UG/KG	5/25/93		4-Chloroaniline
14-35-S-50	93.04865	91587	< 3300.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-S-50	93.04865	95578	< 3300.		UG/KG	5/25/93		o-Chlorophenol
14-35-S-50	93.04865	7005723	< 3300.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-S-50	93.04865	218019	< 3300.		UG/KG	5/25/93		Chrysene
14-35-S-50	93.04865	84742	< 3300.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-50	93.04865	117840	< 3300.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-S-50	93.04865	53703	< 3300.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-S-50	93.04865	132649	< 3300.		UG/KG	5/25/93		Dibenzofuran
14-35-S-50	93.04865	95501	< 3300.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-S-50	93.04865	541731	< 3300.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-S-50	93.04865	106467	< 3300.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-50	93.04865	91941	< 3300.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-S-50	93.04865	120832	< 3300.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-S-50	93.04865	84662	< 3300.		UG/KG	5/25/93		Diethyl phthalate
14-35-S-50	93.04865	131113	< 3300.		UG/KG	5/25/93		Dimethyl phthalate
14-35-S-50	93.04865	105679	< 3300.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-S-50	93.04865	51285	< 3300.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-S-50	93.04865	121142	< 3300.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-50	93.04865	606202	< 3300.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-S-50	93.04865	206440	< 3300.		UG/KG	5/25/93		Fluoranthene
14-35-S-50	93.04865	86737	< 3300.		UG/KG	5/25/93		Fluorene
14-35-S-50	93.04865	118741	< 3300.		UG/KG	5/25/93		Hexachlorobenzene
14-35-S-50	93.04865	87683	< 3300.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-S-50	93.04865	77474	< 3300.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-S-50	93.04865	67721	< 3300.		UG/KG	5/25/93		Hexachloroethane
14-35-S-50	93.04865	193395	< 3300.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-S-50	93.04865	78591	< 3300.		UG/KG	5/25/93		Isophorone
14-35-S-50	93.04865	534521	< 3300.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-S-50	93.04865	91576	< 3300.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-S-50	93.04865	95487	< 3300.		UG/KG	5/25/93		2-Methylphenol
14-35-S-50	93.04865	106445	< 3300.		UG/KG	5/25/93		4-Methylphenol
14-35-S-50	93.04865	91203	< 3300.		UG/KG	5/25/93		Naphthalene
14-35-S-50	93.04865	88744	< 3300.		UG/KG	5/25/93		2-Nitroaniline
14-35-S-50	93.04865	99092	< 3300.		UG/KG	5/25/93		3-Nitroaniline
14-35-S-50	93.04865	100016	< 3300.		UG/KG	5/25/93		4-Nitroaniline
14-35-S-50	93.04865	98953	< 3300.		UG/KG	5/25/93		Nitrobenzene
14-35-S-50	93.04865	88755	< 3300.		UG/KG	5/25/93		2-Nitrophenol
14-35-S-50	93.04865	100027	< 3300.		UG/KG	5/25/93		4-Nitrophenol
14-35-S-50	93.04865	621647	< 3300.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-50	93.04865	62759	< 3300.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-S-50	93.04865	86306	< 3300.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** CM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-50	93.04865	87865	< 3300.		UG/KG	5/25/93		Pentachlorophenol
14-35-S-50	93.04865	85018	< 3300.		UG/KG	5/25/93		Phenanthrene
14-35-S-50	93.04865	108952	< 3300.		UG/KG	5/25/93		Phenol
14-35-S-50	93.04865	129000	3800.	1140.	UG/KG	5/25/93		Pyrene
14-35-S-50	93.04865	120821	< 3300.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-S-50	93.04865	95954	< 3300.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-S-50	93.04865	88062	< 3300.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04865

none

********** EM-9 ANALYTICAL REPORT **********

Matrix Spike Results for Sample # 93.04865 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-50	93.04865	83329	< 1790.07	3300.	UG/KG	5/25/93		Acenaphthene
14-35-S-50	93.04865	59507	< 3580.14	3300.	UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-50	93.04865	95578	< 3580.14	3300.	UG/KG	5/25/93		o-Chlorophenol
14-35-S-50	93.04865	106467	< 1790.07	3300.	UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-50	93.04865	121142	< 1790.07	3300.	UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-50	93.04865	100027	< 3580.14	3300.	UG/KG	5/25/93		4-Nitrophenol
14-35-S-50	93.04865	621647	< 1790.07	3300.	UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-50	93.04865	87865	< 3580.14	3300.	UG/KG	5/25/93		Pentachlorophenol
14-35-S-50	93.04865	108952	< 3580.14	3300.	UG/KG	5/25/93		Phenol
14-35-S-50	93.04865	129000	< 1790.07	3300.	UG/KG	5/25/93		Pyrene
14-35-S-50	93.04865	120821	< 1790.07	3300.	UG/KG	5/25/93		1,2,4-Trichlorobenzene

Matrix Spike Duplicate Results for Sample # 93.04865 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-50	93.04865	83329	< 1818.64	3300.	UG/KG	5/25/93		Acenaphthene
14-35-S-50	93.04865	59507	< 3637.27	3300.	UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-50	93.04865	95578	< 3637.27	3300.	UG/KG	5/25/93		o-Chlorophenol
14-35-S-50	93.04865	106467	< 1818.64	3300.	UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-50	93.04865	121142	< 1818.64	3300.	UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-50	93.04865	100027	< 3637.27	3300.	UG/KG	5/25/93		4-Nitrophenol
14-35-S-50	93.04865	621647	< 1818.64	3300.	UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-50	93.04865	87865	< 3637.27	3300.	UG/KG	5/25/93		Pentachlorophenol
14-35-S-50	93.04865	108952	< 3637.27	3300.	UG/KG	5/25/93		Phenol
14-35-S-50	93.04865	129000	< 1818.64	3300.	UG/KG	5/25/93		Pyrene
14-35-S-50	93.04865	120821	< 1818.64	3300.	UG/KG	5/25/93		1,2,4-Trichlorobenzene

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04866 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/04/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-10R	93.04866	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-S-10R	93.04866	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-S-10R	93.04866	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-S-10R	93.04866	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-S-10R	93.04866	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-S-10R	93.04866	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-S-10R	93.04866	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-S-10R	93.04866	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-S-10R	93.04866	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-S-10R	93.04866	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-S-10R	93.04866	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-S-10R	93.04866	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-S-10R	93.04866	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-S-10R	93.04866	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-S-10R	93.04866	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-S-10R	93.04866	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-S-10R	93.04866	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-S-10R	93.04866	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-S-10R	93.04866	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-S-10R	93.04866	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-10R	93.04866	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-S-10R	93.04866	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-S-10R	93.04866	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-S-10R	93.04866	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-S-10R	93.04866	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-S-10R	93.04866	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-10R	93.04866	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-S-10R	93.04866	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-S-10R	93.04866	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-S-10R	93.04866	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-S-10R	93.04866	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-S-10R	93.04866	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-10R	93.04866	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-S-10R	93.04866	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-S-10R	93.04866	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-S-10R	93.04866	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-S-10R	93.04866	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-S-10R	93.04866	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-S-10R	93.04866	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-10R	93.04866	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-S-10R	93.04866	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-S-10R	93.04866	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-S-10R	93.04866	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-S-10R	93.04866	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-S-10R	93.04866	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-S-10R	93.04866	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-S-10R	93.04866	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-S-10R	93.04866	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-S-10R	93.04866	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-S-10R	93.04866	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-S-10R	93.04866	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-S-10R	93.04866	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-S-10R	93.04866	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-S-10R	93.04866	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-S-10R	93.04866	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-S-10R	93.04866	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-S-10R	93.04866	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-S-10R	93.04866	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-S-10R	93.04866	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-S-10R	93.04866	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-10R	93.04866	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-S-10R	93.04866	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-10R	93.04866	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-S-10R	93.04866	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-S-10R	93.04866	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-S-10R	93.04866	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-S-10R	93.04866	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-S-10R	93.04866	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-S-10R	93.04866	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04866

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04867 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-100	93.04867	83329	< 3300.		UG/KG	5/25/93		Acenaphthene
14-35-S-100	93.04867	208968	< 3300.		UG/KG	5/25/93		Acenaphthylene
14-35-S-100	93.04867	62533	< 3300.		UG/KG	5/25/93		Aniline
14-35-S-100	93.04867	120127	< 3300.		UG/KG	5/25/93		Anthracene
14-35-S-100	93.04867	103333	< 3300.		UG/KG	5/25/93		Azobenzene
14-35-S-100	93.04867	92875	< 3300.		UG/KG	5/25/93		m-Benzidine
14-35-S-100	93.04867	56553	< 3300.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-S-100	93.04867	50328	< 3300.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-S-100	93.04867	205992	< 3300.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-S-100	93.04867	191242	< 3300.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-S-100	93.04867	207089	< 3300.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-S-100	93.04867	65850	< 3300.		UG/KG	5/25/93		Benzoic acid
14-35-S-100	93.04867	100516	< 3300.		UG/KG	5/25/93		Benzyl alcohol
14-35-S-100	93.04867	111911	< 3300.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-S-100	93.04867	111444	< 3300.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-S-100	93.04867	108601	< 3300.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-S-100	93.04867	117817	< 3300.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-S-100	93.04867	101553	< 3300.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-S-100	93.04867	85687	< 3300.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-S-100	93.04867	59507	< 3300.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-100	93.04867	106478	< 3300.		UG/KG	5/25/93		4-Chloroaniline
14-35-S-100	93.04867	91587	< 3300.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-S-100	93.04867	95578	< 3300.		UG/KG	5/25/93		o-Chlorophenol
14-35-S-100	93.04867	7005723	< 3300.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-S-100	93.04867	218019	< 3300.		UG/KG	5/25/93		Chrysene
14-35-S-100	93.04867	84742	< 3300.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-100	93.04867	117840	< 3300.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-S-100	93.04867	53703	< 3300.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-S-100	93.04867	132649	< 3300.		UG/KG	5/25/93		Dibenzofuran
14-35-S-100	93.04867	95501	< 3300.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-S-100	93.04867	541731	< 3300.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-S-100	93.04867	106467	< 3300.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-100	93.04867	91941	< 3300.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-S-100	93.04867	120832	< 3300.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-S-100	93.04867	84662	< 3300.		UG/KG	5/25/93		Diethyl phthalate
14-35-S-100	93.04867	131113	< 3300.		UG/KG	5/25/93		Dimethyl phthalate
14-35-S-100	93.04867	105679	< 3300.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-S-100	93.04867	51285	< 3300.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-S-100	93.04867	121142	< 3300.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-100	93.04867	606202	< 3300.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-S-100	93.04867	206440	< 3300.		UG/KG	5/25/93		Fluoranthene
14-35-S-100	93.04867	86737	< 3300.		UG/KG	5/25/93		Fluorene
14-35-S-100	93.04867	118741	< 3300.		UG/KG	5/25/93		Hexachlorobenzene
14-35-S-100	93.04867	87683	< 3300.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-S-100	93.04867	77474	< 3300.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-S-100	93.04867	67721	< 3300.		UG/KG	5/25/93		Hexachloroethane
14-35-S-100	93.04867	193395	< 3300.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-S-100	93.04867	78591	< 3300.		UG/KG	5/25/93		Isophorone
14-35-S-100	93.04867	534521	< 3300.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-S-100	93.04867	91576	< 3300.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-S-100	93.04867	95487	< 3300.		UG/KG	5/25/93		2-Methylphenol
14-35-S-100	93.04867	106445	< 3300.		UG/KG	5/25/93		4-Methylphenol
14-35-S-100	93.04867	91203	< 3300.		UG/KG	5/25/93		Naphthalene
14-35-S-100	93.04867	88744	< 3300.		UG/KG	5/25/93		2-Nitroaniline
14-35-S-100	93.04867	99092	< 3300.		UG/KG	5/25/93		3-Nitroaniline
14-35-S-100	93.04867	100016	< 3300.		UG/KG	5/25/93		4-Nitroaniline
14-35-S-100	93.04867	98953	< 3300.		UG/KG	5/25/93		Nitrobenzene
14-35-S-100	93.04867	88755	< 3300.		UG/KG	5/25/93		2-Nitrophenol
14-35-S-100	93.04867	100027	< 3300.		UG/KG	5/25/93		4-Nitrophenol
14-35-S-100	93.04867	621647	< 3300.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-100	93.04867	62759	< 3300.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-S-100	93.04867	86306	< 3300.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-100	93.04867	87865	< 3300.		UG/KG	5/25/93		Pentachlorophenol
14-35-S-100	93.04867	85018	< 3300.		UG/KG	5/25/93		Phenanthrene
14-35-S-100	93.04867	108952	< 3300.		UG/KG	5/25/93		Phenol
14-35-S-100	93.04867	129000	< 3300.		UG/KG	5/25/93		Pyrene
14-35-S-100	93.04867	120821	< 3300.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-S-100	93.04867	95954	< 3300.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-S-100	93.04867	88062	< 3300.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04867

none

REPORT NUMBER: 18666

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04868 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-UD	93.04868	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-UD	93.04868	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-UD	93.04868	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-UD	93.04868	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-UD	93.04868	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-UD	93.04868	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-UD	93.04868	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-UD	93.04868	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-UD	93.04868	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-UD	93.04868	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-UD	93.04868	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-UD	93.04868	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-UD	93.04868	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-UD	93.04868	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-UD	93.04868	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-UD	93.04868	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-UD	93.04868	117817	540.	162.	UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-UD	93.04868	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-UD	93.04868	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-UD	93.04868	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-UD	93.04868	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-UD	93.04868	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-UD	93.04868	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-UD	93.04868	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-UD	93.04868	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-UD	93.04868	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-UD	93.04868	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-UD	93.04868	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-UD	93.04868	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-UD	93.04868	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-UD	93.04868	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-UD	93.04868	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-UD	93.04868	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-UD	93.04868	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-UD	93.04868	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-UD	93.04868	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-UD	93.04868	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-UD	93.04868	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-UD	93.04868	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-UD	93.04868	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-UD	93.04868	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-UD	93.04868	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-UD	93.04868	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-UD	93.04868	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-UD	93.04868	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-UD	93.04868	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-UD	93.04868	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-UD	93.04868	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-UD	93.04868	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-UD	93.04868	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-UD	93.04868	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-UD	93.04868	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-UD	93.04868	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-UD	93.04868	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-UD	93.04868	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-UD	93.04868	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-UD	93.04868	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-UD	93.04868	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-UD	93.04868	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-UD	93.04868	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-UD	93.04868	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-UD	93.04868	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-UD	93.04868	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-UD	93.04868	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-UD	93.04868	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-UD	93.04868	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-UD	93.04868	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-UD	93.04868	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-UD	93.04868	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04868

none

********** EM-9 ANALYTICAL REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04869 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-LD	93.04869	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-LD	93.04869	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-LD	93.04869	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-LD	93.04869	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-LD	93.04869	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-LD	93.04869	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-LD	93.04869	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-LD	93.04869	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-LD	93.04869	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-LD	93.04869	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-LD	93.04869	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-LD	93.04869	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-LD	93.04869	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-LD	93.04869	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-LD	93.04869	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-LD	93.04869	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-LD	93.04869	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-LD	93.04869	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-LD	93.04869	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-LD	93.04869	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-LD	93.04869	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-LD	93.04869	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-LD	93.04869	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-LD	93.04869	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-LD	93.04869	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-LD	93.04869	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-LD	93.04869	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-LD	93.04869	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-LD	93.04869	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-LD	93.04869	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene ( )
14-35-LD	93.04869	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-LD	93.04869	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-LD	93.04869	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-LD	93.04869	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-LD	93.04869	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-LD	93.04869	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-LD	93.04869	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-LD	93.04869	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-LD	93.04869	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-LD	93.04869	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-LD	93.04869	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-LD	93.04869	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-LD	93.04869	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-LD	93.04869	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-LD	93.04869	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-LD	93.04869	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-LD	93.04869	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-LD	93.04869	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-LD	93.04869	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-LD	93.04869	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-LD	93.04869	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-LD	93.04869	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-LD	93.04869	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-LD	93.04869	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-LD	93.04869	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-LD	93.04869	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-LD	93.04869	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-LD	93.04869	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-LD	93.04869	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-LD	93.04869	6216[illegible]	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-LD	93.04869	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-LD	93.04869	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-LD	93.04869	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-LD	93.04869	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-LD	93.04869	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-LD	93.04869	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-LD	93.04869	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-LD	93.04869	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-LD	93.04869	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively identified Compounds in Customer Sample # 93.04869

none

********** EM-9 QUALITY ASSURANCE REPORT **********

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QA SAMPLES RUN WITH THIS BATCH

There were no open (non-blind) Quality Control materials run with the samples reported above for one of the following reasons:

____ Only qualitative data requested

____ Only Blind QC samples run with this batch.

____ No QC samples run with this sample batch.

____ No QC samples for this constituent and matrix type available within EM-9

********** EM-9 QUALITY ASSURANCE REPORT **********

SUMMARY OF CONTROL STATUS OF BLANK QC SAMPLES RUN WITH THIS BATCH

Blank Results, Sample # 93.04902 Date Collected: 4/01/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/28/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20227	93.04902	83329	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthene
00.20227	93.04902	208968	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthylene
00.20227	93.04902	62533	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Aniline
00.20227	93.04902	120127	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Anthracene
00.20227	93.04902	103333	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Azobenzene
00.20227	93.04902	92875	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	m-Benzidine
00.20227	93.04902	56553	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]anthracene
00.20227	93.04902	50328	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]pyrene
00.20227	93.04902	205992	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[b]fluoranthene
00.20227	93.04902	191242	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[g,h,i]perylene
00.20227	93.04902	207089	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[k]fluoranthene
00.20227	93.04902	65850	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzoic acid
00.20227	93.04902	100516	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzyl alcohol
00.20227	93.04902	111911	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethoxy)methane
00.20227	93.04902	111444	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethyl)ether
00.20227	93.04902	108601	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroisopropyl)ether
00.20227	93.04902	117817	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-ethylhexyl)phthalate
00.20227	93.04902	101553	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Bromophenylphenyl ether
00.20227	93.04902	85687	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Butyl benzyl phthalate
00.20227	93.04902	59507	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Chloro-3-methylphenol
00.20227	93.04902	106478	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Chloroaniline

********** EM-9 QUALITY ASSURANCE REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20227	93.04902	91587	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Chloronaphthalene
00.20227	93.04902	95578	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	o-Chlorophenol
00.20227	93.04902	7005723	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Chlorophenylphenyl ether
00.20227	93.04902	218019	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Chrysene
00.20227	93.04902	84742	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-butyl phthalate
00.20227	93.04902	117840	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-octyl phthalate
00.20227	93.04902	53703	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzo[a,h]anthracene
00.20227	93.04902	132649	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzofuran
00.20227	93.04902	95501	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	o-Dichlorobenzene (1,2)
00.20227	93.04902	541731	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	m-Dichlorobenzene (1,3)
00.20227	93.04902	106467	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	p-Dichlorobenzene (1,4)
00.20227	93.04902	91941	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	3,3'-Dichlorobenzidine
00.20227	93.04902	120832	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dichlorophenol
00.20227	93.04902	84662	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Diethyl phthalate
00.20227	93.04902	131113	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Dimethyl phthalate
00.20227	93.04902	105679	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dimethylphenol
00.20227	93.04902	51285	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrophenol
00.20227	93.04902	121142	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrotoluene
00.20227	93.04902	606202	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,6-Dinitrotoluene
00.20227	93.04902	206440	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Fluoranthene
00.20227	93.04902	86737	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Fluorene
00.20227	93.04902	118741	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobenzene
00.20227	93.04902	87683	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobutadiene
00.20227	93.04902	77474	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorocyclopentadiene
00.20227	93.04902	67721	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachloroethane
00.20227	93.04902	193395	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Indeno[1,2,3-cd]pyrene
00.20227	93.04902	78591	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Isophorone
00.20227	93.04902	534521	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Methyl-4,6-dinitrophenol
00.20227	93.04902	91576	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylnaphthalene
00.20227	93.04902	95487	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylphenol
00.20227	93.04902	106445	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Methylphenol
00.20227	93.04902	91203	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Naphthalene
00.20227	93.04902	88744	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitroaniline
00.20227	93.04902	99092	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	3-Nitroaniline
00.20227	93.04902	100016	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitroaniline
00.20227	93.04902	98953	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Nitrobenzene

REPORT NUMBER: 18666

********** EM-9 QUALITY ASSURANCE REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20227	93.04902	88755	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitrophenol
00.20227	93.04902	100027	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitrophenol
00.20227	93.04902	621647	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodi-n-propylamine
00.20227	93.04902	62759	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodimethylamine
00.20227	93.04902	86306	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodiphenylamine
00.20227	93.04902	87865	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Pentachlorophenol
00.20227	93.04902	85018	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Phenanthrene
00.20227	93.04902	108952	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Phenol
00.20227	93.04902	129000	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Pyrene
00.20227	93.04902	120821	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	1,2,4-Trichlorobenzene
00.20227	93.04902	95954	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4,5-Trichlorophenol
00.20227	93.04902	88062	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4,6-Trichlorophenol

Blank Results, Sample # 93.04903 Date Collected: 4/01/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/28/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20227	93.04903	83329	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthene
00.20227	93.04903	208968	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthylene
00.20227	93.04903	62533	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Aniline
00.20227	93.04903	120127	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Anthracene
00.20227	93.04903	103333	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Azobenzene
00.20227	93.04903	92875	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	m-Benzidine
00.20227	93.04903	56553	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]anthracene
00.20227	93.04903	50328	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]pyrene
00.20227	93.04903	205992	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[b]fluoranthene

********** EM-9 QUALITY ASSURANCE REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20227	93.04903	191242	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[g,h,i]perylene
00.20227	93.04903	207089	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[k]fluoranthene
00.20227	93.04903	65850	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzoic acid
00.20227	93.04903	100516	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzyl alcohol
00.20227	93.04903	111911	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethoxy)methane
00.20227	93.04903	111444	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethyl)ether
00.20227	93.04903	108601	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroisopropyl)ether
00.20227	93.04903	117817	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-ethylhexyl)phthalate
00.20227	93.04903	101553	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Bromophenylphenyl ether
00.20227	93.04903	85687	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Butyl benzyl phthalate
00.20227	93.04903	59507	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Chloro-3-methylphenol
00.20227	93.04903	106478	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Chloroaniline
00.20227	93.04903	91587	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Chloronaphthalene
00.20227	93.04903	95578	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	o-Chlorophenol
00.20227	93.04903	7005723	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Chlorophenylphenyl ether
00.20227	93.04903	218019	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Chrysene
00.20227	93.04903	84742	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-butyl phthalate
00.20227	93.04903	117840	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-octyl phthalate
00.20227	93.04903	53703	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzo[a,h]anthracene
00.20227	93.04903	132649	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzofuran
00.20227	93.04903	95501	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	o-Dichlorobenzene (1,2)
00.20227	93.04903	541731	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	m-Dichlorobenzene (1,3)
00.20227	93.04903	106467	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	p-Dichlorobenzene (1,4)
00.20227	93.04903	91941	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	3,3'-Dichlorobenzidine
00.20227	93.04903	120832	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dichlorophenol
00.20227	93.04903	84662	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Diethyl phthalate
00.20227	93.04903	131113	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Dimethyl phthalate
00.20227	93.04903	105679	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dimethylphenol
00.20227	93.04903	51285	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrophenol
00.20227	93.04903	121142	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrotoluene
00.20227	93.04903	606202	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,6-Dinitrotoluene
00.20227	93.04903	206440	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Fluoranthene
00.20227	93.04903	86737	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Fluorene
00.20227	93.04903	118741	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobenzene
00.20227	93.04903	87683	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobutadiene
00.20227	93.04903	77474	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorocyclopentadiene

********** EM-9 QUALITY ASSURANCE REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20227	93.04903	67721	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachloroethane
00.20227	93.04903	193395	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Indeno[1,2,3-cd]pyrene
00.20227	93.04903	78591	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Isophorone
00.20227	93.04903	534521	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Methyl-4,6-dinitrophenol
00.20227	93.04903	91576	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylnaphthalene
00.20227	93.04903	95487	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylphenol
00.20227	93.04903	106445	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Methylphenol
00.20227	93.04903	91203	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Naphthalene
00.20227	93.04903	88744	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitroaniline
00.20227	93.04903	99092	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	3-Nitroaniline
00.20227	93.04903	100016	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitroaniline
00.20227	93.04903	98953	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Nitrobenzene
00.20227	93.04903	88755	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitrophenol
00.20227	93.04903	100027	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitrophenol
00.20227	93.04903	621647	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodi-n-propylamine
00.20227	93.04903	62759	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodimethylamine
00.20227	93.04903	86306	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodiphenylamine
00.20227	93.04903	87865	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Pentachlorophenol
00.20227	93.04903	85018	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Phenanthrene
00.20227	93.04903	108952	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Phenol
00.20227	93.04903	129000	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Pyrene
00.20227	93.04903	120821	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	1,2,4-Trichlorobenzene
00.20227	93.04903	95954	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4,5-Trichlorophenol
00.20227	93.04903	88062	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4,6-Trichlorophenol

Blank Spike Results: none

Blank Spike Duplicate Results: none

********** EM-9 QUALITY ASSURANCE REPORT **********

SUMMARY OF CONTROL STATUS OF BLIND QA SAMPLES RUN WITH THIS BATCH

Blind QC Results, Sample # 93.04899 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/28/93

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND-NAME
93.04899	83329	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthene
93.04899	208968	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthylene
93.04899	62533	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Aniline
93.04899	120127	3.8	1.14	MG/KG	4.83	0.25	5/25/93	UNDER CONTROL	Anthracene
93.04899	103333	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Azobenzene
93.04899	92875	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	m-Benzidine
93.04899	56553	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]anthracene
93.04899	50328	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]pyrene
93.04899	205992	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[b]fluoranthene
93.04899	191242	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[g,h,i]perylene
93.04899	207089	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[k]fluoranthene
93.04899	65850	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzoic acid
93.04899	100516	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzyl alcohol
93.04899	111911	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethoxy)methane
93.04899	111444	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethyl)ether
93.04899	108601	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroisopropyl)ether
93.04899	117817	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-ethylhexyl)phthalate
93.04899	101553	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Bromophenylphenyl ether
93.04899	85687	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Butyl benzyl phthalate
93.04899	59507	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Chloro-3-methylphenol
93.04899	106478	1.7	0.51	MG/KG	5.22	0.27	5/25/93	OUT OF CONTROL	4-Chloroaniline
93.04899	91587	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Chloronaphthalene
93.04899	95578	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	o-Chlorophenol
93.04899	7005723	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Chlorophenylphenyl ether
93.04899	218019	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Chrysene
93.04899	84742	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-butyl phthalate

93.04899	117840	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-octyl phthalate
93.04899	53703	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzo[a,h]anthracene
93.04899	132649	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzofuran
93.04899	95501	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	o-Dichlorobenzene (1,2)
93.04899	541731	3.3	0.99	MG/KG	4.94	0.26	5/25/93	UNDER CONTROL	m-Dichlorobenzene (1,3)
93.04899	106467	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	p-Dichlorobenzene (1,4)
93.04899	91941	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	3,3'-Dichlorobenzidine
93.04899	120832	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dichlorophenol
93.04899	84662	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Diethyl phthalate
93.04899	131113	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Dimethyl phthalate
93.04899	105679	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dimethylphenol
93.04899	51285	3.1	0.93	MG/KG	6.28	0.33	5/25/93	OUT OF CONTROL	2,4-Dinitrophenol
93.04899	121142	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrotoluene
93.04899	606202	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,6-Dinitrotoluene
93.04899	206440	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Fluoranthene
93.04899	86737	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Fluorene
93.04899	118741	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobenzene
93.04899	87683	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobutadiene
93.04899	77474	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorocyclopentadiene
93.04899	67721	4.5	1.35	MG/KG	6.37	0.33	5/25/93	UNDER CONTROL	Hexachloroethane
93.04899	193395	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Indeno[1,2,3-cd]pyrene
93.04899	78591	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Isophorone
93.04899	534521	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Methyl-4,6-dinitrophenol
93.04899	91576	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylnaphthalene
93.04899	95487	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylphenol
93.04899	106445	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Methylphenol
93.04899	91203	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Naphthalene
93.04899	88744	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitroaniline
93.04899	99092	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	3-Nitroaniline
93.04899	100016	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitroaniline
93.04899	98953	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Nitrobenzene
93.04899	88755	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitrophenol
93.04899	100027	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitrophenol
93.04899	621647	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodi-n-propylamine
93.04899	62759	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodimethylamine
93.04899	86306	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodiphenylamine
93.04899	87865	4.5	1.35	MG/KG	6.02	0.31	5/25/93	UNDER CONTROL	Pentachlorophenol
93.04899	85018	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Phenanthrene
93.04899	108952	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Phenol
93.04899	129000	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Pyrene
93.04899	120821	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	1,2,4-Trichlorobenzene
93.04899	95954	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4,5-Trichlorophenol
93.04899	88062	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4,6-Trichlorophenol

Blind QC Results, Sample # 93.04900 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

93.04900	83329	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthene
93.04900	208968	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthylene
93.04900	62533	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Aniline
93.04900	120127	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Anthracene
93.04900	103333	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Azobenzene
93.04900	92875	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	m-Benzidine
93.04900	56553	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]anthracene
93.04900	50328	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]pyrene
93.04900	205992	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[b]fluoranthene
93.04900	191242	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[g,h,i]perylene
93.04900	207089	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[k]fluoranthene
93.04900	65850	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzoic acid
93.04900	100516	1.8	0.54	MG/KG	3.11	0.16	5/25/93	WARNING 2-3 SIG	Benzyl alcohol
93.04900	111911	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethoxy)methane
93.04900	111444	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethyl)ether
93.04900	108601	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroisopropyl)ether
93.04900	117817	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-ethylhexyl)phthalate
93.04900	101553	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Bromophenylphenyl ether
93.04900	85687	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Butyl benzyl phthalate
93.04900	59507	2.5	0.75	MG/KG	4.51	0.23	5/25/93	WARNING 2-3 SIG	4-Chloro-3-methylphenol
93.04900	106478	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Chloroaniline
93.04900	91587	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Chloronaphthalene
93.04900	95578	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	o-Chlorophenol
93.04900	7005723	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Chlorophenylphenyl ether
93.04900	218019	2.	0.6	MG/KG	2.59	0.13	5/25/93	UNDER CONTROL	Chrysene
93.04900	84742	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-butyl phthalate
93.04900	117840	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-octyl phthalate
93.04900	53703	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzo[a,h]anthracene
93.04900	132649	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzofuran
93.04900	95501	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	o-Dichlorobenzene (1,2)
93.04900	541731	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	m-Dichlorobenzene (1,3)
93.04900	106467	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	p-Dichlorobenzene (1,4)
93.04900	91941	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	3,3'-Dichlorobenzidine
93.04900	120832	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dichlorophenol
93.04900	84662	1.8	0.54	MG/KG	2.8	0.15	5/25/93	UNDER CONTROL	Diethyl phthalate
93.04900	131113	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Dimethyl phthalate
93.04900	105679	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dimethylphenol
93.04900	51285	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrophenol
93.04900	121142	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrotoluene
93.04900	606202	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,6-Dinitrotoluene
93.04900	206440	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Fluoranthene
93.04900	86737	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Fluorene
93.04900	118741	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobenzene

93.04900	87683	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobutadiene
93.04900	77474	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorocyclopentadiene
93.04900	67721	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachloroethane
93.04900	193395	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Indeno[1,2,3-cd]pyrene
93.04900	78591	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Isophorone
93.04900	534521	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Methyl-4,6-dinitrophenol
93.04900	91576	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylnaphthalene
93.04900	95487	2.	0.6	MG/KG	2.56	0.13	5/25/93	UNDER CONTROL	2-Methylphenol
93.04900	106445	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Methylphenol
93.04900	91203	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Naphthalene
93.04900	88744	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitroaniline
93.04900	99092	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	3-Nitroaniline
93.04900	100016	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitroaniline
93.04900	98953	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Nitrobenzene
93.04900	88755	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitrophenol
93.04900	100027	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitrophenol
93.04900	621647	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodi-n-propylamine
93.04900	62759	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodimethylamine
93.04900	86306	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodiphenylamine
93.04900	87865	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Pentachlorophenol
93.04900	85018	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Phenanthrene
93.04900	108952	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Phenol
93.04900	129000	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Pyrene
93.04900	120821	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	1,2,4-Trichlorobenzene
93.04900	95954	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4,5-Trichlorophenol
93.04900	88062	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4,6-Trichlorophenol

********** EM-9 QUALITY ASSURANCE REPORT **********

SURROGATE RESULTS FOR EPA SEMIVOLATILES

Surrogate 1 = 2-Fluorophenol (CAS # = 367124)
Surrogate 2 = Phenol-d5 (CAS # = 4165622)
Surrogate 3 = Nitrobenzene-d5 (CAS # = 4165600)
Surrogate 4 = 2-Fluorobiphenyl (CAS # = 321608)
Surrogate 5 = 2,4,6-Tribromophenol (CAS # = 118796)
Surrogate 6 = p-Terphenyl-d14 (CAS # =)

SAMPLE NUMBER	UNITS	Surrogate 1	Surrogate 2	Surrogate 3	Surrogate 4	Surrogate 5	Surrogate 6	COMPLETION DATE
93.04845	%	54.43	73.87	66.76	76.08	94.2	86.16	25-May-1993
93.04845	%	40.67	62.6	54.6	67.48	86.23	85.18	25-May-1993
93.04845	%	30.47	48.47	46.14	65.98	81.55	77.94	25-May-1993
93.04846	%	38.15	57.7	51.58	68.4	87.68	85.78	25-May-1993
93.04847	%	38.63	61.28	51.96	74.72	91.29	95.6	25-May-1993
93.04848	%	31.3	53.95	45.9	62.96	89.39	102.2	25-May-1993
93.04849	%	42.96	69.21	60.7	95.1	108.22	123.14	25-May-1993
93.04850	%	28.49	47.9	42.52	59.96	92.37	100.14	25-May-1993
93.04851	%	37.62	57.41	53.94	68.98	75.97	88.76	25-May-1993
93.04852	%	41.95	65.93	58.1	72.66	92.71	98.28	25-May-1993
93.04853	%	39.73	55.07	53.66	66.18	77.54	90.24	25-May-1993
93.04854	%	40.52	63.29	53.38	71.06	90.23	93.84	25-May-1993
93.04855	%	36.28	65.14	51.8	79.78	110.28	108.3	25-May-1993
93.04856	%	41.4	60.98	52.8	66.18	94.77	87.32	25-May-1993
93.04857	%	54.28	75.27	70.84	90.7	114.69	114.78	25-May-1993
93.04858	%	51.88	77.64	63.64	81.44	100.51	84.92	25-May-1993
93.04859	%	60.1	81.5	74.2	82.8	102.4	93.4	25-May-1993
93.04860	%	57.5	78.14	67.82	82.48	105.67	109.44	25-May-1993
93.04861	%	35.51	50.95	44.26	56.5	92.66	88.18	25-May-1993
93.04862	%	55.61	79.57	68.32	80.28	89.92	103.56	25-May-1993
93.04863	%	45.87	64.63	60.76	85.8	123.6	121.68	25-May-1993
93.04864	%	67.43	84.22	82.46	88.5	101.4	127.16	25-May-1993
93.04865	%	72.8	90.	79.2	87.8	82.5	113.4	25-May-1993
93.04865	%	73.2	92.9	77.6	92.	90.2	116.4	25-May-1993
93.04865	%	72.4	85.6	84.4	84.4	80.9	114.4	25-May-1993
93.04866	%	42.56	58.64	53.72	65.02	94.29	95.02	25-May-1993

********** EM-9 QUALITY ASSURANCE REPORT **********

SAMPLE NUMBER	UNITS	Surrogate 1	Surrogate 2	Surrogate 3	Surrogate 4	Surrogate 5	Surrogate 6	COMPLETION DATE
93.04867	%	78.5	87.6	74.6	90.4	97.1	117.8	25-May-1993
93.04868	%	66.6	86.	74.28	85.34	108.82	94.68	25-May-1993
93.04869	%	83.24	98.92	89.58	90.58	115.21	116.72	25-May-1993
93.04899	%	63.01	72.8	75.38	74.	88.51	87.78	25-May-1993
93.04900	%	55.67	66.71	63.64	68.6	85.37	78.2	25-May-1993
93.04902	%	18.12	28.73	36.2	47.92	70.98	94.74	25-May-1993
93.04903	%	19.21	24.	26.02	34.66	63.85	88.96	25-May-1993
EPA Limits:								
Water	%	21 - 100	10 - 94	35 - 114	43 - 116	10 - 123	33 - 141	
Soil	%	25 - 121	24 - 113	23 - 120	30 - 115	19 - 122	18 - 137	

REPORT NUMBER: 18666

Analyst	Reviewer	Section Leader	QA Officer
5/26/93	5/26/93	5/26/93	5-26-93
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1986,' LA-11114-MS, pp. 3-4.

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Metals Analyses

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

TO: Philip Fresquez, EM-8

DATE: September 15, 1993

FROM: Cynthia Mahan, EM-9

MAIL STOP/TELEPHONE: E518/7-6011

SUBJECT: Results Associated with Request 14399.

I apologize for the delay in reporting the analytical data for request 14399. The delay was due in part because Hg results were missing on three of the samples, numbers 93.04868-70. Unfortunately, these soil extracts were consumed during the metals analysis and Hg information could not be obtained. We regret this inconvenience, but if it is possible for you to resample, we would certainly analyze the samples for you at our cost. The blind qc results for all elements except Ag were "under control". However the Ag run-time qc's were all statistically acceptable. Ag is likely precipitating from the qc samples. If you have any questions, please give me a call.

REPORT NUMBER: 20562

TCLP-Ag, Ba, Cd, Cr, Pb

2 samples TA-14-35-0-0 TA-14-35-5-10 exceed TCLP >5 ppm

********** EM-9 ANALYTICAL REPORT **********

Prepared by: CMAHAN on 15-Sep-1993

REQUEST NUMBER: 14399 MATRIX: SE ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: R8149 PAGE: 233

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE		COMMENT
14-35-0-0	93.04845	AG	ICPES	< 0.01		MG/L	7/23/93	07061H	<5 ppm
14-35-0-0	93.04845	BA	ICPES	2.5	0.3	MG/L	7/23/93	07061H	<100 ppm
14-35-0-0	93.04845	CD	ICPES	< 0.003		MG/L	7/23/93	07061H	<1 ppm >E
14-35-0-0	93.04845	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	<1 ppm
14-35-0-0	93.04845	PB	ICPES	56.	6.	MG/L	7/23/93	07061H	>5 ppm
14-35-E-5	93.04846	AG	ICPES	0.02	0.007	MG/L	7/23/93	07061H	
14-35-E-5	93.04846	BA	ICPES	1.4	0.1	MG/L	7/23/93	07061H	
14-35-E-5	93.04846	CD	ICPES	0.004	0.002	MG/L	7/23/93	07061H	ok
14-35-E-5	93.04846	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-E-5	93.04846	PB	ICPES	1.2	0.1	MG/L	7/23/93	07061H	
14-35-E-10	93.04847	AG	ICPES	0.016	0.008	MG/L	7/23/93	07061H	
14-35-E-10	93.04847	BA	ICPES	1.1	0.1	MG/L	7/23/93	07061H	ok
14-35-E-10	93.04847	CD	ICPES	0.003	0.0004	MG/L	7/23/93	07061H	
14-35-E-10	93.04847	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-E-10	93.04847	PB	ICPES	0.32	0.04	MG/L	7/23/93	07061H	
14-35-E-25	93.04848	AG	ICPES	< 0.01		MG/L	7/23/93	07061H	
14-35-E-25	93.04848	BA	ICPES	0.94	0.01	MG/L	7/23/93	07061H	ok
14-35-E-25	93.04848	CD	ICPES	0.004	0.001	MG/L	7/23/93	07061H	
14-35-E-25	93.04848	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-E-25	93.04848	PB	ICPES	0.36	0.04	MG/L	7/23/93	07061H	
14-35-E-50	93.04849	AG	ICPES	0.011	0.003	MG/L	7/23/93	07061H	
14-35-E-50	93.04849	BA	ICPES	1.1	0.1	MG/L	7/23/93	07061H	ok
14-35-E-50	93.04849	CD	ICPES	0.004	0.002	MG/L	7/23/93	07061H	
14-35-E-50	93.04849	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-E-50	93.04849	PB	ICPES	1.1	0.1	MG/L	7/23/93	07061H	
14-35-E-100	93.04850	AG	ICPES	0.02	0.01	MG/L	7/23/93	07061H	
14-35-E-100	93.04850	BA	ICPES	1.	0.1	MG/L	7/23/93	07061H	ok
14-35-E-100	93.04850	CD	ICPES	0.003	0.003	MG/L	7/23/93	07061H	
14-35-E-100	93.04850	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-E-100	93.04850	PB	ICPES	0.05	0.03	MG/L	7/23/93	07061H	
14-35-E-10R	93.04851	AG	ICPES	< 0.01		MG/L	7/23/93	07061H	
14-35-E-10R	93.04851	BA	ICPES	1.2	0.1	MG/L	7/23/93	07061H	
14-35-E-10R	93.04851	CD	ICPES	0.007	0.003	MG/L	7/23/93	07061H	ok
14-35-E-10R	93.04851	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-E-10R	93.04851	PB	ICPES	0.66	0.06	MG/L	7/23/93	07061H	
14-35-SE-5	93.04852	AG	ICPES	0.022	0.008	MG/L	7/23/93	07061H	
14-35-SE-5	93.04852	BA	ICPES	1.4	0.1	MG/L	7/23/93	07061H	

14-35-SE-5	93.04852	CD	ICPES	0.005	0.0008	MG/L	7/23/93	07061H	ok
14-35-SE-5	93.04852	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-SE-5	93.04852	PB	ICPES	1.1	0.1	MG/L	7/23/93	07061H	
14-35-SE-10	93.04853	AG	ICPES	0.014	0.006	MG/L	7/23/93	07061H	
14-35-SE-10	93.04853	BA	ICPES	1.6	0.2	MG/L	7/23/93	07061H	
14-35-SE-10	93.04853	CD	ICPES	0.006	0.002	MG/L	7/23/93	07061H	ok
14-35-SE-10	93.04853	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-SE-10	93.04853	PB	ICPES	3.3	0.3	MG/L	7/23/93	07061H	
14-35-SE-25	93.04854	AG	ICPES	0.025	0.005	MG/L	7/23/93	07061H	
14-35-SE-25	93.04854	BA	ICPES	1.2	0.1	MG/L	7/23/93	07061H	
14-35-SE-25	93.04854	CD	ICPES	< 0.003		MG/L	7/23/93	07061H	ok
14-35-SE-25	93.04854	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-SE-25	93.04854	PB	ICPES	0.73	0.07	MG/L	7/23/93	07061H	
14-35-SE-50	93.04855	AG	ICPES	0.03	0.004	MG/L	7/23/93	07061H	
14-35-SE-50	93.04855	BA	ICPES	0.91	0.09	MG/L	7/23/93	07061H	
14-35-SE-50	93.04855	CD	ICPES	< 0.003		MG/L	7/23/93	07061H	ok
14-35-SE-50	93.04855	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-SE-50	93.04855	PB	ICPES	< 0.03		MG/L	7/23/93	07061H	
14-35-SE-100	93.04856	AG	ICPES	0.024	0.008	MG/L	7/23/93	07061H	
14-35-SE-100	93.04856	BA	ICPES	0.61	0.06	MG/L	7/23/93	07061H	
14-35-SE-100	93.04856	CD	ICPES	0.003	0.0007	MG/L	7/23/93	07061H	ok
14-35-SE-100	93.04856	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-SE-100	93.04856	PB	ICPES	< 0.03		MG/L	7/23/93	07061H	
14-35-SW-5	93.04857	AG	ICPES	0.024	0.002	MG/L	7/23/93	07061H	
14-35-SW-5	93.04857	BA	ICPES	1.2	0.1	MG/L	7/23/93	07061H	
14-35-SW-5	93.04857	CD	ICPES	0.005	0.0007	MG/L	7/23/93	07061H	ok
14-35-SW-5	93.04857	CR	ICPES	0.004	0.002	MG/L	7/23/93	07061H	
14-35-SW-5	93.04857	PB	ICPES	1.5	0.2	MG/L	7/23/93	07061H	
14-35-SW-10	93.04858	AG	ICPES	0.018	0.002	MG/L	7/23/93	07061H	
14-35-SW-10	93.04858	BA	ICPES	1.1	0.1	MG/L	7/23/93	07061H	
14-35-SW-10	93.04858	CD	ICPES	0.005	0.001	MG/L	7/23/93	07061H	ok
14-35-SW-10	93.04858	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-SW-10	93.04858	PB	ICPES	1.3	0.1	MG/L	7/23/93	07061H	
14-35-SW-25	93.04859	AG	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-25	93.04859	BA	ICPES	1.	0.1	MG/L	8/09/93	07021H	
14-35-SW-25	93.04859	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	ok
14-35-SW-25	93.04859	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-25	93.04859	PB	ICPES	0.76	0.08	MG/L	8/09/93	07021H	
14-35-SW-50	93.04860	AG	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-50	93.04860	BA	ICPES	0.72	0.07	MG/L	8/09/93	07021H	
14-35-SW-50	93.04860	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	ok
14-35-SW-50	93.04860	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-50	93.04860	PB	ICPES	< 0.04		MG/L	8/09/93	07021H	
14-35-SW-100	93.04861	AG	ICPES	0.01	0.01	MG/L	8/09/93	07021H	
14-35-SW-100	93.04861	BA	ICPES	0.41	0.04	MG/L	8/09/93	07021H	
14-35-SW-100	93.04861	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	ok
14-35-SW-100	93.04861	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-100	93.04861	PB	ICPES	0.05	0.01	MG/L	8/09/93	07021H	
14-35-S-5	93.04862	AG	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-5	93.04862	BA	ICPES	1.5	0.2	MG/L	8/09/93	07021H	
14-35-S-5	93.04862	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	ok
14-35-S-5	93.04862	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-5	93.04862	PB	ICPES	1.8	0.2	MG/L	8/09/93	07021H	
14-35-S-10	93.04863	AG	ICPES	0.01	0.01	MG/L	8/09/93	07021H	
14-35-S-10	93.04863	BA	ICPES	0.78	0.08	MG/L	8/09/93	07021H	
14-35-S-10	93.04863	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	ok
14-35-S-10	93.04863	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-10	93.04863	PB	ICPES	4.6	0.5	MG/L	8/09/93	07021H	>5ppm
14-35-S-25	93.04864	AG	ICPES	0.02	0.01	MG/L	8/09/93	07021H	
14-35-S-25	93.04864	BA	ICPES	0.89	0.09	MG/L	8/09/93	07021H	

14-35-S-25	93.04864	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	ok
14-35-S-25	93.04864	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-25	93.04864	PB	ICPES	< 0.04		MG/L	8/09/93	07021H	
14-35-S-50	93.04865	AG	ICPES	0.02	0.01	MG/L	8/09/93	07021H	
14-35-S-50	93.04865	BA	ICPES	1.2	0.1	MG/L	8/09/93	07021H	
14-35-S-50	93.04865	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	ok
14-35-S-50	93.04865	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-50	93.04865	PB	ICPES	0.43	0.04	MG/L	8/09/93	07021H	
14-35-S-10R	93.04866	AG	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-10R	93.04866	BA	ICPES	0.85	0.09	MG/L	8/09/93	07021H	
14-35-S-10R	93.04866	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	ok
14-35-S-10R	93.04866	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-10R	93.04866	PB	ICPES	0.3	0.03	MG/L	8/09/93	07021H	
14-35-S-100	93.04867	AG	ICPES	0.01	0.01	MG/L	8/09/93	07021H	
14-35-S-100	93.04867	BA	ICPES	0.64	0.06	MG/L	8/09/93	07021H	
14-35-S-100	93.04867	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	ok
14-35-S-100	93.04867	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-100	93.04867	PB	ICPES	< 0.04		MG/L	8/09/93	07021H	
14-35-UD	93.04868	AG	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-UD	93.04868	BA	ICPES	1.6	0.2	MG/L	8/09/93	07021H	ok
14-35-UD	93.04868	CD	ICPES	0.04	0.01	MG/L	8/09/93	07021H	
14-35-UD	93.04868	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-UD	93.04868	PB	ICPES	0.06	0.01	MG/L	8/09/93	07021H	
14-35-LD	93.04869	AG	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-LD	93.04869	BA	ICPES	1.1	0.1	MG/L	8/09/93	07021H	
14-35-LD	93.04869	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	ok
14-35-LD	93.04869	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-LD	93.04869	PB	ICPES	< 0.04		MG/L	8/09/93	07021H	
14-35-RIN	93.04870	AG	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-RIN	93.04870	BA	ICPES	0.38	0.04	MG/L	8/09/93	07021H	
14-35-RIN	93.04870	CD	ICPES	< 0.003		MG/L	8/09/93	07021H	ok
14-35-RIN	93.04870	CR	ICPES	0.027	0.003	MG/L	8/09/93	07021H	
14-35-RIN	93.04870	PB	ICPES	0.12	0.01	MG/L	8/09/93	07021H	

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REPORT NUMBER: 20562 (continued)

********** EM-9 QUALITY ASSURANCE REPORT *********

Prepared by: CMAHAN on 15-Sep-1993

REQUEST NUMBER: 14399 MATRIX: SE ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: R8149 PAGE: 233

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.00895	AG	< 10.		UG/L	9.8	0.8	8/10/93	UNDER CONTROL
00.00895	BA	100.	10.	UG/L	44.	2.	8/10/93	OUT OF CONTROL
00.00895	CD	19.	2.	UG/L	20.	1.	8/10/93	UNDER CONTROL
)0.00895	CR	15.	2.	UG/L	18.6	0.4	8/10/93	UNDER CONTROL
00.00895	PB	40.	10.	UG/L	23.7	0.7	8/10/93	UNDER CONTROL
00.28333	AG	2.3	0.2	MG/L	2.	0.09	7/23/93	UNDER CONTROL
00.28333	AG	2.	0.2	MG/L	2.	0.09	8/10/93	UNDER CONTROL
00.28333	BA	11.	1.	MG/L	10.	0.43	8/10/93	UNDER CONTROL
00.28333	BA	11.	1.	MG/L	10.	0.43	7/23/93	UNDER CONTROL
00.28333	CD	11.	1.	MG/L	9.96	0.43	7/23/93	UNDER CONTROL
00.28333	CD	10.	1.	MG/L	9.96	0.43	8/10/93	UNDER CONTROL
00.28333	CR	11.	1.	MG/L	9.97	0.43	7/23/93	UNDER CONTROL
00.28333	CR	9.7	0.9	MG/L	9.97	0.43	8/10/93	UNDER CONTROL
00.28333	PB	11.	1.	MG/L	10.1	0.43	7/23/93	UNDER CONTROL
00.28333	PB	11.	1.	MG/L	10.1	0.43	8/10/93	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
93.04918	AG	190.	20.	UG/L	3059.	132.	8/09/93	OUT OF CONTROL
93.04918	BA	1800.	200.	UG/L	1793.	77.	8/09/93	UNDER CONTROL
93.04918	CD	2100.	200.	UG/L	2211.	95.	8/09/93	UNDER CONTROL
93.04918	CR	< 4.		UG/L	0.0		8/09/93	UNDER CONTROL
·.04918	PB	23000.	2000.	UG/L	22697.	976.	8/09/93	UNDER CONTROL
.04919	AG	220.	20.	UG/L	311.	13.	8/09/93	OUT OF CONTROL
93.04919	BA	5100.	500.	UG/L	4955.	213.	8/09/93	UNDER CONTROL
93.04919	CD	3000.	300.	UG/L	2988.	128.	8/09/93	UNDER CONTROL
93.04919	CR	290.	30.	UG/L	311.	13.	8/09/93	UNDER CONTROL

93.04919 PB	31000.	3000.	UG/L	29339.	1262.	8/09/93	UNDER CONTROL
93.04920 AG	190.	20.	UG/L	4012.	173.	8/09/93	OUT OF CONTROL
93.04920 BA	1400.	100.	UG/L	1394.	60.	8/09/93	UNDER CONTROL
.04920 CD	< 3.		UG/L	0.0		8/09/93	UNDER CONTROL
.04920 CR	2800.	300.	UG/L	3104.	133.	8/09/93	UNDER CONTROL
93.04920 PB	17000.	2000.	UG/L	16758.	721.	8/09/93	UNDER CONTROL

REPORT NUMBER: 20562

Analyst	Reviewer	Section Leader	QA Officer
9/15/93	9/15/93	9/15/93	9/17/93
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1991,' LA-12436-MS, Vol. I, pp. 21-22.

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REPORT NUMBER: 20563

TCLP - As, Hg, Se (all ok).

********** EM-9 ANALYTICAL REPORT **********

Prepared by: CMAHAN on 15-Sep-1993

REQUEST NUMBER: 14399 MATRIX: SE ANALYST: HARRY PATTERSON PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: Y004330 PAGE: 130

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS (ppb)	COMPLETION DATE	COMMENT
14-35-0-0	93.04845	AS	ETVAA	< 2.		UG/L	6/18/93	<5 ppm
14-35-0-0	93.04845	HG	CVAA	< 0.2		UG/L	6/25/93	<2 ppm ok
14-35-0-0	93.04845	SE	ETVAA	< 2.		UG/L	6/18/93	<1 ppm
14-35-E-5	93.04846	AS	ETVAA	2.79	2.	UG/L	6/18/93	
14-35-E-5	93.04846	HG	CVAA	< 0.2		UG/L	6/25/93	ok
14-35-E-5	93.04846	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-10	93.04847	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-10	93.04847	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-E-10	93.04847	SE	ETVAA	< 2.		UG/L	6/23/93	ok
14-35-E-25	93.04848	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-25	93.04848	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-E-25	93.04848	SE	ETVAA	< 2.		UG/L	6/18/93	ok
14-35-E-50	93.04849	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-50	93.04849	HG	CVAA	0.2		UG/L	6/25/93	
14-35-E-50	93.04849	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-100	93.04850	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-100	93.04850	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-E-100	93.04850	SE	ETVAA	< 2.		UG/L	6/18/93	ok
14-35-E-10R	93.04851	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-10R	93.04851	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-E-10R	93.04851	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-SE-5	93.04852	AS	ETVAA	2.86	2.	UG/L	6/18/93	
14-35-SE-5	93.04852	HG	CVAA	< 0.2		UG/L	6/25/93	ok
14-35-SE-5	93.04852	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-SE-10	93.04853	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-SE-10	93.04853	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SE-10	93.04853	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-SE-25	93.04854	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-SE-25	93.04854	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SE-25	93.04854	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SE-50	93.04855	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-SE-50	93.04855	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SE-50	93.04855	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SE-100	93.04856	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-SE-100	93.04856	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SE-100	93.04856	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-5	93.04857	AS	ETVAA	2.5	2.	UG/L	7/08/93	

14-35-SW-5	93.04857	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SW-5	93.04857	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-10	93.04858	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-10	93.04858	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SW-10	93.04858	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-25	93.04859	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-25	93.04859	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SW-25	93.04859	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-50	93.04860	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-50	93.04860	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SW-50	93.04860	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-100	93.04861	AS	ETVAA	3.1	2.	UG/L	7/08/93	
14-35-SW-100	93.04861	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SW-100	93.04861	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-5	93.04862	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-5	93.04862	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-5	93.04862	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-10	93.04863	AS	ETVAA	2.7	2.	UG/L	7/08/93	
14-35-S-10	93.04863	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-10	93.04863	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-25	93.04864	AS	ETVAA	2.7	2.	UG/L	7/08/93	
14-35-S-25	93.04864	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-25	93.04864	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-50	93.04865	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-50	93.04865	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-50	93.04865	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-10R	93.04866	AS	ETVAA	2.9	2.	UG/L	7/08/93	
14-35-S-10R	93.04866	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-10R	93.04866	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-100	93.04867	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-100	93.04867	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-100	93.04867	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-UD	93.04868	AS	ETVAA	3.	2.	UG/L	7/08/93	
14-35-UD	93.04868	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-LD	93.04869	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-LD	93.04869	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-RIN	93.04870	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-RIN	93.04870	SE	ETVAA	< 2.		UG/L	7/08/93	

CUSTOMER SAMPLE DUPLICATES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
14-35-SE-10	93.04853	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-SE-10	93.04853	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-SW-5	93.04857	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SW-5	93.04857	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-100	93.04867	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-100	93.04867	SE	ETVAA	< 2.		UG/L	7/08/93	

MATRIX SPIKES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT
14-35-SE-10	93.04853	AS	ETVAA	10.	13.	UG/L	6/18/93	
14-35-SE-10	93.04853	SE	ETVAA	10.	8.96	UG/L	6/18/93	

14-35-S-100	93.04867 AS	ETVAA	1.	1.	UG/L	7/08/93
14-35-S-100	93.04867 SE	ETVAA	1.	1.4	UG/L	7/08/93

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REPORT NUMBER: 20563 (continued)

********** EM-9 QUALITY ASSURANCE REPORT *********

Prepared by: CMAHAN on 15-Sep-1993

REQUEST NUMBER: 14399 MATRIX: SE ANALYST: HARRY PATTERSON PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: Y004330 PAGE: 130

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.00895	AS	55.7	11.1	UG/L	49.		7/08/93	UNDER CONTROL
00.00895	SE	8.5	1.7	UG/L	9.7	0.5	7/08/93	UNDER CONTROL
00.23653	HG	4.	0.4	UG/L	4.	0.2	6/25/93	UNDER CONTROL
00.26379	AS	75.37	15.7	UG/L	70.	3.	6/18/93	UNDER CONTROL
00.26379	AS	75.3	15.	UG/L	70.	3.	7/08/93	UNDER CONTROL
00.26379	SE	49.8	9.8	UG/L	50.	2.	7/08/93	UNDER CONTROL
00.26379	SE	44.26	8.8	UG/L	50.	2.	6/18/93	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
93.04912	HG	1.1	0.2	UG/L	1.	0.06	6/25/93	UNDER CONTROL
93.04913	HG	3.9	0.4	UG/L	4.	0.24	6/25/93	UNDER CONTROL
93.04914	HG	4.	0.4	UG/L	4.	0.24	6/25/93	UNDER CONTROL
93.04915	AS	26.5	5.3	UG/L	26.	1.2	7/08/93	UNDER CONTROL
93.04915	SE	10.4	2.1	UG/L	10.	0.4	7/08/93	UNDER CONTROL
93.04916	AS	28.3	5.6	UG/L	30.	1.3	7/08/93	UNDER CONTROL
93.04916	SE	64.8	13.	UG/L	65.	2.8	7/08/93	UNDER CONTROL
93.04917	AS	36.	7.2	UG/L	37.5	1.6	7/08/93	UNDER CONTROL
93.04917	SE	< 2.		UG/L	0.0		7/08/93	UNDER CONTROL

PORT NUMBER: 20563

Analyst	Reviewer	Section Leader	QA Officer
9/15/93	9/15/93	9/15/93	9/16/93

Date Date Date Date

Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1991,' LA-12436-MS, Vol. I, pp. 21-22.

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REPORT NUMBER: 18315

Total Be and Pb

********** EM-9 ANALYTICAL REPORT **********

Prepared by: JDMORGAN on 28-Apr-1993

REQUEST NUMBER: 14400 MATRIX: SS ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

ANALYTICAL TECHNIQUE: ICPES ANALYTICAL PROCEDURE: NOTEBOOK: R8149 PAGE: 111

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS (ppm)	COMPLETION DATE	COMMENT
14-35-0-0	93.04871	BE	0.15	0.03	UG/G	4/27/93	DB0416H
14-35-0-0	93.04871	PB	410.	41.	UG/G	4/27/93	DB0416H
14-35-E-5	93.04872	BE	1.7	0.4	UG/G	4/27/93	DB0416H
14-35-E-5	93.04872	PB	85.	8.	UG/G	4/27/93	DB0416H
14-35-E-10	93.04873	BE	0.28	0.06	UG/G	4/27/93	DB0416H
14-35-E-10	93.04873	PB	49.	5.	UG/G	4/27/93	DB0416H
14-35-E-25	93.04874	BE	0.37	0.07	UG/G	4/27/93	DB0416H
14-35-E-25	93.04874	PB	225.	23.	UG/G	4/27/93	DB0416H
14-35-E-50	93.04875	BE	0.22	0.04	UG/G	4/27/93	DB0416H
14-35-E-50	93.04875	PB	97.	9.	UG/G	4/27/93	DB0416H
14-35-E-100	93.04876	BE	0.5	0.1	UG/G	4/27/93	DB0416H
14-35-E-100	93.04876	PB	75.	7.	UG/G	4/27/93	DB0416H
14-35-E-10R	93.04877	BE	0.38	0.07	UG/G	4/27/93	DB0416H
14-35-E-10R	93.04877	PB	40.	5.	UG/G	4/27/93	DB0416H
14-35-SE-5	93.04878	BE	0.38	0.07	UG/G	4/27/93	DB0416H
14-35-SE-5	93.04878	PB	45.	5.	UG/G	4/27/93	DB0416H
14-35-SE-10	93.04879	BE	0.36	0.07	UG/G	4/27/93	DB0416H
14-35-SE-10	93.04879	PB	150.	15.	UG/G	4/27/93	DB0416H
14-35-SE-25	93.04880	BE	0.33	0.06	UG/G	4/27/93	DB0416H
14-35-SE-25	93.04880	PB	39.	5.	UG/G	4/27/93	DB0416H
14-35-SE-50	93.04881	BE	0.6	0.1	UG/G	4/27/93	DB0416H
14-35-SE-50	93.04881	PB	< [illegible]		UG/G	4/27/93	DB0416H
14-35-SE-100	93.04882	BE	0.36	0.08	UG/G	4/27/93	DB0416H
14-35-SE-100	93.04882	PB	< 15.		UG/G	4/27/93	DB0416H
14-35-SW-5	93.04883	BE	0.2	0.1	UG/G	4/27/93	DB0416H
14-35-SW-5	93.04883	PB	73.	7.	UG/G	4/27/93	DB0416H
14-35-SW-10	93.04884	BE	0.33	0.06	UG/G	4/27/93	DB0416H
14-35-SW-10	93.04884	PB	64.	6.	UG/G	4/27/93	DB0416H
14-35-SW-25	93.04885	BE	0.36	0.07	UG/G	4/27/93	DB0416H
14-35-SW-25	93.04885	PB	60.	6.	UG/G	4/27/93	DB0416H
14-35-SW-50	93.04886	BE	1.1	0.2	UG/G	4/27/93	DB0416H
14-35-SW-50	93.04886	PB	31.	3.	UG/G	4/27/93	DB0416H
14-35-SW-100	93.04887	BE	1.4	0.2	UG/G	4/27/93	DB0416H
14-35-SW-100	93.04887	PB	70.	7.	UG/G	4/27/93	DB0416H
14-35-S-5	93.04888	BE	0.5	0.1	UG/G	4/27/93	DB0416H
14-35-S-5	93.04888	PB	125.	13.	UG/G	4/27/93	DB0416H
14-35-S-10	93.04889	BE	0.13	0.02	UG/G	4/27/93	DB0416BH

Be = 2.8 ± 0.1
Pb = 54 ppm ± 1

Be
0.23 to ~~0.50~~ 1.70
0.55 (± 0.60) ppm

Pb
40 to 225 ppm
95 (± 67) ppm

Be
0.35 to 0.6
0.40 (± 0.11)

Pb
<15 to 150 ppm
53 (± 56) ppm

Be
0.2 to 1.4
0.47 (± 0.53)

Pb
31 to 73 ppm
60 (± 17)

14-35-S-10	93.04889 PB	45.	5.	UG/G	4/27/93	DB0416BH	Be
14-35-S-25	93.04890 BE	0.9	0.2	UG/G	4/27/93	DB0416BH	0.13 to 0.9
14-35-S-25	93.04890 PB	19.	2.	UG/G	4/27/93	DB0416BH	0.47 (± 0.3
14-35-S-50	93.04891 BE	0.41	0.08	UG/G	4/27/93	DB0416BH	
14-35-S-50	93.04891 PB	43.	4.	UG/G	4/27/93	DB0416BH	Pb
14-35-S-10R	93.04892 BE	0.22	0.04	UG/G	4/27/93	DB0416BH	
14-35-S-10R	93.04892 PB	< 15.		UG/G	4/27/93	DB0416BH	<15 to 125 pp
14-35-S-100	93.04893 BE	0.7	0.1	UG/G	4/27/93	DB0416BH	
14-35-S-100	93.04893 PB	41.	4.	UG/G	4/27/93	DB0416BH	48 (± 40) pp
14-35-UD	93.04894 BE	0.9	0.2	UG/G	4/27/93	DB0416BH	Be
14-35-UD	93.04894 PB	75.	8.	UG/G	4/27/93	DB0416BH	
14-35-LD	93.04895 BE	1.1	0.2	UG/G	4/27/93	DB0416BH	
14-35-LD	93.04895 PB	35.	4.	UG/G	4/27/93	DB0416BH	

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REPORT NUMBER: 18315 (continued)

********** EM-9 QUALITY ASSURANCE REPORT *********

Prepared by: JDMORGAN on 28-Apr-1993

REQUEST NUMBER: 14400 MATRIX: SS ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: R8149 PAGE: 111

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.27503	BE	2.5	0.3	MG/L	2.5	0.1	4/27/93	UNDER CONTROL
00.27503	PB	10.	1.	MG/L	10.	0.4	4/27/93	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
93.04897	BE	0.3	0.1	MG/L	0.25	0.01	4/27/93	UNDER CONTROL
93.04897	PB	2.4	0.2	MG/L	2.06	0.09	4/27/93	UNDER CONTROL
93.04898	BE	1.2	0.1	MG/L	1.15	0.05	4/27/93	UNDER CONTROL
93.04898	PB	17.	2.	MG/L	16.8	0.7	4/27/93	UNDER CONTROL
93.04904	BE	0.27	0.05	MG/L	0.25	0.01	4/27/93	UNDER CONTROL
93.04904	PB	2.1	0.2	MG/L	2.06	0.09	4/27/93	UNDER CONTROL

REPORT NUMBER: 18315

JDMorgan	BDuran	CTa	mag
Analyst	Reviewer	Section Leader	QA Officer
4/28/93	4/28/93	4/29/93	4/29/93
Date	Date	Date	Date

Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1986,' LA-11114-MS, pp. 3-4.

REPORT NUMBER: 18384

Total Be and Pb in water -

********** EM-9 ANALYTICAL REPORT **********

Prepared by: JDMORGAN on 5-May-1993

REQUEST NUMBER: 14400 MATRIX: W ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

ANALYTICAL TECHNIQUE: ICPES ANALYTICAL PROCEDURE: NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS (ppb)	COMPLETION DATE	COMMENT
14-35-RIN	93.04896	BE	1.3	0.1	UG/L	5/03/93	
14-35-RIN	93.04896	PB	98.	40.	UG/L	5/03/93	

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REPORT NUMBER: 18384 (continued)

********** EM-9 QUALITY ASSURANCE REPORT *********

Prepared by: JDMORGAN on 5-May-1993

REQUEST NUMBER: 14400 MATRIX: W ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: PAGE:

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.27503	BE	2.5	0.3	MG/L	2.5	0.1	5/03/93	UNDER CONTROL
00.27503	PB	11.	1.	MG/L	10.	0.4	5/03/93	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

There were no blind Quality Control materials run with the samples reported above for one of the following reasons:

___ Only qualitative data requested

✓ Only Open (non-blind) QC samples run with this sample batch.

___ No QC samples run with this sample batch.

___ No QC samples for this constituent and matrix type available within EM-9

REPORT NUMBER: 18384

Analyst	Reviewer	Section Leader	QA Officer
JD Morgan	B Duran	CM a	Laura Kelly for mag
5/5/93	5/5/93	5/5/93	5/6/93
Date	Date	Date	Date

Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in

'Quality Assurance for Health and Environmental Chemistry: 1986,' LA-11114-MS, pp. 3-4.

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HE Analyses

Los Alamos
NATIONAL LABORATORY
memorandum
EXPLOSIVES TECHNOLOGY
M-1

To/MS: Phil Fresquez, EM-8, K490
Thru: T. Spontarelli, M-1, MS C920
From/MS: Wayne King, M-1, MS C920
Phone/FAX: (505)667-6751/(505)667-0500

Symbol: M-1:92-169
Date: July 1, 1993

SUBJECT: SOIL SAMPLES (U)

Seventy-four soil samples and three water samples were received from EM-8 for explosive residue analysis. The predominant explosives of interest were HMX, RDX, Tetryl, TNT, and 2,4-DNT.

Three quality control samples were analyzed, along with the 77 environmental samples, to verify the method. The average per cent recovery data is given in Table 1.

The detection limits (as shown in Table 2) were established by preparing a series of calibration standards with the concentration of analyses in solution that can be detected with a 95% certainty.

WK/pdg

Cy: D. B. Griechen, M-DO, MS P915
T. Spontarelli, M-1
W. King, M-1
M-1 File

TABLE 1

Recovery data from quality control samples

EXPLOSIVE	RESULT	UNITS	QC VALUE	% RECOVERY
HMX	1.2	ug/g	0.9	125
RDX	1.1	ug/g	1.0	107
TETRYL	0.9	ug/g	1.0	90
TNT	1.0	ug/g	1.0	100
2,4 DNT	1.1	ug/g	1.0	109
HMX	11.2	ug/g	10.0	111
RDX	10.2	ug/g	10.0	102
TETRYL	15.3	ug/g	10.0	135
TNT	13.2	ug/g	10.0	124
2,4 DNT	10.9	ug/g	10.0	108
HMX	113.8	ug/g	100.3	112
RDX	99.5	ug/g	100.1	99
TETRYL	170.1	ug/g	100.0	141
TNT	143.6	ug/g	100.0	130
2,4 DNT	109.7	ug/g	100.1	109

TABLE 2

COMPOUND	ug/g
HMX	<0.3
RDX	<0.3
TETRYL	<0.4
TNT	<0.4
2,4 DNT	<0.2

HMX RDX Tetryl TNT (NOT ND 2,4 DNT).

GROUP M-1 ANALYTICAL LABORATORY REPORT

Requestor	Phil Fresquez	**Lab. No.**	21764
Sample	[redacted] samples from TA-14-35	**P.O./P.C**	M-106
Analysis Req'd	HE Detection	**Date Rec'd**	4/14/93
Operator	Wayne King	**Reported**	6/28/93

SAMPLE	HMX µg/g	RDX µg/g	TETRYL µg/g	TNT µg/g	2,4 DNT µg/g
TA-14-35-0-0	198.7	<0.3	12.7	181.6	<0.2
TA-14-35-E-5	391.4	<0.3	1.1	27.5	<0.2
TA-14-35-E-10	200.5	<0.3	<0.4	0.7	<0.2
TA-14-35-E-25	210.5	<0.3	<0.4	<0.4	<0.2
TA-14-35-E-50	270.8	<0.3	<0.4	<0.4	<0.2
TA-14-35-E-100	110.4	1.9	<0.4	<0.4	<0.2
TA-14-35-E-10R	141.2	<0.3	<0.4	2.1	<0.2
TA-14-35-SE-5	264.5	<0.3	<0.4	11.8	<0.2
TA-14-35-SE-10	876	<0.3	2.2	7.6	<0.2
TA-14-35-SE-25	429.6	<0.3	<0.4	0.7	<0.2
TA-14-35-SE-50	59.9	2.1	<0.4	<0.4	<0.2
TA-14-35-SE-100	5.6	2.1	<0.4	<0.4	<0.2
TA-14-35-S-5	521	<0.3	3.7	38	<0.2
TA-14-35-S-10	243.2	<0.3	<0.4	0.7	<0.2
TA-14-35-S-25	17.4	2.1	<0.4	<0.4	<0.2
TA-14-35-S-50	61.2	2.2	<0.4	<0.4	<0.2
TA-14-35-S-100	264.4	<0.3	<0.4	<0.4	<0.2

TA-14-35-S-10R	98.4	<0.3	<0.4	<0.4	<0.2
SAMPLE	**HMX µg/g**	**RDX µg/g**	**TETRYL µg/g**	**TNT µg/g**	**2,4 DNT µg/g**
TA-14-35-SW-5	231.6	<0.3	<0.4	1.4	<0.2
TA-14-35-SW-10	371	<0.3	<0.4	<0.4	<0.2
TA-14-35-SW-25	188.9	<0.3	<0.4	<0.4	<0.2
TA-14-35-SW-50	1.5	1.6	<0.4	<0.4	<0.2
TA-14-35-SW-100	2.2	4.3	<0.4	<0.4	<0.2
TA-14-35-UD-117	64.7	1.2	<0.4	<0.4	<0.2
TA-14-35-LD-133	1.1	2.4	<0.4	<0.4	<0.2
SAMPLE	**HMX ug/ml**	**RDX ug/ml**	**TETRYL ug/ml**	**TNT ug/ml**	**2,4 DNT ug/ml**
TA-14-35-RINSATE	<0.3	<0.3	<0.4	<0.4	<0.2

REPORT NUMBER: 20099

Sr-90

********** EM-9 ANALYTICAL REPORT **********

Prepared by: DK on 24-Aug-1993

ANALYSIS: SR-90 REQUEST NUMBER: 14403 MATRIX: SS ANALYST: RICHARD PETERS PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

ANALYTICAL TECHNIQUE: PC ANALYTICAL PROCEDURE: ER 190 NOTEBOOK: 0 PAGE: 0

CUSTOMER SAMPLES:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
14-35-0-0	93.04845	0.1	0.2	PCI/G	8/06/93	< 0.08 U.L.B.
14-35-E-5	93.04846	0.0	0.2	PCI/G	8/06/93	
14-35-E-10	93.04847	0.0	0.2	PCI/G	8/06/93	
14-35-E-25	93.04848	0.1	0.2	PCI/G	8/06/93	
14-35-E-50	93.04849	0.2	0.2	PCI/G	8/06/93	all are ~~below~~ within
14-35-E-100	93.04850	0.0	0.3	PCI/G	8/06/93	
14-35-E-10R	93.04851	0.0	0.2	PCI/G	8/06/93	
14-35-SE-5	93.04852	0.0	0.2	PCI/G	8/06/93	U.L. Background
14-35-SE-10	93.04853	0.1	0.2	PCI/G	8/06/93	
14-35-SE-25	93.04854	0.0	0.2	PCI/G	8/06/93	
14-35-SE-50	93.04855	0.0	0.2	PCI/G	8/06/93	
14-35-SE-100	93.04856	0.1	0.2	PCI/G	8/06/93	
14-35-SW-5	93.04857	0.0	0.2	PCI/G	8/06/93	ok
14-35-SW-10	93.04858	0.0	0.2	PCI/G	8/06/93	
14-35-SW-25	93.04859	0.1	0.2	PCI/G	8/06/93	
14-35-SW-50	93.04860	0.1	0.2	PCI/G	8/06/93	
14-35-SW-100	93.04861	0.4	0.2	PCI/G	8/06/93	
14-35-S-5	93.04862	0.0	0.2	PCI/G	8/06/93	
14-35-S-10	93.04863	0.1	0.2	PCI/G	8/06/93	
14-35-S-25	93.04864	0.2	0.2	PCI/G	8/06/93	
14-35-S-50	93.04865	0.4	0.2	PCI/G	8/06/93	
14-35-S-10R	93.04866	0.1	0.2	PCI/G	8/06/93	
14-35-S-100	93.04867	0.2	0.2	PCI/G	8/06/93	
14-35-UD	93.04868	0.3	0.2	PCI/G	8/06/93	
14-35-LD	93.04869	1.1	0.3	PCI/G	8/06/93	✓ < 0.08 U.L.B

********** EM-9 QUALITY ASSURANCE REPORT *********

Prepared by: DK on 24-Aug-1993

REQUEST NUMBER: 14403 MATRIX: SS ANALYST: RICHARD PETERS PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

There were no open (non-blind) Quality Control materials run with the samples reported above for one of the following reasons:

____ Only qualitative data requested

____ Only Blind QC samples run with this sample batch.

____ No QC samples run with this sample batch.

____ No QC samples for this constituent and matrix type available within EM-9

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
93.04908	6.1	0.4	PCI/G	6.4	0.19	8/06/93	UNDER CONTROL
93.04909	21.9	1.4	PCI/G	22.6	0.7	8/06/93	UNDER CONTROL
93.04910	0.0	0.2	PCI/G	12.8	0.4	8/06/93	OUT OF CONTROL *

* Sample aliquot may not have been spiked by QAOM. mag 8/24/93

REPORT NUMBER: 20099

SJG	DK	DK	mag
Analyst	Reviewer	Section Leader	QA Officer
8/25/93	8-24-93	8-24-93	8-24-93
Date	Date	Date	Date

Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1991,' LA-12436-MS, Vol. I, pp. 21-22.

REPORT NUMBER: 19043

TPH U

********** EM-9 ANALYTICAL REPORT **********

Prepared by: AS on 23-Jun-1993

ANALYSIS: U REQUEST NUMBER: 14403 MATRIX: SS ANALYST: RICHARD PETERS PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

ANALYTICAL TECHNIQUE: KPA ANALYTICAL PROCEDURE: NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
14-35-0-0	93.04845	2.32	0.16	UG/G	6/23/93	
14-35-E-5	93.04846	5.17	0.36	UG/G	6/23/93	
14-35-E-10	93.04847	2.27	0.16	UG/G	6/23/93	
14-35-E-25	93.04848	3.34	0.23	UG/G	6/23/93	2.27 to 6.4 ppm
14-35-E-50	93.04849	4.23	0.3	UG/G	6/23/93	$\bar{x}$ = 4.33 (± 1.43)
14-35-E-100	93.04850	4.55	0.32	UG/G	6/23/93	
14-35-E-10R	93.04851	6.4	0.45	UG/G	6/23/93	
14-35-SE-5	93.04852	5.65	0.4	UG/G	6/23/93	
14-35-SE-10	93.04853	31.16	2.18	UG/G	6/23/93	1.8 to 31.16 ppm
14-35-SE-25	93.04854	4.88	0.34	UG/G	6/23/93	$\bar{x}$ = 9.44 (± 12.2)
14-35-SE-50	93.04855	3.69	0.26	UG/G	6/23/93	
14-35-SE-100	93.04856	1.8	0.13	UG/G	6/23/93	
14-35-SW-5	93.04857	4.42	0.31	UG/G	6/23/93	
14-35-SW-10	93.04858	7.36	0.52	UG/G	6/23/93	3.63 to 7.36 ppm
14-35-SW-25	93.04859	5.31	0.37	UG/G	6/23/93	$\bar{x}$ = 4.90 (± 1.57)
14-35-SW-50	93.04860	3.63	0.25	UG/G	6/23/93	
14-35-SW-100	93.04861	3.74	0.26	UG/G	6/23/93	
14-35-S-5	93.04862	5.06	0.35	UG/G	6/23/93	
14-35-S-10	93.04863	4.49	0.31	UG/G	6/23/93	
14-35-S-25	93.04864	2.09	0.15	UG/G	6/23/93	1.99 to 6.22 ppm
14-35-S-50	93.04865	1.99	0.14	UG/G	6/23/93	$\bar{x}$ = 4.33 (± 1.09)
14-35-S-10R	93.04866	6.22	0.44	UG/G	6/23/93	
14-35-S-100	93.04867	6.13	0.43	UG/G	6/23/93	
14-35-UD	93.04868	2.45	0.17	UG/G	6/23/93	Drainage < 3.34 B.G.
14-35-LD	93.04869	2.73	0.41	UG/G	6/23/93	

********** EM-9 QUALITY ASSURANCE REPORT *********

Prepared by: AS on 23-Jun-1993

REQUEST NUMBER: 14403 MATRIX: SS ANALYST: RICHARD PETERS PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

There were no open (non-blind) Quality Control materials run with the samples reported above for one of the following reasons:

____ Only qualitative data requested

____ Only Blind QC samples run with this sample batch.

____ No QC samples run with this sample batch.

____ No QC samples for this constituent and matrix type available within EM-9

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
93.04905	0.676	0.047	UG/G	1.11	0.02	6/23/93	OUT OF CONTROL
93.04906	1.472	0.103	UG/G	2.38	0.07	6/23/93	OUT OF CONTROL
93.04907	1.429	0.69	UG/G	1.11	0.05	6/23/93	UNDER CONTROL

REPORT NUMBER: 19043	AS	DK	DK	mag
	Analyst	Reviewer	Section Leader	QA Officer
	9/22/93	9-23-93	9-23-93	9-23-93
	Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1986,' LA-11114-MS, pp. 3-4.

********** EM-9 ANALYTICAL REPORT **********

Prepared by: DMH on 18-Sep-1993

ANALYSIS: U REQUEST NUMBER: 14403 MATRIX: W ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

ANALYTICAL TECHNIQUE: ICPMS ANALYTICAL PROCEDURE: 200.8 NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
14-35-RIN	93.04870	12.	1.	UG/L	6/04/93	

********** EM-9 QUALITY ASSURANCE REPORT *********

Prepared by: DMH on 18-Sep-1993

REQUEST NUMBER: 14403 MATRIX: W ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.00895	1.	1.	UG/L	0.0		6/18/93	UNDER CONTROL
00.22907	82.9	25.	UG/L	100.	10.	6/18/93	UNDER CONTROL
00.22907	80.2	39.	UG/L	100.	10.	6/18/93	UNDER CONTROL
00.22907	88.8	14.	UG/L	100.	10.	6/18/93	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
93.04911	149.	14.	UG/L	140.	6.	6/04/93	UNDER CONTROL

REPORT NUMBER: 20599

Analyst	Reviewer	Section Leader	QA Officer
9/20/93	9/20/93	9/20/93	9/20/93
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1991,' LA-12436-MS, Vol. I, pp. 21-22.

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Appendix F

The New Mexico Environment Department's August 17, 1995, Letter to the Department of Energy/Los Alamos Area Office Regarding Comments Concerning Ground-Water Contamination and Protection at Los Alamos National Laboratory (LANL), Los Alamos, New Mexico

State of New Mexico
ENVIRONMENT DEPARTMENT
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-2850

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON III
DEPUTY SECRETARY

17 August 1995

Mr. Larry Kirkman
Acting Area Manager
Department of Energy
Los Alamos Area Office
528 35th Street, Mail Stop A316
Los Alamos, NM 87544

RE: Comments Concerning Ground-water Contamination and Protection at Los Alamos National Laboratory(LANL), Los Alamos, New Mexico

Dear Mr. Kirkman:

The New Mexico Environment Department(NMED), Department of Energy Oversight Bureau(DOE OB) and Hazardous and Radioactive Material Bureau(HRMB) staff have assessed LANL's ground-water protection program, and have concluded that several problems concerning ground-water contamination and protection exist. The following summarizes major concerns of the NMED in relation to ground-water protection at LANL:

- From 1989 to 1993, water at approximately 271 ground-water monitoring stations(wells) exceeded Department of Energy, Environmental Protection Agency, New Mexico State drinking water standards or maximum contaminant levels, and NMED Water Quality Control Commission (WQCC) standards.

- Results of historical tritium concentration trend analyses, performed for seven LANL regional aquifer monitoring wells indicate that past laboratory releases of tritium-contaminated water may have commingled with the regional aquifer.

- LANL's Environmental Surveillance group recently released preliminary data which indicate that the regional aquifer near production well O-4 contains strontium-90 at levels

four(4) times the New Mexico State drinking water standard and NMED WQCC standard.

- Both LANL and NMED DOE OB analytical data obtained from on-site and off-site springs are showing elevated concentrations of chlorinated solvents, high explosives, nitrates/nitrites as nitrogen and radionuclides.

- Preliminary modeling of the water balance in Mortandad Canyon by NMED suggests radionuclide-bearing effluent from LANL's liquid radioactive waste treatment facility(Tech Area 50) can leak out of the shallow(alluvium) aquifer and thus percolate towards the regional aquifer.

The above conditions warrant NMED's previous recommendations to develop a site-wide ground-water monitoring system to ascertain the impacts of laboratory operations to the groundwater regime. Currently, the impact to human health and the environment is unknown. A plan is required to determine adequately the effect past, current, and future laboratory operations have on the ground-water regime. The inadequacy of LANL's current ground-water monitoring system, the lack of basic hydrologic information, and the lack of compliance with both HSWA and RCRA ground-water monitoring requirements have previously been conveyed by NMED through memoranda, presentations, and letters. *(c.f. NMED internal letter, August 26, 1992; NMED letter to Jerry Bellows, November 25, 1992; NMED Initial Ground-Water Assessment Report, December 1992; NMED internal memo, February 5, 1993; NMED presentation at San Ildefonso, February 16, 1993; NMED/LANL meeting February 19, 1993; NMED letter to Diana Webb, March 10, 1993; NMED letter to Diana Webb, July 1, 1993; NMED letter to distribution, August 6, 1993; NMED memo to EPA, August 5, 1993; NMED internal memo, November 23, 1993; NMED letter to Diana Webb, February 28, 1994; NMED internal memo, February 22, 1994; NMED internal presentations, May 13, 1994; NMED letter to Joseph Vozella, July 7, 1994; NMED letter to EPA, January 23, 1995; NMED letter to EPA, January 24, 1995; NMED/DOE meeting, April 13, 1995; NMED letter to Larry Kirkman, May 30, 1995; NMED internal memo, July 5, 1995).*

Basic geology, hydrogeology, and pathways for contaminant transport have not been adequately addressed to date. At present, the following fundamental hydrogeologic issues/questions remain unresolved at LANL.

- Individual zones of saturation beneath LANL have not been adequately delineated, and the "hydraulic interconnection" between these is not understood. A facility-wide description of the hydrogeologic characteristics affecting ground-water flow beneath the facility cannot be made without adequate delineation of the perched-intermediate aquifer(s) beneath LANL.

- The recharge area(s) for the main and perched-intermediate aquifers have not been identified. It is unknown at this time if any significant quantity of water is recharging the main aquifer through fracture-fault zones which occur on the Pajarito Plateau. Characterization of these site-wide fault zones as potential pathways for aqueous migration is not complete. It is unknown what effect, if any, these zones may have on the direction of ground-water flow and hydraulic gradient of the main and perched-intermediate aquifers.

- The ground-water flow direction(s) of the main aquifer and perched-intermediate aquifer(s), as influenced by pumping of production wells are unknown.

- Aquifer characteristics cannot be determined without additional monitoring wells installed within specific intervals of the various aquifers beneath the facility. Locations of wells designed for aquifer testing cannot be addressed adequately without the delineation of individual zones of saturation beneath LANL.

At present, it appears that several different organizations(i.e., Environmental Restoration, Environmental Surveillance and Earth and Environmental Science divisions) at LANL are performing activities related to ground-water protection, monitoring and characterization. NMED does not consider that LANL's individual programs are adequately addressing the necessary requirements for a comprehensive ground-water protection program.

The hydrogeologic projects underway lack the integration necessary to meet the specific requirements of the HSWA permit and to address the fundamental hydrogeologic issues mentioned above. The lack of knowledge surrounding these fundamental hydrogeologic issues does not allow for compliance with the regulatory requirements of a site-wide characterization.

NMED is currently evaluating what work needs to be conducted and to what level of detail to assure compliance with both the HSWA hydrogeologic permit requirements and the requirements for ground-water monitoring of RCRA regulated units. This evaluation should be completed in October, 1995, and provided to EPA and then available to LANL.

During the course of NMED's investigation for the RCRA hydrogeologic evaluation, it has become evident to NMED that a RCRA site-wide hydrogeologic workplan should be developed and submitted to NMED and EPA for review and approval. A site-wide hydrogeologic workplan developed under the driver of RCRA will provide a mechanism to assure a compliance schedule with specific tasks to meet the permit objectives. The workplan should address both the HSWA hydrogeologic permit requirements and RCRA regulatory ground-water monitoring requirements.

Thank you for your attention in this matter. Should you have any questions concerning either technical or regulatory issues please contact Ms. Teri Davis of HRMB at (505) 827-1560. If you have any questions concerning technical matters please contact Mr. Michael Dale of DOE OB at (505) 672-0449.

Sincerely,

Ed Kelley

Ed Kelley PhD, Director, Water and Waste Management Division
New Mexico Environment Department

cc: Theodore Taylor, DOE LAAO, AAMEP, MS A316
Joseph Vozella, DOE LAAO, MS A316
Ivan Trujillo, DOE LAAO, MS A316
Matt Johansen, DOE LAAO, MS A316
Ken Zamora, Scientech/LAAO, MS A316
Barbara Driscoll, EPA Region 6
Gilbert Sanchez, San Ildefonso Pueblo, Environmental Director
Mark Weidler, NMED, Secretary
Peter Maggiore, NMED, Environmental Protection Division
Neil Weber, NMED, Chief, DOE Oversight Bureau
Benito Garcia, NMED, Chief, HRMB
Jim Piatt, NMED, Chief, SWQB
Marcy Leavitt, NMED, Chief, GWPRB
Sig Hecker, LANL, Laboratory Director, MS A100
Tom Baca, LANL, EM, MS J591
Jorg Jansen, LANL, EM/ER, MS M992
Steve Rae, LANL, ESH-18, MS K490

Appendix G

Surface Water Runoff Data for Q-Site at Technical Area 14

Los Alamos
NATIONAL LABORATORY
memorandum

Chemical Science and Technology
CST-12 - Organic Analysis
Los Alamos, New Mexico 87545

To/MS: Michael Alexander/ESH-16/MS K497
Thru: Gerald Ansell/CST-12/MS E517
From/MS: Betty Harris/CST-12/MS G740
Phone/FAX: 5-3410/5-9345
Symbol: CST-12:96-188
Date: 9/13/96

CONTAMINANTS AT TA-14, Q-SITE

During the summer of 1995 a university team from Hobbs Junior College and I constructed sample collectors at twelve locations at Q-SITE, TA-14. The purpose of the project was to quantify the concentrations of contaminants of concern (COC). Water and soil samples were collected and analyzed for volatile organics, semi-volatile organics, explosives, and metals. Also, samples were screened for radiation.

Results obtained using Gas Chromatography and Mass Spectroscopy (GC/MS), showed no detectable amounts of volatile and semi-volatile organics. However, high performance liquid chromatography (HPLC) analyses confirmed parts per billion (ppb) levels of explosives in the soil at two sample points QCS-3 and QWS-1.* Small pieces of uranium oxide were found in and around a sump, Q-43 (west and near Gun Facility), and along the lower bottom edge, QWW-1, of a recently installed access road. Otherwise, no radiation was detected in the samples.

The United States Environmental Protection Agency (US-EPA) method SW846-700 series, which uses an atomic absorption spectrophotometer with a graphite furnace detector, was employed to determine metal contamination soil and waste samples. Parts per million (ppm) levels of barium, beryllium, cadmium, chromium, and lead were detected.

US-EPA SW846 Method 8330 was used by Wayne King, DX-2, to analyze soil and water samples possibly contaminated with explosives.

The concentrations of volatile and semi-volatile organics in soil and water samples were determined by Jeff Roberts of CST-12 by standard US-EPA methods.

The paper describing this work has not been published. Please contact me if you need more information.

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* Consult ledger on Figure 1 for an explanation of sample nomenclature.

UNM DOE LANL SANDIA NMIMT NMSU

HOWE Laboratory

5317 Lovington Highway 505-392-5603 ext. 634 Hobbs, NM 88240

New Mexico Junior College

Dr. Betty Harris
Los Alamos National Laboratories
MS C920
Los Alamos, NM 87545

January 26, 1996

Dr. Harris,

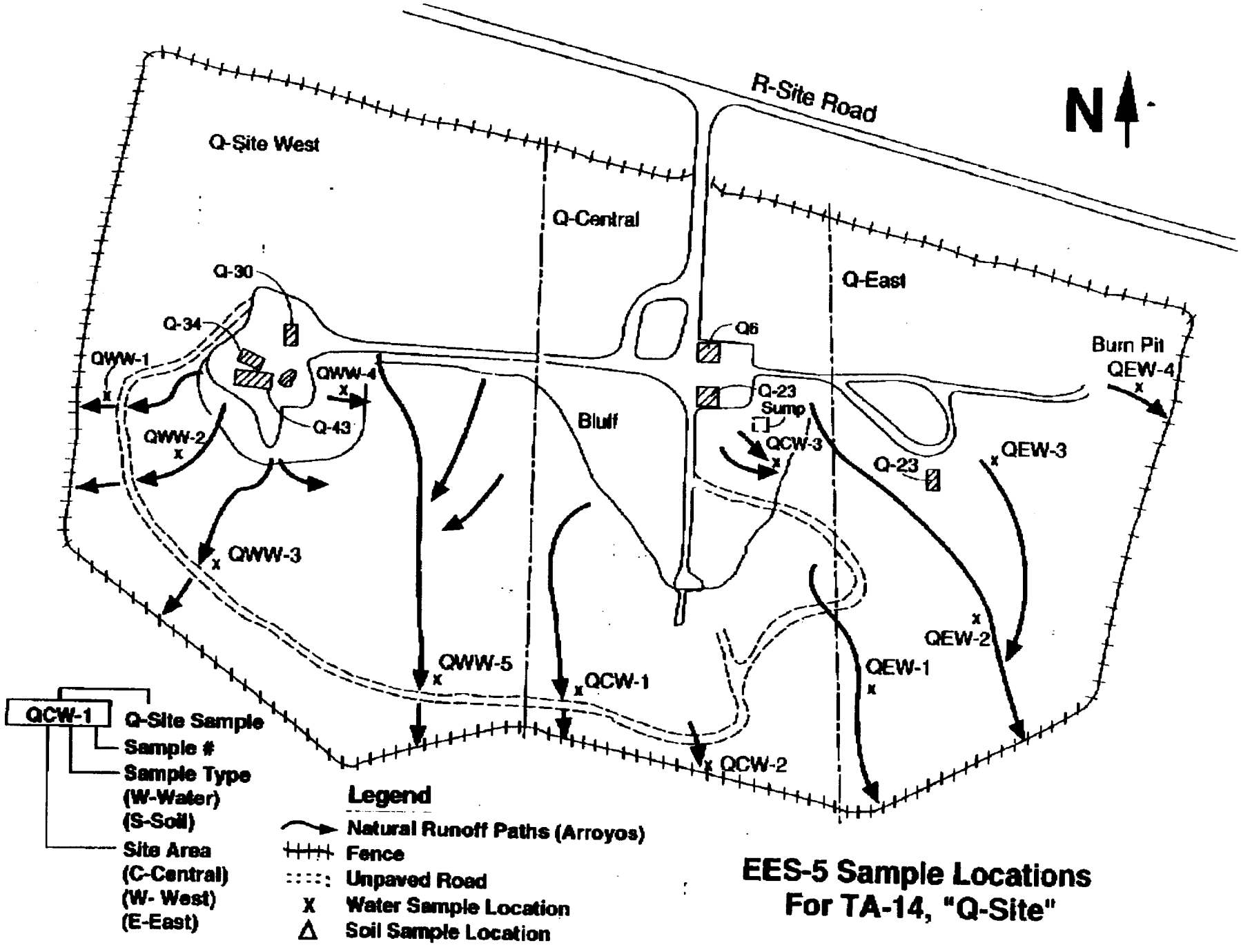
The results for the 10 water samples submitted for analysis for the metals barium, beryllium, cadmium, chromium and lead follow. Results are given in micrograms/liter.

TOTAL METALS (ug/L)

SAMPLE	Ba	Be	Cd	Cr	Pb	METHOD
QEW-1	120	3	1.0	5.8	11	SW-846 7000 Series
QEW-3	115	<0.1	1.0	5.1	<1.0	SW-846 7000 Series
QEW-4	66	0.5	2.8	4.8	1.0	SW-846 7000 Series
QWW-1	40	0.5	<0.1	2.6	<1.0	SW-846 7000 Series
QWW-2,3	45	<0.1	<0.1	2.6	1.0	SW-846 7000 Series
QWW-4	70	<0.1	<0.1	2.7	1.8	SW-846 7000 Series
QWW-6	70	1.7	1.9	1.9	2.7	SW-846 7000 Series
QCW-1	25	0.8	<0.1	4.2	2.8	SW-846 7000 Series
QCW-2	26	0.9	<0.1	3.9	5.1	SW-846 7000 Series
QCW-3	57	0.3	<0.1	4.3	5.9	SW-846 7000 Series

NOTE: The SW-846 7000 series analyses by graphite furnace for the above metals bear the following method numbers:

Metal	Method Number
Barium	7081
Beryllium	7091
Cadmium	7131A
Chromium	7191
Lead	7421



EES-5 Sample Locations For TA-14, "Q-Site"

Appendix H

Evaluation of Meteorological Conditions for Open Burning

EVALUATION OF METEOROLOGICAL CONDITIONS FOR OPEN BURNING

Purpose

Los Alamos National Laboratory (LANL) operating groups conduct open burning operations that are permitted and approved by the New Mexico Environmental Department's Air Pollution Control Bureau. This Air Quality Group procedure describes the process used by ESH-17 to determine if wind speed, atmospheric stability, and mixing depth are within allowable limits before issuing permission to LANL operating groups to perform open burning.

Scope

This procedure applies to all open burning performed at LANL.

In this procedure

This procedure addresses the following major topics:

Topic	See Page
General Information About this Procedure	2
Who Requires Training to this Procedure?	2
Obtaining and Evaluating Meteorological Conditions	4
Records Resulting from this Procedure	6

Signatures

Prepared by: Leland Maez, Open Burn Permitting Project Leader	Date: 3/1/96
Approved by: Pat Beaulieu, ESH-17 Quality Assurance Officer	Date: 3/1/96
Approved by: Ernie Gladney, ESH-17 Group Leader	Date: 3/4/96

02/29/96

General information about this procedure

Attachments

This procedure has no attachments.

History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	3/2/96	New document.

Who requires training to this procedure?

The following personnel require training before implementing this procedure:

- ESH-17 personnel assigned to assess meteorological conditions before issuing permission for open burning.

Training method

The training method for this procedure is "self-study" (reading) and is documented in accordance with the procedure for training (ESH-17-024).

Prerequisite

Access to LANL Weather Machine (Internet connection)

General information, continued

Definitions specific to this procedure

Mean wind speed: The mean wind speed is measured in meters per second at 11 meters above ground level over a 15 minute period. Wind is a factor in issuing permission for a burn because high wind speeds increase fire danger. A burn should be postponed if the mean wind speed is equal to or greater than 10 meters per second.

Atmospheric stability: Stability is classified as A, B, C, D, E, or F. Atmospheric stability controls the rate of growth of the plume. When conditions are A, B, C, or D, mixing is quite rapid and concentrations fall off quickly with distance from the source. When conditions are categorized as E or F, the decrease in concentration with distance is slower. A burn should be postponed if the stability is E or F.

Mixing depth: Mixing depth is the depth of the layer in which most of the mixing will occur. A shallow mixing layer will impede vertical growth of the plume once it has reached the top of the mixed layer. If the mixing depth is less than 200 meters, the burn should be postponed.

References

The following documents are referenced in this procedure:

- ESH-17-024, "Personnel Training"

Note

Actions specified within this procedure, unless preceded with "should" or "may," are to be considered mandatory guidance (i.e., "shall").

Obtaining and evaluating meteorological conditions

Background

In order to assure proper dispersion of the smoke generated by open burning and to minimize fire risk, meteorological conditions must be within acceptable limits. ESH-17 personnel must evaluate meteorological conditions before granting permission to operating groups to perform a burn.

Obtaining and evaluating data

To obtain and evaluate meteorological data, perform the following steps:

Step	Action
1	On the morning of the scheduled burn, log onto the LANL Weather Machine at address http://weather.lanl.gov.
2	Under "Current and Recent Conditions around Los Alamos," select "Detailed Tabular Summary, Long Form."
3	Scroll to the most recent meteorological data for the present date. If you cannot access the Weather Machine data, or the most current data is more than 30 minutes old, call an ESH-17 meteorologist at 667-7079 to obtain the required information.
4	Find the "PG Stability category EPA based on Sigma Phi" at the meteorology tower nearest to the burn site. **If the stability is...** — **Then...** A, B, C, or D — Continue with step 5 E or F — Notify the operating group that the burn must be postponed
5	Find the 11 meter height wind speed at the meteorology tower nearest to the burn site. **If the wind speed is...** — **Then...** Less than 5 m/s — Go to step 7 Equal to or greater than 5 m/s — Continue with step 6

Obtaining and evaluating met. conditions, continued

Step	Action
6	Call an ESH-17 meteorologist at 667-7079 to consult about fire danger. The meteorologist will obtain the current fire danger index and determine if the wind speed is acceptable. **If the meteorologist determines...** — **Then...** The wind speed is acceptable — Perform step 7 while in telephone contact with the meteorologist The wind speed is excessive — Notify the operating group that the burn must be postponed
7	Call an ESH-17 meteorologist at 667-7079 and request the current estimate of mixing depth. **If the mixing depth is...** — **Then...** Greater than 200 meters — Immediately notify the operating group that the burn may be performed between the hours of 10 AM and 4 PM MST and must be started within 2 hours of the evaluated meteorology data time Less than or equal to 200 meters — Notify the operating group that the burn must be postponed
8	When verbal permission has been granted to perform a burn, record the following information in the applicable section of the Open Burning Log: • Operating group personnel to whom you verbally granted burn permission • Date and time period during which the burn may be performed • Evaluated mean wind speed, atmospheric stability, and mixing height values

Records resulting from this procedure

Records

The following records generated as a result of this procedure are to be submitted as records to the records coordinator:

- When an open burning permit expires, information recorded in the Open Burning Log applicable to that permit is submitted as a record

Appendix I

Air Quality Impact Modeling for the Open Burning Unit at Technical Area 14 (Included as Attachment D of Los Alamos National Laboratory's Five-Year Open Burn Permit Application, approved by the New Mexico Environment Department Air Quality Bureau on August 18, 1997.)

ATTACHMENT D

TECHNICAL APPROACH TO ESTIMATING EMISSIONS FROM OPEN BURNING OPERATIONS CONDUCTED AT TECHNICAL AREAS 11, 14, 16, AND 36

The following is a comprehensive analysis which provides detailed emission estimates for wood and fuel fire testing conducted at TA-11, HE contaminated waste burning at TA-14, equipment flashing and HE contaminated solvent/oil burning at TA-16, and DU contaminated wood waste burning and wood fire testing conducted at TA-36. Also, provided in this section are the impact analysis results from open burning emissions.

This analysis is organized into two sections: 1.) Emission Estimates from Open Burning Operations, and 2.) Ambient Air Quality Emission Impact Analysis.

Radioactive air emission estimates and the resulting dose to the nearest off-site receptor from the burning of depleted uranium is included in this analysis for completeness and as a courtesy.

SECTION 1 - EMISSION ESTIMATES FROM OPEN BURNING OPERATIONS

Open Burning of Wood

Air emissions from the combustion of wood were derived using emission factors developed by the Environmental Protection Agency (EPA) and found in AP-42 in the July 1995, Version 4.0 of Air Chief; available on CD ROM. Specifically, the combustion of wood in residential fireplaces with no emission control devices.

Additional Information:

TA-16 HE Contaminated Solvent/Oil Burning

Because of the high combustion temperatures required to sustain burning of very dilute liquid mixtures, a wood fire may be built under the 3 foot tall burn tray and continually stoked until the HE contaminated liquids have been combusted. Wood is used only occasionally during this operation as an aid in the combustion of very dilute solvent/oil mixtures. This analysis conservatively assumes wood is present at every burn.

TA-36 Open Burn Area

Air emissions estimates for open burning of firing site wastes are based on a wood pile size of $300m^3$. The quantity of wood available for burning was estimated by assuming that the loosely piled mound consisted of 25% by volume wood, density of $0.5\ g/cm^3$ (from CRC Handbook of Chemistry and Physics, 62nd edition, p. F-1). The amount of DU present in the wood waste was estimated using monitoring studies and predictive methods.

Open Burning of High Explosives

In all operations containing HE contaminated waste, the quantity of HE is minimal with respect to the amount of the other associated combustible waste. Although the burning of HE is not regulated, combustion emissions are included in this analysis for completeness of impact modeling.

Emission estimates for the combustion of HE were performed using emission factors compiled from data provided in the documents titled: "Emissions from the Open Burning or Detonation of High Explosives," R.V. Carter, U.S. Army Environmental Hygiene Agency, 1978; "Air Quality Impact Analysis, Open Burning of Explosives," Department of Energy, Pantex Plant, Amarillo, Texas, Radian Corp., 1990; "Lawrence Livermore National Laboratory (LLNL) Explosives Handbook Properties of Chemical Explosives and Explosive Simulants," B. M. Dobratz, 1981. Table 1 shows the typical profile of the HE burned at the Laboratory as well as their associated emissions.

TABLE 1, EMISSIONS FROM THE OPEN BURNING OF HIGH EXPLOSIVES

High Explosives, Propellants, and Binders	Composition Fraction	Quantity Burned (lb/burn)	Combustion Products (lb)		
			CO	NOx	PM
TATB[1,2]	0.21	0.42	1.09E-02	2.92E-02	8.17E-02
NTO[1,2]	0.18	0.36	1.01E-02	2.70E-02	7.56E-02
Pyroxylin[1,2]	0.04	0.08	2.24E-03	6.00E-03	1.68E-02
Comp B[1,2]	0.04	0.08	2.00E-04	1.48E-03	N/A
LAX 112[1,2]	0.04	0.08	2.24E-03	6.00E-03	1.68E-02
RDX[1,2]	0.04	0.08	2.09E-04	1.50E-03	N/A
DNT[1,2]	0.04	0.08	2.24E-03	6.00E-03	1.68E-02
Nitroguanidine[1,2]	0.04	0.08	2.22E-04	1.50E-03	2.34E-03
HMX[1,2]	0.04	0.08	2.22E-04	1.50E-03	2.34E-03
PETN[1,2]	0.04	0.08	2.00E-04	1.48E-03	N/A
TNT[1,2]	0.04	0.08	2.24E-03	6.00E-03	1.68E-02
HNS[1,2]	0.04	0.08	2.18E-04	1.15E-03	6.48E-03

Barium nitrate[3,4]	0.01	0.02	N/A	7.00E-03	N/A
Cyanuric acid[3,4]	0.01	0.02	2.20E-03	1.76E-02	1.76E-02
Pentek[3,4]	0.01	0.02	2.20E-03	1.76E-02	1.76E-02
Exxon461[3,4]	0.02	0.04	1.00E-03	N/A	N/A
KFE[3,4]	0.02	0.04	1.00E-03	N/A	N/A
Polystyrene[3,4]	0.02	0.04	2.20E-03	N/A	N/A
Estane[3,4]	0.02	0.04	2.20E-03	N/A	N/A
Viton[3,4]	0.02	0.04	1.00E-03	N/A	N/A
BDNPA-F[3,4]	0.02	0.04	2.20E-03	N/A	N/A
DBP[3,4]	0.02	0.04	2.20E-03	N/A	N/A
DOP[3,4]	0.02	0.04	2.20E-03	N/A	N/A
CEF[3,4]	0.02	0.04	1.00E-03	N/A	N/A
TOTAL	**1**	**2**	**5.06E-02**	**1.31E-01**	**2.71E-01**

1 Emission factors from Roy V. Carter (June 1978), Emissions from the Open Burning and Detonation of Explosives.

2 Emission factors from U.S. Environmental Protection Agency (July 1995), AP-42 Air Pollution Emission Factors.

3 Emission factors from Radian Corp. (July 1990), Air Quality Impact Analysis, Open Burning of Explosives, Department of Energy, Pantex Plant, Amarillo, Texas.

4 Emission factors based on chemical structures from B. M. Dobratz (March 1981), LLNL Explosives Handbook Properties of Chemical Explosives and Explosive Simulants.

Open Burning of Associated Waste

Emissions from the associated waste burned during operations (i.e. paper, plastic, Kimwipes, Lexan or Plexiglas, burlap, etc.) was derived from the burning of municipal waste published in the Environmental Protection Agency's (EPA) Air Chief 4.0 CD ROM (a.k.a. Compilation of Air Pollutant Emission Factors AP-42, 1995). Emissions from the burning of distillate oil to account for the kerosene used as a starter aid was derived from emission factors provided in EPA's AP-42, Section 1.3 (Fuel Oil Combustion).

Open Burning of HE Contaminated Solvents or Oil

High explosives (HE) contaminated dilute solvents and lubricant oils are burned in a liquid burn tray at the TA-16 burn grounds and in solvent coated rags at the TA-14 burn cage. The average composition of the solvent solutions burned at LANL are: 30% methanol; 25% water; 20% acetonitrile; 20% tetrahydrofuran; and 5% of any the solvents shown in Table 2 (Sandoval, LANL-1995) . Table 2 also gives the chemical properties and assumptions required for the emission calculations. Combustion emissions except for NOx are estimated from a study performed by A. Tewarson entitled Prediction of Fire Properties of Fuels, Factory Mutual

Research Corporation, 1985 (Attachment E). NOx emissions were estimated from emission factors provided in EPA's AP-42, Section 1.3 (Fuel Oil Combustion).

TABLE 2, CHEMICAL PROPERTIES OF SOLVENTS AND PUMP OIL

SOLVENT TYPE	MOLECULAR WEIGHT (g/mole)	DENSITY (g/ml)	NUMBER OF CARBONS	ASSUMPTIONS USED FOR CALCULATIONS
pump oil*	72	0.9050	5	**
methanol	32	0.7914	1	experimental data available
acetonitrile	41	0.7868	2	C_2 linear alkanes
tetrahydrofuran	72	0.8888	4	C_3-C_6 linear ketones
methyl ethyl ketone	72	0.8054	4	C_3-C_6 linear ketones
butyl acetate	116	0.8825	6	C_5-C_{10} acetate
ethyl acetate	88	0.9003	4	C_4 acetate
toluene	92	0.8669	7	experimental data available
ethanol	46	0.7893	2	experimental data available
acetone	58	0.7899	3	experimental data available
cyclohexane	84	0.7785	6	C_5 -C_{10} cyclo alkane

* Approximated as n-Pentane (C_5H_{12}).

** Used average of values given for linear, branched, and cyclic alkanes (paraffins).

Depleted Uranium Emission Estimates

A study conducted by Pacific Northwest Laboratory found the fractional airborne release of uranium during controlled burning to be between 0.05 and 0.003 percent of the uranium mass burned. An open burning emission study was conducted at LANL in 1980 titled, *'Oxidation of Depleted Uranium Penetraters and Aerosol Dispersal at High Temperatures'*. This study measured the amount of aerosolized DU during open burning using wood and paper as fuel. The study indicated that at temperatures ranging from 500 °C to 1000 °C, aerosol concentrations of DU in the respirable size range (<10μm) are typically less than 0.001 percent of the DU mass burned. The average fuel fire burn temperature is estimated to be 1000 °C.

Additional Information:

TA-11 Fuel and Wood Fire Testing and TA-36 Wood Fire Testing

These tests are performed to in order to study the effects fire will have on transportation packing devices and explosive test assemblies. Test assemblies may contain as much as 40 kg of DU.

TA-36 Open Burn Area

Wood consisting primarily of shot tables and stands used during detonation testing at the Laboratory's explosives sites. Tables and shot stands aid in holding or securing assemblies for detonation. Some of these assemblies contain DU. When detonated, particles and shrapnel may become lodged in the wood. The

majority of the explosive testing performed involves projectile firing. It is estimated that over 98 % of the DU projectile strikes a predetermined target. Monitoring studies confirm that volumes of 20 cords of firing site debris (wood from tables and shot stands) can contain as much as 50 grams of DU lodged as shrapnel. Air emissions estimates for open burning of firing site wastes are based on a wood pile size of $300m^3$. The quantity of wood available for burning was estimated by assuming that the loosely piled mound consisted of 25% by volume wood, density of 0.5 g/cm^3 (from CRC Handbook of Chemistry and Physics, 62nd edition, p. F-1).

Emissions Summary

Table 3 summarizes the analysis used to estimate emissions from the open burning operations included in the attached application. Table 4 provides a detailed summary of emissions from open burning operations on a per burn basis.

Burn times approximate the average burn time length and are not intended to be used as terms or conditions of the permit.

TABLE 3, EMISSIONS ANALYSIS (continued)

		40 kg DU	1980 LANL Study 'Oxidation of Depleted Uranium Penetrators'	10^{-01} % of mass burned
		45 kg HE material	U.S Army Environmental Hygiene Agency, 1978, 'Emissions From the Open Burning or Detonation of Explosives'	CO 48.56 lb/ton NOx 126.5 lb/ton PM-10 4.82 lb/ton
TA-14	Burn Cage *Burn time 1 hour*	13 lb (see type and quantity of material section) wood/ cardboard	AP 42, Wood Combustion in Residential Fireplaces, July 1995, Version 4.0 of EPA's Air Chief	CO 252.6 lb/ton NOx 2.6 lb/ton SOx 0.4 lb/ton PM-10 34.6 lb/ton
		35 lb (see type and quantity of material section) plastic/ paper	AP 42 Burning of Municipal Waste, July 1995, Version 4.0 of EPA's Air Chief	CO 85 lb/ton NOx 6 lb/ton SOx 1.0 lb/ton PM 16 lb/ton
		2 lb HE	U.S Army Environmental Hygiene Agency, 1978, 'Emissions From the Open Burning or Detonation of Explosives'	CO 48.56 lb/ton NOx 126.5 lb/ton PM-10 4.82 lb/ton
		½ gal fire starter aid/fluid	Factory Mutual Research Corporation, 1986, A. Tewarson, 'Prediction of Fire Properties of Fuels'	CO 0.014 lb/gal NOx 0.66 lb/gal PM 0.177 lb/gal

TABLE 4, EMISSIONS SUMMARY (continued)

TA	BURN TYPE	MATERIAL	QUANTITY	CO (lb)	NOx (lb)	SOx (lb)	PM-10 (lb)	DU (gr)
14	Burn Cage	*wood/cardboard*	13 lb	1.6	0.02	0.003	0.2	
		plastic/paper	35 lb	1.5	0.1	0.02	0.3	
		HE	2 lb	0.05	0.1		0.005	
		fire starter aid/fluid	½ gal	0.01	0.3		0.1	
	SUM			***3.3***	***0.5***	***0.02***	***0.6***	***0***
16	Flash Pad	*wood*	1600 lb	202.1	2.1	0.3	27.7	
		rags/paper	50 lb	2.1	0.2	0.03	0.4	
	SUM			***204.2***	***2.2***	***0.3***	***28.1***	***0***
	using propane	*propane*	100 lb	0.4	0.03	0.006	0.08	
		rags/paper	50 lb	2.1	0.2	0.03	0.4	
	SUM			***2.5***	***0.2***	***0.04***	***0.5***	***0***
	Solvent Burn	*solvent*	55 gal	0.8	36.3	0	9.7	
		oil	55 gal	1.6	0	0	16	
		scrap wood	1600 lb	202.1	2.1	0.3	27.7	
	SUM			***204.5***	***38.4***	***0.3***	***53.4***	***0***
	using propane	*propane*	100 lb	0.04	0.003	0.0006	0.008	
		solvent	55 gal	0.8	36.3	0	9.7	
		oil	55 gal	1.6	0	0	16	
	SUM			***2.44***	***36.303***	***0.0006***	***25.708***	***0***
36	Wood Burn	*wood*	83000 lb	10482.9	107.9	16.6	1435.9	
		Lexan	250 lb	10.6	0.75	0.125	2	
		diesel or kerosene	10 gal	0.3			2.9	
		DU	55 gr					0.00055
	SUM			***10493.8***	***108.7***	***16.7***	***1440.8***	***0.00055***
	Sled Track Test	*wood*	2000 lb	252.6	2.6	0.4	34.6	
		HE	99 lb	2.4	6.3		0.2	
		DU	40000 gr					0.4
	SUM			***255***	***8.9***	***0.4***	***34.8***	***0.4***

SECTION 2 - AMBIENT AIR QUALITY EMISSION IMPACT ANALYSIS

Air emission impacts from open burning are regulated under ambient air quality standards set forth by federal statutes and adopted by the State of New Mexico. Air emissions from LANL's open burning operation include criteria pollutants such as carbon monoxide (CO), oxides of nitrogen (NOx), particulate matter (PM), and sulfur dioxide (SO_2). In addition, impacts from depleted uranium (DU) must meet the NESHAP standards for radionuclide emissions as set forth in 40 CFR 61 Subpart H, *emissions of radionuclides from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem.*

Compliance with the ambient air quality standards was determined using the SCREEN 3 air emissions dispersion model. Impact estimates from DU was determined using the *HOTSPOT 8.0* emissions dispersion model.

Results of the impact analysis, the parameters supplied to the modeling programs, and the applicable standard for each regulated pollutant are shown in Tables 7 - 12 for both the maximum impact and for the nearest off-site location for each open burn operation. The impacts from **all** regulated pollutants are shown to be well below the ambient standards at **all** affected locations.

Air Quality Impacts

Criteria Pollutants

Air quality impacts of the combustion products CO, NOx, SO_x, and PM were assessed at the maximum impact points and the nearest off-site receptors for each open burn operation. Compliance with the standard was evaluated using the SCREEN 3 air emissions dispersion model. The SCREEN 3 model was developed and approved by EPA as a screening procedure for estimating air quality impacts of stationary sources. SCREEN 3 is a conservative model which uses worst case meteorological data to determine emission impacts. In addition, the SCREEN 3 model assumes that emissions from a source or operation is continuous. Because open burning operations at LANL are intermittent with varying burn times, source terms supplied to the SCREEN 3 model were determined as follows:

- 1-hr impacts are normally estimated by the SCREEN 3 model. Emission quantities supplied to the model came from the total emissions from a single burn divided by the number of hours the burn lasted.
- 8 and 24-hr impacts were estimated by taking the 1-hr impact results and multiplying by constants developed by EPA (i.e. 0.7 and 0.4 respectively).
- The conservative impact data generated by the model assumes the emission is continuous (lasts 24 hours a day, 365 days a year).

TABLE 9, TA-14 BURN CAGE

CHEMICAL	MODELING PARAMETERS	AMBIENT AIR QUALITY STANDARD			AIR CONCENTRATION AT: 61 M (Max.)	2042 M (Pajarito Rd.)	2286 M (SR 4)
CO	D Stability	8-hour average	0.5 mg/m³	(8.7 ppm)	0.5 ppm	4E-03 ppm	3E-03 ppm
		1-hour average	2.0 mg/m³	(13.1 ppm)	0.8 ppm	6E-03 ppm	5E-03 ppm
NOx	60 min burn time	24-hour average	5.0 μg/m³	(0.1 ppm)	2E-02 ppm	1E-04 ppm	9E-05 ppm
		Annual arithmetic average	1.0 μg/m³	(0.05 ppm)	3E-03 ppm	2E-05 ppm	2E-05 ppm
PM	2.5 meters/sec. wind speed	24-hour average	150 μg/m³		137 μg/m³	1 μg/m³	1 μg/m³
		7-day average	*110 μg/m³				
		30-day average	*90 μg/m³				
		Annual geometric mean	60 μg/m³		27 μg/m³	0.2 μg/m³	0.2 μg/m³
SO_2	Heat Released 15,748 cal/sec.	24-hour average	5.0 μg/m³	(0.1 ppm)	0.03 ppm	2E-04 ppm	2E-04 ppm
		Annual arithmetic average	1.0 μg/m³	(0.02 ppm)	0.01 ppm	4E-05 ppm	4E-05 ppm

* Impacts were not averaged for standard.

TABLE 10, TA-16 FLASH PAD AND SOLVENT/OIL BURNS

CHEMICAL	MODELING PARAMETERS	AMBIENT AIR QUALITY STANDARD			AIR CONCENTRATION AT: 498 M (Max.)	1828 M (SR 4)
CO	D Stability	8-hour average	0.5 mg/m³	(8.7 ppm)	0.5 ppm	0.2 ppm
		1-hour average	2.0 mg/m³	(13.1 ppm)	1 ppm	0.8 ppm
NOx	120 min burn time	24-hour average	5.0 μg/m³	(0.1 ppm)	2E-03 ppm	6E-04 ppm
		Annual arithmetic average	1.0 μg/m³	(0.05 ppm)	0.002 ppm	3E-04 ppm
PM	2.5 meters/sec. wind speed	24-hour average	150 μg/m³		30 μg/m³	10 μg/m³
		7-day average	*110 μg/m³			
		30-day average	*90 μg/m³			
		Annual geometric mean	60 μg/m³		2 μg/m³	0.4 μg/m³
SO_2	Heat Released 15,748 cal/sec.	24-hour average	5.0 μg/m³	(0.1 ppm)	2E-04 ppm	6E-05 ppm
		Annual arithmetic average	1.0 μg/m³	(0.02 ppm)	7E-06 ppm	2E-06 ppm

[1] 8-hour and 24-hour evaluations took the maximum 1-hour impacts from flash burning and multiplied by the factors of 0.7 and 0.4 respectively supplied by EPA for averaging time adjustments.

[2] Annual arithmetic average and the annual geometric mean were derived by summing emissions from all burning operations and dividing by 8760 hours.

[3] The 7-day average and 30-day average were not evaluated.

N/E - No Evaluation Performed.

Appendix J

Baseline Human Health and Ecological Risk Assessment for Technical Area 14

BASELINE HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT FOR TECHNICAL AREA 14

Table of Contents

List of Figures iii
List of Tables iv
List of Acronyms and Abbreviations v

1.0 Introduction 1

2.0 Identification of Chemicals of Potential Concern 1
2.1 Site Descriptions 2
2.2 Methodology for Selection of Chemicals of Potential Concern 2
2.3 Chemicals of Potential Concern 4

3.0 Human Health Risk Assessment 8
3.1 Exposure Assessment 8
3.1.1 Exposure Pathways 8
3.1.2 Quantification of Exposure 9
3.1.2.1Exposure Models 12
3.1.2.2Exposure Parameters 16
3.1.2.3Intakes for Chemicals of Potential Concern 16
3.2 Toxicity Assessment 16
3.3 Risk Characterization 20
3.3.1 Estimation of Carcinogenic Risk 20
3.3.2 Estimation of Noncarcinogenic Risk 22
3.3.3 Results of the Human Health Risk Characterization 23
3.3.4 General Uncertainties 26

4.0 Ecological Risk Assessment 26
4.1 Problem Formulation 27
4.1.1 Ecological Description 27
4.1.2. Conceptual Model 31
4.1.3 Endpoints 31
4.1.4 Chemicals of Potential Ecological Concern 31
4.2 Analysis 33
4.2.1 Exposure Assessment 33
4.2.2 Exposure Pathways 33
4.2.3 Ecological Receptors 33
4.2.4 Exposure Estimation 34
4.2.4.1Terrestrial Receptors 37
4.2.4.2Aquatic Receptors 39
4.2.2 Effects Characterization 39
4.2.2.1Plants 40
4.2.2.2Wildlife 40
4.2.2.3Aquatic Macroinvertebrates 42

Table of Contents *(Continued)*

4.3 Risk Characterization 42
4.4 Uncertainties 43

5.0 References 46

List of Figures

Number	Title	Page
3-1	Site Conceptual Model for TA-14 Current and Future Land Use	10

List of Tables

Number	Title	Page
2-1	Surface Soil Sampling Summary LANL Technical Area 14	5
2-2	Surface Water Sampling Summary LANL Technical Area 14	6
2-3	Air Quality Modeling Summary LANL Technical Area 14	7
3-1	Potentially Complete Human Exposure Pathways at LANL Technical Area 14	11
3-2	Exposure Parameters	17
3-3	Human Toxicity Factors Used for Chemicals of Potential Concern at LANL Technical Area 14	19
3-4	Estimated Daily Intakes and Incremental Lifetime Cancer Risks (ILCR) for LANL Technical Area 14	24
3-5	Estimated Daily Intakes and Hazard Quotients (HQ) for LANL Technical Area 14	25
4-1	Endpoints for the LANL Technical Area 14 Ecological Risk Assessment	32
4-2	Data Used to Model Exposure in the Terrestrial Wildlife Species LANL Technical Area 14	35
4-3	Transfer Factors Used in Exposure Models for LANL Technical Area 14 Ecological Risk Assessment	36
4-4	Toxicity Data for Ecological Receptors at LANL Technical Area 14	41
4-5	Ecological Hazard Quotients for Terrestrial Receptors at LANL Technical Area 14	44
4-6	Comparison of Surface Water Concentrations to Ecological Benchmark Values for LANL Technical Area 14	45

List of Acronyms and Abbreviations

amsl	above mean sea level
cm^2	square centimeter(s)
COPC	chemical of potential concern
COPEC	chemicals of potential ecological concern
EPA	U.S. Environmental Protection Agency
g	gram(s)
g/m^2	gram(s) per square meter
g/m^2-hr	gram(s) per square meter per hour
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
hr	hour(s)
HQ	hazard quotient
hr/day	hours per day
ILCR	incremental lifetime cancer risk
IRIS	Integrated Risk Information System
kg	kilogram(s)
kg/day	kilogram(s) per day
kg/mg	kilogram(s) per milligram(s)
L/cm^3	liter(s) per cubic centimeter(s)
L/day	liter(s) per day
LANL	Los Alamos National Laboratory
LD_{50}	lethal dose to 50 percent of the test population
LOAEL	lowest-observed-adverse-effect-levels
m/sec	meter(s) per second
m^2	square meter(s)
m^3	cubic meter(s)
m^3/day	cubic meter(s) per day
m^3/hr	cubic meter(s) per hour
mg	milligram(s)
mg/cm^2	milligram(s) per square centimeter(s)
mg/day	milligram(s) per day
mg/hr	milligram(s) per hour
mg/kg	milligram(s) per kilogram

mg/kg-day	milligram(s) per kilogram(s) per day
mg/L	milligram(s) per liter
mg/m^3	milligram(s) per cubic meter(s)
μg	micrograms
$\mu g/m^3$	micrograms per cubic meter(s)
N	number of samples
NCP	National Contingency Plan
NOAEL	no-observed-adverse-effect-level
OB/OD	open burning/open detonation
ppm	parts per million
RAGS	Risk Assessment Guidance for Superfund
RfC	reference concentration
RfD	reference dose
RME	reasonable maximum exposure
SF	slope factor
TA	technical area
UCL	upper confidence limit
UTL	upper tolerance limit
yr	year

1.0 Introduction

This document addresses the overall baseline human health and ecological effects of exposure to chemicals of potential concern (COPC) in surface soil and sediment, surface water, and air at Technical Area (TA) 14 at Los Alamos National Laboratory (LANL).

The human health risk assessment is an estimation of potential risk which may occur at TA-14 under normal operating conditions. This risk assessment was performed in accordance with the "Risk Assessment Guidance for Superfund" (RAGS) (U.S. Environmental Protection Agency [EPA], 1989) and additional guidance provided by EPA.

The ecological risk assessment process performed for the TA-14 site is a screening level assessment. Methodology used is based on screening level guidance presented by EPA (EPA, 1992; 1996a; 1997) and by Wentsel et al. (1996) and is consistent with a phased approach. This assessment utilizes conservatism in the estimation of ecological risks; however, ecological relevance and professional judgement are also incorporated, as recommended by EPA (1996a) and Wentsel et al. (1996), to ensure that the predicted exposures of selected ecological receptors reasonably reflect those expected to occur at the site.

This report consists of the following major elements: identification of COPC (Section 2), human health risk assessment (Section 3), and ecological risk assessment (Section 4).

2.0 Identification of Chemicals of Potential Concern

This section identifies the COPC for TA-14 at LANL . Pertinent data collection considerations are discussed, and the data evaluation process is presented.

Data collected during the investigations were evaluated for use in this risk assessment in accordance with EPA guidance (EPA, 1989). This process included evaluating the sample collection and analytical methods used, evaluating the quality of the data, and selection of the COPC. The goal of the COPC selection process was three-fold: (1) to identify those chemicals that are likely to be site-related, (2) to determine the acceptability of the analytical data for use in the risk assessment, and (3) to focus the risk assessment on those constituents that represent the dominant potential risks at these sites. The various analytical data used are provided in Appendices E and G of the TA-14 NOD Response, Attachment 4-9 of the OB/OD Part B Permit Application, or at the end of this document.

2.1 Site Descriptions

TA-14 is located within the west central area of LANL on the southern edge of Three-Mile Mesa. It is bounded on the south by Cañon del Valle and on the north by Three-Mile Canyon. The mesa tops are primarily woodlands and savanna. Topography includes steep canyon cliffs, a fairly level wooded mesa top, forested slopes, and canyon bottoms. Mesatop elevations range from approximately 7,350 to 7,450 feet above mean sea level (amsl); canyon bottom elevations range from 7,110 to 7,400 feet amsl.

2.2 Methodology for Selection of Chemicals of Potential Concern

This section presents the procedure used to identify the COPC for TA-14. The analytical data were organized by medium into individual data sets (e.g., surface soil data). For individual data sets that contained nondetections (i.e., data which were "U" or "UJ" qualified), the detection limit of the nondetected result was divided by two before any statistical calculation was performed. Samples with duplicates were averaged and treated as a single result for any statistical calculations. Both of these steps are in accordance with EPA guidance (EPA, 1989). All statistical calculations were performed using STATISTICA® (Statsoft, 1996) for Windows, Version 5. The following statistical manipulations were performed on each of the individual data sets:

- Frequency Sampled - Number of samples that were collected and analyzed for a particular chemical in a specific medium. Field duplicate samples for the same sample locations were averaged and counted as a single sample.
- Number of Detections - Number of detections of a particular chemical in a specific medium.
- Maximum Concentration - Highest concentration of a particular chemical in a specific medium.
- Minimum Concentration - Lowest concentration of a particular chemical in a specific medium. This value may be one half of the detection limit for data sets which contain only nondetections.
- Mean Concentration - Arithmetic mean of a particular chemical in a specific medium.
- Standard Deviation - Sample standard deviation of a particular chemical in a specific medium.

- Upper 95-Percent Confidence Limit of the Mean (UCL) - Upper 95-percent UCL was calculated for a chemical in a specific medium using the Student's *t* statistic and assuming that the analytical data were normally distributed.

- Upper 95-Percent Upper Tolerance Limit (UTL) - Upper 95-percent UTL was calculated for a chemical in a specific medium for comparison to background.

Subsequent to the statistical calculations, analytical results were screened using criteria from EPA guidance (EPA, 1989) to focus the risk assessment process on those constituents that were COPC. The screening criteria included the following:

- COPC which were 100 percent nondetections for a given medium were eliminated from consideration.

- If inorganic chemicals were present in soil at naturally occurring background levels, they were eliminated from consideration. The 95-percent UTL for the TA-14 analytical data were compared to 95-percent UTL regional background concentrations. If the TA-14 UTL was less then the regional background UTL, the inorganic chemical was eliminated as a COPC.

- All metals which are considered essential nutrients were eliminated from consideration.

- Due to the presence of several laboratory contaminants in virtually all environmental sampling efforts, the EPA has developed guidance for eliminating these contaminants from consideration as COPC. A chemical is excluded from consideration if the maximum sample concentration does not exceed 10 times the highest blank concentration for all common laboratory contaminants (these include 2-butanone, acetone, methylene chloride, toluene, and phthalate) or does not exceed 5 times the highest blank concentration for other chemicals (EPA, 1989). This criterion was developed by the EPA to prevent the inclusion of chemicals that are most likely sampling or analytical artifacts. Although no COPC were detected in the TA-14 blank samples, it is possible that both of the phthalate compounds detected in surface soil samples from TA-14 are laboratory contaminants.

- Constituents that are infrequently detected may be artifacts in the data due to sampling, analytical, or other problems (EPA, 1989). Constituents were eliminated from further consideration as COPC if they were detected in 5 percent or less of the data from a particular source area. Class A carcinogens, however, were not eliminated on the basis of frequency of detection.

The remaining COPC were carried through the risk assessment process.

2.3 Chemicals of Potential Concern

Existing analytical data for surface soil and surface water at TA-14 are summarized in Tables 2-1 and 2-2. Included in this summary are the number of samples (N), the number of detections, the maximum and minimum values, mean, standard deviation, 95-percent UCL, 95-percent UTL, the LANL regional background value (if it exists), the determination of whether the analyte is a COPC, and the reason for exclusion if the analyte is not a COPC.

Table 2-3 summarizes the air modeling results for air emissions from the open detonation of wood and plastic waste at TA-36. TA-36 was selected as a worst-case waste treatment and receptor location for the modeled scenario because its treatment capacity (2,000 pounds) greatly exceeds the treatment capacity of the TA-14 OD unit (20 pounds). Open detonations at TA-14 are smaller in size and at a greater distance from potential receptors. Therefore, under baseline conditions, air emissions due to routine operations at TA-14 are minimal (i.e., no risk to potential occupational receptors).

Table 2-1
Surface Soil Sampling Summary
LANL Technical Area 14

Chemical of Potential Concern	N	Number of Detects	Minimum	Maximum	Mean	Standard Deviation	95 % UCL[a]	95% UTL[b]	Background 95% UTL	Chemical of Concern	Reason for Exclusion
Barium[c]	12	12	120	550	249	144	340	638	1140	No	e
Total Beryllium[c]	12	12	1.8	4.6	2.94	0.80	3.45	5.11	3.31	Yes	
Cadmium[c]	12	12	0.08	3.4	0.53	0.92	1.11	3.02	2.70	Yes	
Chromium[c]	12	12	5.2	17	9.72	3.41	11.9	18.9	34.2	No	e
Total Lead[c]	12	12	13	79	37.5	18.30	49.13	87.0	39	Yes	
HMX[c]	25	25	1.1	876	209	200	292	665	NA	Yes	
RDX[c]	25	9	0.15	4.3	0.89	1.13	1.36	3.46	NA	Yes	
Tetryl[c]	25	4	0.2	12.7	0.96	2.57	2.02	6.82	NA	Yes	
TNT[c]	25	10	0.2	181.6	11.0	36.72	26.2	94.6	NA	Yes	
Bis-2-Ethylhexylphthalate[d]	25	3	165	1100	238	219	329	738	NA	Yes	
Di-n-Octyphthalate[d]	25	1	165	690	186	105	229	425	NA	No	f
Pyrene[d]	25	1	165	3800	310	727	610	1966	NA	No	f

[a]UCL = Upper Confidence Limit.
[b]UTL = Upper Tolerance Limit.
[c]Sampling results have units of ppm.
[d]Sampling results have units of ppb.
e = Not a chemical of potential concern because on-site concentrations are less than background.
f = Not a chemical of potential concern based on frequency of detection.
N = Number of samples.

Table 2-2
Surface Water Sampling Summary
LANL Technical Area 14

Chemical of Potential Concern	N	Number of Detects	Minimum	Maximum	Mean	Standard Deviation	95 % UCL[a]	95% UTL[b]	Background 95% UTL	Chemical of Concern	Reason for Exclusion
Barium[c]	10	10	25	120	63.4	32.9	87.0	158	ND[d]	Yes	
Total Beryllium[c]	10	7	0.05	3	0.79	0.93	1.45	3.46	ND	Yes	
Cadmium[c]	10	4	0.05	2.8	0.70	0.98	1.40	3.50	ND	Yes	
Chromium[c]	10	10	1.9	5.8	3.79	1.28	4.71	7.48	ND	Yes	
Total Lead[c]	10	8	0.5	11	3.23	3.31	5.59	12.7	ND	Yes	

[a]UCL = Upper Confidence Limit.
[b]UTL = Upper Tolerance Limit.
[c]Sampling results have units of ppb.
[d]ND = No data.
N = Number of samples.

Table 2-3
Air Quality Modeling Summary
LANL Technical Area 14

Chemical of Potential Concern	Air Concentrations at Pajarito Road (800 m NNE)	Air Concentrations at White Rock (2980 m ESE)	Ambient Air Quality Standard
Carbon Monoxide (1-hour average)	0.16 mg/m^3	0.02 mg/m^3	2.0 mg/m^3
Sulfur Dioxide (24-hour average)	0.054 ug/m^3	0.02 ug/m^3	5.0 ug/m^3
Lead (3-month average)	4.3×10^{-6} ug/m^3	1.6×10^{-6} ug/m^3	0.03 ug/m^3

3.0 Human Health Risk Assessment

This human health risk assessment was performed in accordance with RAGS (EPA, 1989) and additional EPA guidance.

3.1 Exposure Assessment

This section identifies exposure pathways and quantifies chemical intakes. The purpose of this exposure assessment is to estimate the type and magnitude of exposure to humans.

3.1.1 Exposure Pathways

For exposure and potential risks to occur, complete exposure pathways must exist. A complete pathway requires the following elements (EPA, 1989):

- A source and mechanism for release of contamination,
- A transport or retention medium,
- A point of potential human contact (exposure point), and
- An exposure route at the exposure point.

If any one of these elements is missing, the pathway is not considered complete. Following is a brief discussion of the exposure pathway elements.

Contamination sources and the transport /retention medium are the same as those addressed in Section 2.3. At TA-14, the primary medium of concern is surface soil.

Exposure points are locations of human contact with contaminated media. Exposure points consider human activity patterns and the location of potentially exposed individuals relative to the location of contaminated media. For this assessment, contact with potentially contaminated media takes place as a result of occupational exposure. To maintain the conservative methodology of RAGS (EPA, 1989), the contact point for soil and surface water contamination in all exposure scenarios is located at the contaminant source.

The following three exposure routes were examined:

- Ingestion,
- Inhalation (both dust and modeled air concentrations), and
- Dermal contact.

Because land use at LANL and TA-14 is restricted, the only potential current on-site user is an occupational receptor. The potentially complete exposure pathways include exposure to surface soil, surface water (under limited conditions), and air. Figure 3-1 illustrates the site conceptual model for TA-14. Table 3-1 lists the complete human exposure pathways for current land use. This table also indicates which pathways have been selected for risk characterization and presents the rationale for inclusion or exclusion of each pathway.

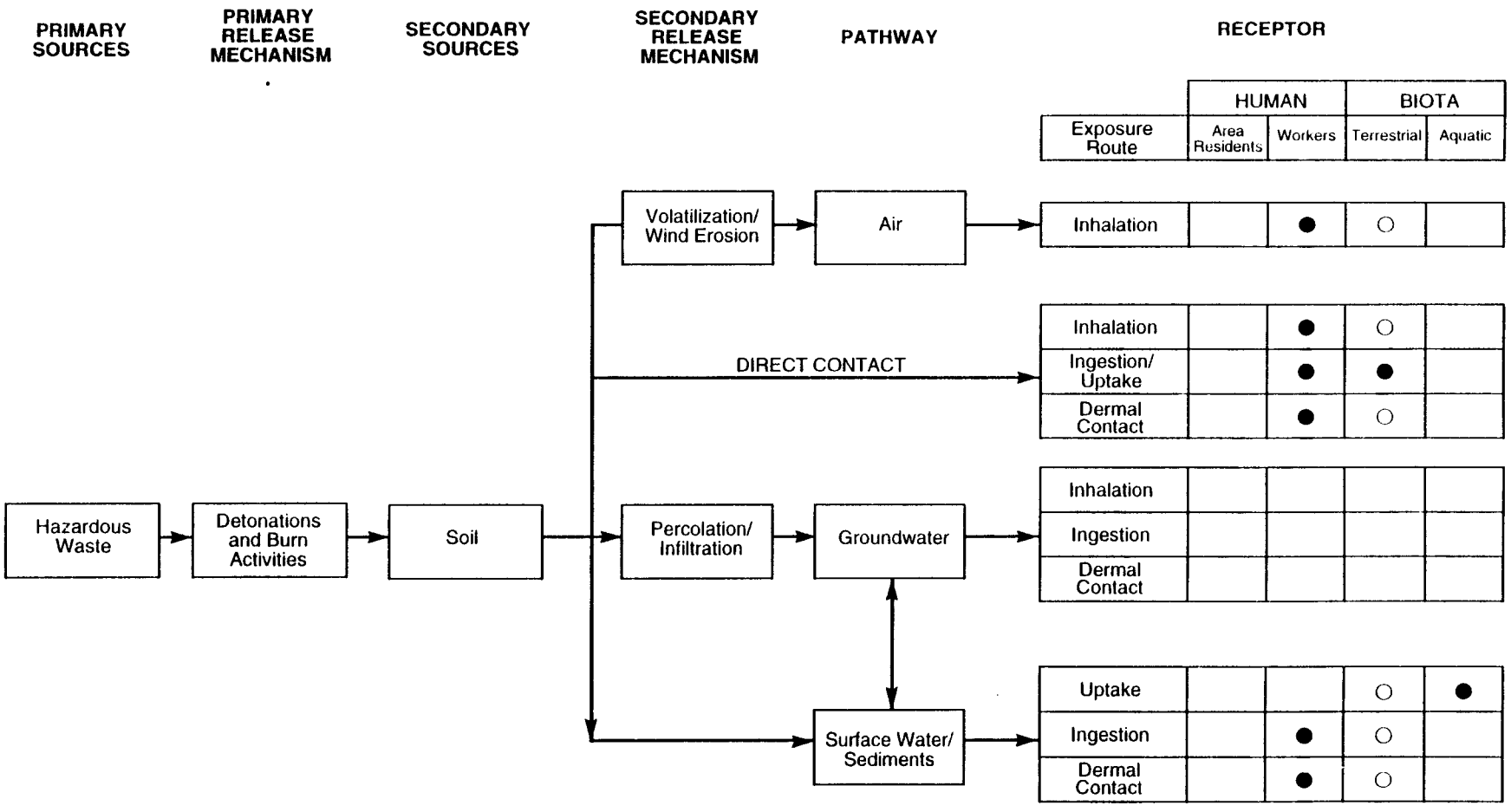
Since land use at TA-14 is expected to remain under DOE control, future pathways at TA-14 will be similar the current pathways listed above. Therefore, this risk assessment assumes that any restrictions currently in place will remain in place for the foreseeable future. Under these conditions, the current and future human health risks are identical (i.e., the pathways and receptors are the same). For the remainder of the document, these risks will be linked to an occupational receptor with no further consideration of whether the exposure is current or future.

3.1.2 Quantification of Exposure

This section describes the estimation of exposure (intake) for the COPC that may come into contact with human receptors. The process involves the following:

- Identification of applicable human exposure models and input parameters,
- Determination of the concentration of each chemical in environmental media at the point of human exposure, and
- Estimation of human intakes.

For each potentially complete future exposure pathway identified in Section 3.1.1, a reasonable maximum exposure (RME) scenario has been developed. The RME is the highest exposure that is reasonably expected to occur at a site (EPA, 1989). The intent of the RME, as defined by EPA, is to estimate a conservative exposure case (i.e., well above the average case) that is still within the possible range of exposures. The RME is both protective and reasonable but is not the worst possible case (EPA, 1991a).



○ Minor Exposure Pathway

Figure 3-1
Site Conceptual Model for TA-14
Current and Future Land Use

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Table 3-1
Potentially Complete Human Exposure Pathways at LANL Technical Area 14

Environmental Medium	Exposure Route	Potentially Exposed Population	Pathway Selected for Evaluation	Reason for Selection or Exclusion
Surface Soil	Inhalation Ingestion Dermal Contact	Residential Recreational	No	No current or future on-site residents or recreational users at TA-14.
Surface Soil	Inhalation Ingestion Dermal Contact	Occupational	Yes	Potential intermittent occupational exposure is likely under current and future operating conditions.
Surface Water	Inhalation Ingestion Dermal Contact	Residential Recreational	No	No current or future on-site residents or recreational users at TA-14.
Surface Water	Ingestion Dermal Contact	Occupational	Yes	Potential intermittent occupational contact with surface water is unlikely. At TA-14, there is no permanent on-site surface water (all surface water is due to runoff). However, exposure and the associated risk due to contact with surface water were calculated as a worst-case scenario.
Air[a]	Inhalation	Occupational	Yes	Air modeling calculated COPC air concentrations to a potential occupational receptor.
Groundwater	Inhalation Ingestion Dermal Contact	Residential Recreational Occupational	No	No current or projected use of groundwater at TA-14.
Subsurface Soil	Inhalation Ingestion Dermal Contact	Residential Recreational Occupational	No	No subsurface soil analytical information was available for TA-14. However, due to the activities which occur at the site, waste burning and detonations, surface soil is the only media of concern. Surface soil COPC are expected to be the risk drivers.

[a]Air refers specifically to evaluating exposure using air modeling data. Potential exposure by inhalation of constituents from other media (e.g., soil) is presented with those media.

3.1.2.1 Exposure Models

The primary source for the exposure models used in this baseline risk assessment is RAGS (EPA, 1989). Shown below is the generalized equation for calculating chemical intakes:

$$I = C \frac{CR \times EFD}{BW \times AT}$$

where

I	=	Intake; the amount of chemical at the exchange boundary (milligrams per kilogram [mg/kg] body weight per day [mg/kg-day]).
C	=	Chemical concentration at the exposure point; the concentration contacted over the exposure period (e.g., mg per liter [mg/L] water or mg/kg soil).
CR	=	Contact rate; the amount of contaminated medium contacted per unit time or event (e.g., mg per day [mg/day] soil ingestion rate or cubic meters per hour air inhalation rate).
EFD	=	Exposure frequency and duration; describes how often and how long exposure occurs. Often calculated using two terms (EF times ED).
EF	=	Exposure frequency (days/year).
ED	=	Exposure duration (years).
BW	=	Body weight; the average body weight over the exposure period (kg).
AT	=	Averaging time; period over which exposure is averaged (days).

Each model for exposure to COPC at TA-14 is summarized below.

Ingestion of Soil and Surface Water

For estimating chemical intake from ingestion of soil and surface water, the following equation applies:

$$Intake = \frac{C_i \ x \ EF \ x \ F \ x \ IR \ x \ ED}{AT \ x \ BW}$$

where

Intake	=	Intake of chemical through ingestion of medium (mg/kg-day).
C_i	=	Chemical concentration in medium i (mg/kg or mg/L).
IR	=	Ingestion rate for medium i and receptor (kg/day or L/day).
F	=	Fraction of ingested medium from contaminated source (unitless).

EF, ED, BW, and AT are defined above.

Inhalation of Dust

Ambient sampling for beryllium has been conducted at numerous regional, perimeter, and on-site locations at and surrounding LANL. The measured on-site beryllium concentrations (see LANL's Environmental Surveillance Reports for 1993, 1992, 1991, and 1990) are significantly lower than the TA-14 site-specific values modeled in this analysis. This risk assessment was performed based on an EPA particulate emission factor (EPA, 1996) using TA-14 site-specific values.

For estimating respirable particulate emission from wind erosion, assuming an unlimited reservoir, the equation is (EPA, 1985):

$$E_{10} = 0.036 \ (1-V) \ (\frac{[u]}{u_t})^3 \ f(x)$$

where

E_{10}	=	PM_{10} emission factor (grams per square meter [g/m^2]-hour [hr]).
V	=	Fraction of contaminated surface vegetative cover (unitless, assumed to be 0).
[u]	=	Mean annual wind speed (meters [m] per second [sec], 3.2 m/sec).
u_t	=	The threshold value of wind speed at 7 m (m/sec).

f(x) = Function plotted in EPA, 1985 [f(x) = 1.5] where x = 0.886 $u_t/[u]$.

Once the PM_{10} emission factor is calculated, the emission rates for the individual COPC were calculated according to the following:

$$R_{10} = \alpha \ x \ E_{10} \ x \ A \ x \ C$$

where

R_{10} = Emission rate of contaminant as PM_{10} (mg/hr).

α = Chemical concentration (mg/kg).

E_{10} = PM_{10} emission factor (g/m^2-hr).

A = Site area ([m^2], assumed to be 1000 m^2).

C = Conversion factor for kg to g.

Once the dust concentration in air has been calculated for each COPC, the chemical intake is:

$$Intake = \frac{C_i \ x \ BA \ x \ IR \ x \ ET \ x \ EF \ x \ ED}{BW \ x \ AT}$$

where

C_i = Chemical - specific air concentration (g/cubic meter [m^3]).

BA = Bioavailability factor (unitless).

IR = Inhalation rate (m^3/event, typically m^3/hr).

ET = Exposure time (hr/day).

EF, ED, BW, and AT are defined above.

Dermal Contact Soil and Sediment

The following is the chemical intake equation for dermal absorption of chemicals due to contact with soil or sediment:

$$AD = \frac{C_i \ x \ AF \ x \ ABS \ x \ CF \ x \ SA \ x \ EF \ x \ ED}{AT \ x \ BW}$$

where

AD	=	Absorbed dose (mg/kg-day).
C_i	=	Chemical concentration in medium (mg/kg).
SA	=	Skin surface area available for contact (square centimeters [cm^2]/event).
AF	=	Soil-to-skin adherence factor (mg/cm^2).
ABS	=	Skin absorption factor (unitless).
CF	=	Conversion factor (10^{-6} kg/mg).
EF	=	Exposure frequency (events/year).

ED, BW, and AT are defined above.

Dermal Contact with Surface Water

The following is the intake equation for dermal absorption of chemicals due to contact with surface water:

$$AD = \frac{C_i \ x \ SA \ x \ PC \ x \ CF \ x \ ET \ x \ EF \ x \ ED}{BW \ x \ AT}$$

where

AD	=	Absorbed dose (mg/kg-day).
C_i	=	Chemical concentration in surface water (mg/L).
SA	=	Skin surface area available for contact (cm^2).
PC	=	Chemical-specific dermal permeability (EPA, 1992a).
CF	=	Conversion factor (10^{-3} L/cm^3).
ET	=	Exposure time (hr/day).

EF, ED, BW, and AT are defined above.

3.1.2.2 Exposure Parameters

Three types of parameters are used in exposure models to estimate intake (EPA, 1989):

- Chemical-related parameters (e.g., exposure point concentrations),
- Parameters that describe the exposed population (e.g., contact rate, exposure frequency and duration, and body weight), and
- Toxicity-related parameters (i.e., slope factors [SF] and reference doses [RfD]).

The exposed population and exposure-related parameters are summarized in Table 3-2. The exposure parameters were taken from EPA guidance and are based on best professional judgement using site-specific information where available. Upper-bound values are generally 90th or 95th percentile values, depending on the data available for each parameter. A combination of upper-bound and average exposure parameters were used to estimate the RME for each scenario.

3.1.2.3 Intakes for Chemicals of Potential Concern

Noncarcinogenic and carcinogenic intakes of COPC at TA-14 are discussed in Section 3.3.3. Intakes are expressed in units of milligrams of individual constituent per kilogram of receptor per day.

3.2 Toxicity Assessment

Toxicity information is given in the same units provided by the source material (dose rates and concentrations are primarily used). The EPA weight-of-evidence classification (cancer class) system for carcinogenicity is presented here for reference. The classification is as follows (EPA, 1989):

- Class A—Human carcinogen,
- Class B1—Probable human carcinogen; limited human data available,
- Class B2—Probable human carcinogen; sufficient evidence in animals; inadequate or no evidence in humans,
- Class C—Possible human carcinogen,
- Class D—Not classifiable as to human carcinogenicity, and

Table 3-2
Exposure Parameters

Parameter	Value	Units	Reference/Rationale
OCCUPATIONAL INGESTION OF SOIL			
Ingestion Rate	50	mg/day	EPA, 1991a
Fraction Ingested	1	unitless	Assumes all of soil intake from site
Exposure Frequency	24	day/year	Maximum allowable time spent on site (including both detonation and burn activities)
Exposure Duration	25	years	EPA, 1991a
Body Weight	70	kg	EPA, 1991a
Averaging Time: Carcinogens Noncarcinogens	 25,550 9,125	 days days	EPA, 1989
OCCUPATIONAL DERMAL CONTACT WITH SOIL			
Adherence Factor	1.0	mg/cm^2	EPA, 1992a
Absorption Fraction	chemical specific	unitless	EPA, 1992a
Skin Surface Area	5,000	cm^2/event	EPA, 1992a
Exposure Frequency	24	day/year	Maximum allowable time spent on site (including both detonation and burn activities)
Exposure Duration	25	years	EPA, 1991a
Body Weight	70	kg	EPA, 1991a
Averaging Time: Carcinogens Noncarcinogens	 25,550 9,125	 days days	EPA, 1989
OCCUPATIONAL INHALATION OF DUST AND MODELED AIR CONCENTRATIONS			
Inhalation Rate	20	m^3/day	EPA, 1991a
Exposure Frequency	24 250	day/year	Maximum allowable time spent on site (including both detonation and burn activities) EPA, 1991a (modeled air concentrations)
Exposure Duration	25	years	EPA, 1991a
Body Weight	70	kg	EPA, 1991a
Averaging Time: Carcinogens Noncarcinogens	 25,550 9,125	 days days	EPA, 1989
OCCUPATIONAL INGESTION OF SURFACE WATER			
Ingestion Rate	0.04	L/day	EPA, 1991a

Table 3-2 *(continued)*
Exposure Parameters

Parameter	Value	Units	Reference/Rationale
Fraction Ingested	1	unitless	Assumes all of soil intake from site
Exposure Frequency	24	day/year	Maximum allowable time spent on site (including both detonation and burn activities)
Exposure Duration	25	years	EPA, 1991a
Body Weight	70	kg	EPA, 1991a
Averaging Time: Carcinogens Noncarcinogens	 25,550 9,125	 days days	EPA, 1989
OCCUPATIONAL DERMAL CONTACT WITH SURFACE WATER			
Dermal Permeability Constant	chemical specific	cm/hr	EPA, 1992a
Skin Surface Area	5,000	cm^2	EPA, 1992a
Exposure Frequency	24	day/year	Maximum allowable time spent on site (including both detonation and burn activities)
Exposure Duration	25	years	EPA, 1991a
Exposure Time	1	hr/day	Assumed value
Body Weight	70	kg	EPA, 1991a
Averaging Time: Carcinogens Noncarcinogens	 25,550 9,125	 days days	EPA, 1989

cm^2 = square centimeter(s)
cm/hr = centimeter(s) per hour
hr/day = hour(s) per day
kg = kilogram(s)
L = liter(s)
m^3 = cubic meter(s)
m^3/hr = cubic meter(s) per hour
mg = milligram(s)
mg/cm^2 = milligram(s) per square centimeter(s)

- Class E—Evidence of noncarcinogenicity for humans.

Slope factors are typically calculated for potential carcinogens in Classes A, B1, and B2. Quantitative estimation of slope factors for chemicals in Class C proceeds on a case-by-case basis.

For chemicals, the primary source for toxicity values, both RfD and SF, is the Integrated Risk Information System (IRIS) (EPA, 1997a). If a toxicity value for a given chemical is not available in IRIS, the secondary source is the Health Effects Assessment Summary Tables (HEAST) (EPA, 1996a). No surrogate values were developed for chemicals for which no toxicity information existed in either of the above references.

Table 3-3 summarizes the chemical toxicity information including the COPC RfD, SF, and EPA cancer classification.

Table 3-3
Human Toxicity Factors Used for Chemicals of Potential Concern at LANL Technical Area 14

Chemical of Potential Concern	Reference Doses[a]		Slope Factors[a]		Cancer Class[a]
	Oral (mg/kg-day)	Inhalation (mg/kg-day)	Oral $(mg/kg\text{-}day)^{-1}$	Inhalation $(mg/kg\text{-}day)^{-1}$	
Barium	7.00E-02	ND[b]	ND	ND	ND
Beryllium	5.00E-03	ND	4.30E+00	8.40E+00	B2
Bis(2-ethylhexyl)phthalate	2.00E-02	ND	1.40E-02	ND	B2
Cadmium	5.00E-04	ND	ND	6.30E+00	B1
Chromium	1.00E+00	ND	ND	ND	ND
HMX	5.00E-02	ND	NA[c]	NA	D
Lead	ND	ND	ND	ND	B2
RDX	3.00E-03	ND	[illegible]10E-01	ND	C
Tetryl	ND	ND	ND	ND	ND
TNT	5.00E-04	ND	3.00E-02	ND	C

[a]All toxicity values from Integrated Risk Information System (IRIS) (EPA 1997a).
[b]ND = No data available to establish toxicity factor.
[c]NA = Not considered to be carcinogenic to humans (EPA 1997a).

3.3 Risk Characterization

This section provides a characterization of the potential health risks associated with the intake of chemicals at TA-14. Risk characterization compares estimated potential cancer risks with reasonable levels of risk for carcinogens and compares estimated daily intake (rate) with reference levels for noncarcinogens. Carcinogens may also pose a systemic (noncarcinogenic) hazard, and these potential hazards are characterized in the same manner as other noncarcinogens.

Estimation of potential risk from exposure to the site contaminants is based on RAGS (EPA, 1989). This assessment employs a health-protective bias that leads to the overestimation of risk. Individuals are exposed to an RME (see Section 3.1.1) and exposure is evaluated (see Section 3.1.2) to provide estimates of daily intakes. These estimated intakes (rates) are combined with the individual chemical toxicological values (see Section 3.2) to determine the potential carcinogenic risks and the potential systemic impacts on human health.

3.3.1 Estimation of Carcinogenic Risk

In weighing occupational exposure to potentially carcinogenic compounds, a reasonable level of risk must be selected. The EPA used an incremental lifetime cancer risk (ILCR) (also referred to as excess cancer risk) of one in one million (1×10^{-6}) as the lower bound of an acceptable range for developing drinking water standards. The upper bound of an acceptable ILCR recommended by the EPA for drinking water is 1 in 10,000 (1×10^{-4}) (EPA, 1987). In addition, the EPA specifies a risk range of 10^{-6} to 10^{-4} associated with the consideration and selection of remedial alternatives for contaminated land in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (EPA, 1990).

Based on the regulatory precedents cited above, a reasonable and appropriate ILCR range would be from 10^{-6} to 10^{-4}. As implemented under the NCP, pathway ILCR greater than 10^{-6} must receive risk management consideration (EPA, 1990). The quantitative risk assessment is one of many factors that is considered in the decision-making process for remediation. Therefore, there is no single risk value that defines "acceptable" and "unacceptable" risk. The purpose of this risk assessment is to present quantitative and qualitative estimates of potential risk; thus, all pathway risk greater than the lower bound of 10^{-6} will be examined.

For TA-14, cumulative site ILCRs were developed. These cumulative ILCRs included all media and pathways that were appropriate to combine. Cumulative ILCRs occur when there

is potential for an individual to be exposed to multiple pathways at the same given instant in time. Where the cumulative site ILCR to an individual based on the RME for both current and future land use is less than 10^{-4}, action is generally not warranted unless there are adverse environmental impacts (EPA, 1991b).

Carcinogenic risk is estimated as the probability of an additional incidence of cancer above background. This risk is:

$$\text{ILCR} = \text{SF} \times \text{Intake}$$

where

ILCR = ILCR (unitless).

SF = Carcinogenic SF [$(\text{mg/kg-day})^{-1}$].

Intake = Chronic daily intake averaged over a 70-year lifetime (mg/kg-day).

The carcinogenic SFs for the COPC are presented in Table 3-3.

For a given pathway and medium with exposure to several carcinogens, the following equation was used to sum the cancer risk:

$$Risk_{t,p} = \sum_{i=1}^{I} ILCR_p\ (chem_i)$$

where

$Risk_{t,p}$ = Total cancer risk for pathway p (unitless).

$ILCR_p(chem_i)$ = Individual cancer risk for constituent i through exposure pathway p (unitless).

Estimates of ILCRs for each exposure pathway are addressed in Section 3.3.3.

3.3.2 Estimation of Noncarcinogenic Risk

Chemicals that pose a health threat other than cancer were evaluated by comparing an exposure level or intake to an acceptable level or RfD. The ratio of estimated daily intake to the RfD is termed the hazard quotient (HQ) and is defined as:

$$HQ_{i,p} = \frac{I_{i,p}}{RfD_i}$$

where

$HQ_{i,p}$ = Individual HQ for exposure to constituent i through exposure pathway p (unitless).

$I_{i,p}$ = Daily intake via a specific pathway p for constituent i (mg/kg-day).

RfD_i = RfD for exposure by the specific pathway (limited to oral and inhalation values) for constituent i (mg/kg-day).

The RfD is an estimate of the intake level to which a human population, including sensitive subpopulations, may be chronically exposed without a significant risk of adverse health effects (EPA, 1989). The RfDs for the COPC at TA-14 are listed in Table 3-3. Because the HQ does not define intake response relationships, its numerical value should not be construed as a direct estimate of risk, but it does suggest that a given situation should be more closely scrutinized. The concept of the HQ implies the existence of a threshold for systemic health effects. It is a numerical indication of the fraction of acceptable limits of exposure or the degree to which acceptable exposure levels are exceeded. As this quotient increases toward unity, concern for the potential hazard of the constituent increases. A value above unity is an indication of risk, although a direct correlation to the magnitude of the risk cannot be drawn.

In the case of simultaneous exposure to several chemicals, the hazard index (HI) is calculated to evaluate the potential risk from exposure to the mixture by summing the HQs for each chemical, media, and pathway. The total HI incorporates the assumption of additive effects when dealing with a mixture of components. The HI formula is as follows (EPA, 1989):

$$HI = \sum_{i=1}^{I} HQ_i$$

where

HI = Hazard index (unitless).

HQ_i = Hazard quotient for exposure to constituent i (unitless).

Summation of the individual HQs could result in an HI that exceeds 1, even if no single chemical exceeds its acceptable level. Mechanistically, it is not appropriate to sum HQs unless the constituents that make up the mixture have similar modes of action on an identical organ. Consequently, the summing of HQs for a mixture of compounds that is not expected to include the same type of effects could overestimate the potential risk. The EPA recommends that if the total HI is greater than unity, the components of the mixture should be grouped by critical effect, and separate hazard indices should be calculated for each effect.

Estimates of noncarcinogenic risks for each occupational exposure pathway are provided in the following section.

3.3.3 Results of the Human Health Risk Characterization

Tables 3-4 and 3-5 summarize the risks for each exposure pathway at TA-14. Included in this summary are the carcinogenic and noncarcinogenic intakes; ILCR and HQ for each COPC and pathway; and pathway total ILCR and HI.

The human health risk assessment suggests that the current level of contamination, for both surface soil and surface water, does not pose a potential significant risk to human health. None of the individual COPC for any of the pathways considered had an ILCR above 1×10^{-6} or an HQ above 1.0. The current and future cumulative site ILCR to an occupational receptor based on the RME is 6.3×10^{-7}, well below 1×10^{-4}. Therefore, under current and anticipated future conditions, exposure to COPC at TA-14 as a whole poses no potential significant carcinogenic risk (EPA, 1991b).

Table 3-4
Estimated Daily Intakes and Incremental Lifetime Cancer Risks (ILCR) for LANL Technical Area 14

Potentially Exposed Population	Exposure Pathway	Chemical	Estimated Intake (mg/kg-day)	ILCR
Occupational	Incidental Ingestion of Soil	Beryllium Bis(2-ethylhexyl)phthalate RDX TNT Total	5.8E-08 5.5E-09 2.3E-08 4.4E-07	2.5E-07 7.7E-11 2.5E-09 1.3E-08 2.6E-07
Occupational	Dermal Contact with Soil	Beryllium Bis(2-ethylhexyl)phthalate RDX TNT Total	5.8E-08 8.3E-08 2.3E-08 4.4E-07	2.5E-07 1.2E-09 2.5E-09 1.3E-08 2.7E-07
Occupational	Inhalation of Fugitive Dust	Beryllium Cadmium Total	6.8E-11 2.2E-11	5.7E-10 1.4E-10 7.1E-10
Occupational	Incidental Ingestion of Surface Water	Beryllium	2.0E-08	8.7E-08
Occupational	Dermal Contact with Surface Water	Beryllium	2.4E-09	1.0E-08
Occupational	Inhalation of Air (modeled)	No carcinogenic chemicals of potential concern		

Table 3-5
Estimated Daily Intakes and Hazard Quotients (HQ) for LANL Technical Area 14

Potentially Exposed Population	Exposure Pathway	Chemical	Estimated Intake (mg/kg-day)	HQ
Occupational	Incidental Ingestion of Soil	Beryllium	1.6E-07	3.2E-05
		Bis(2-ethylhexyl)phthalate	1.5E-08	7.7E-07
		Cadmium	5.2E-08	1.0E-04
		HMX	1.4E-05	2.7E-04
		RDX	6.4E-08	2.1E-05
		TNT	1.2E-06	2.5E-03
		Total		2.9E-03
Occupational	Dermal Contact with Soil	Beryllium	1.6E-07	3.2E-05
		Bis(2-ethylhexyl)phthalate	2.3E-07	1.2E-05
		Cadmium	5.2E-09	1.0E-05
		HMX	1.4E-05	2.7E-04
		RDX	6.4E-08	2.1E-05
		TNT	1.2E-06	2.5E-03
		Total		2.8E-03
Occupational	Inhalation of Fugitive Dust	No noncarcinogenic chemicals of potential concern		
Occupational	Incidental Ingestion of Surface Water	Barium	3.4E-06	4.9E-05
		Beryllium	5.7E-08	1.1E-05
		Cadmium	5.5E-08	1.1E-04
		Chromium	1.8E-07	1.8E-07
		Total		1.7E-04
Occupational	Dermal Contact with Surface Water	Barium	4.1E-07	5.8E-06
		Beryllium	6.8E-09	1.4E-06
		Cadmium	6.6E-09	1.3E-05
		Chromium	2.2E-08	2.2E-08
		Total		2.0E-05
Occupational	Inhalation of Air (modeled)	No noncarcinogenic chemicals of potential concern		

3.3.4 General Uncertainties

The overriding uncertainties associated with the risk characterization are as follows:

- The extrapolation of toxic effects observed at the high doses necessary to conduct animal studies to effects that might occur at much lower, more realistic doses.
- The extrapolation from toxic effects in laboratory animals to toxic effects in humans (i.e., responses of animals may be different from responses of humans).
- Pathway analyses have been conservative and generally do not include fate and transport considerations (such as dispersion or adsorption) in the estimates.

Extrapolations from laboratory animal studies form the basis for the derivation of factors used to estimate risks. Uncertainties are taken into account when deriving RfDs and SFs. The risk assessment utilized EPA guidance in minimizing the uncertainties through the use of published standards and criteria to evaluate risks posed by chemicals measured at TA-14.

In addition to the general uncertainties listed above, the sources of uncertainty in characterizing risk at TA-14 include the following:

- Risk due to lead was not quantified. However, the maximum detected lead concentration in surface soil was 79 mg/kg. Most occupational preliminary remediation goals for lead are set at 1,000 mg/kg or higher (CEPA, 1996; EPA, 1996). Therefore, lead is not of concern at TA-14.

Risk assessment is ultimately an integrated evaluation of historical, chemical, analytical, environmental, demographic, and toxicological data that are as site-specific as possible. To safeguard against the effects of uncertainty in the evaluation, each step is biased toward health protective estimations. Because each step builds on the previous one, this biased approach should more than compensate for risk assessment uncertainties. In addition, the calculations presented in this risk assessment do not necessarily accurately represent currently existing or expected future exposure or health risks. Rather, they are estimates of potential risk only if all the conservative assumptions are realized.

4.0 Ecological Risk Assessment

As mentioned earlier, the ecological risk assessment for TA-14 is a screening level assessment. A screening level assessment is defined here as a preliminary evaluation of

potential ecological risks that incorporates limited site-specific data, conservative exposure assumptions, literature-obtained transfer factors, and literature-obtained or -derived ecotoxicological benchmark values. It is used as an evaluation tool to determine what chemicals in the environment may present risk and establishes a basis for the collection of additional site-specific data should risks be predicted. This assessment follows the generally accepted tiered approach as recommended by EPA (EPA, 1992c; 1996b; and 1997b). A discussion of the site, fate and transport characteristics, and COPC were discussed in previous sections of this document. This section briefly re-addresses components of the problem formulation phase of the ecological risk assessment that were presented in earlier sections of this document. It also includes the analysis and risk characterization components of the risk assessment process.

4.1 Problem Formulation

Problem formulation is the first step of an ecological risk assessment process. It can be defined as a systematic planning step that identifies the major factors to be considered in a particular assessment (EPA, 1992c). In short, it establishes the goals, breadth, and focus of the assessment and is linked to the regulatory and policy context of the assessment. The problem formulation process begins with the initial stages of characterization exposure and ecological effects expected and observed. It describes the relationships among assessment and measurement endpoints, data required, and methodology that will be used to analyze the data. This section specifically addresses the ecology of the site (Section 4.1.1), the conceptual model (Section 4.1.2), the assessment and measurement endpoints used in the evaluation process (Section 4.1.3), and the chemicals of potential ecological concern (Section 4.1.4).

4.1.1 Ecological Description

The open burning/open detonation (OB/OD) units at TA-14 are located near the south rim of Three-Mile Mesa and bounded by Cañon de Valle and Three-Mile Canyon. The following information is based on LANL's Biological Resource Evaluations Teams' draft "Biological and Floodplain/Wetlands Assessment for Environmental Restoration Program Operable Unit 1085, TAs 14 and 67" (LANL, 1995). The elevation of the mesatop at the site is approximately 7,400 feet. The soils in this area consist primarily of Carjo loam, Pogna fine sandy loam, and Frijoles very fine sandy loam. Steep rock outcrops characterize the canyon wall south of the site, which descends about 300 feet into Cañon de Valle. The drainage in Cañon de Valle is ephemeral, flowing southeast to Water Canyon, about 1 mile downstream, which in turn flows into the Rio Grande, about 8 miles further downstream.

The vegetation on Three-Mile Mesa is woodland, dominated by ponderosa pine (*Pinus ponderosa*), piñon pine (*Pinus edulis*), and one-seed juniper (*Juniperus monosperma*). The dominant shrubs in this habitat include oaks (*Quercus* spp.), mountain mahogany (*Cercocarpus montanus*), Apache plume (*Fallugia paradoxa*), and squawbush (*Rhus trilobata*). Herbaceous understory plants include mountain muhly (*Muhlenbergia montana*), blue grama (*Bouteloua gracilis*), little bluestem (*Andropogon scoparius*), bitterweed (*Hymenoxys richardsonii*), and wormwood (*Artemisia carruthii*). On the south-facing canyon wall and in the bottom of Cañon de Valle, the vegetation is dominated by ponderosa pine and one-seed juniper, with Gambel oak (*Quercus gambelii*) also becoming an important overstory species. Shrubs include New Mexico locust (*Robinia neomexicana*), cliffbush (*Jamesia americana*), mountain mahogany, and hybrid oaks (probably hybrids between Gambel oak and wavyleaf oak [*Quercus undulata*]). Herbaceous understory plants include mountain muhly, bluegrass (*Poa* spp.), little bluestem, big bluestem (*Andropogon gerardii*), and wormwood.

Eighty-two species of birds are either known or expected to occur in the area, of which 42 are known to breed in TA-14 or TA-67. These include the American kestrel (*Falco sparverius*), great horned owl (*Bubo virginianus*), western wood pewee (*Contopus sordidulus*), common raven (*Corvus corax*), scrub jay (*Amphelocoma coerulescens*), American robin (*Turdus migritorius*), yellow-rumped warbler (*Dendroica coronata*), rufous-sided towhee (*Pipilo eurythrophthalamus*), and chipping sparrow (*Spizella passerina*). Mammalian wildlife species include mice (*Peromyscus* and *Reithrodontomys* spp.), voles (*Microtus* spp.), woodrats (*Neotoma* spp.), chipmunks (*Eutamias* spp.), Abert's squirrel (*Sciurus aberti*), gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), bobcat (*Felis rufus*), black bear (*Ursus americanus*), mule deer (*Odocoileus hemionus*), and elk (*Cervus elaphus*).

No threatened, endangered, or sensitive (TES) plant species are known or expected to occur in TA-14. NMED requested that LANL consider the potential exposure of nine TES wildlife species in the evaluation for the TA-14 NOD response. These include the Jemez Mountains salamander (*Plethodon neomexicanus*), bald eagle (*Haliaeetus leucocephalus*), American peregrine falcon (*Falco peregrinus anatum*), whooping crane (*Grus americana*), Mexican spotted owl (*Strix occidentalis lucida*), broad-billed hummingbird (*Cynanthus latirostris*), southwestern willow flycatcher (*Empidonax traillii extimus*), gray vireo (*Vireo vicinior*), and meadow jumping mouse (*Zapus hudsonius luteus*). The following accounts describe the potential for each of these to occur at or be influenced by hazardous waste treatment operations at the TA-14 OB/OD units.

Jemez Mountains salamander. The Jemez Mountains salamander has been recorded in several canyons that cross LANL boundaries. The species occurs in moist locations, such as rotting logs, and especially on north-facing slopes with slopes greater than 37 percent. It has been recorded at elevations ranging from over 10,000 feet down to 7,180 feet (in Los Alamos Canyon). In Cañon de Valle, the Jemez Mountains salamander has been found at an elevation of 8,101 feet. Thus, the OB/OD units are situated at the lower extreme of the known elevation range of this species and nearly 700 feet below its known occurrence in Cañon de Valle. Because the slopes below this site are south-facing, it is highly unlikely that the moist micohabitat conditions necessary for this species exist on these slopes. Therefore, due to the absence of favorable habitat conditions, it is unlikely that this species will be affected by operations at the OB/OD units.

Bald eagle. Bald eagles migrate and winter along the Rio Grande, roosting in White Rock Canyon and hunting on Cochiti Reservoir, as far upstream as Alamo Canyon. Storm water runoff from the area of the OB/OD units is hydrologically connected to this part of the Rio Grande through Cañon de Valle and Water Canyon, over a distance of about 9 miles, making possible a pathway for chemicals from this site to enter the food chain for this species. However, the large degree of dilution occurring along the path to the Rio Grande coupled with dilution within the reservoir itself would make this exposure pathway insignificant.

American peregrine falcon. American peregrine falcon nesting habitat (cliffs) has been identified in Los Alamos County, north of LANL. The species has been observed on occasion in the area of LANL, but no nests have been recorded there. Lower Water and Ancho Canyons are marginally suitable for falcons, but no observations of the species have been made in the area of TA-14. Therefore, the potential for exposure to this species by chemical constituents at the OB/OD units is very low.

Whooping crane. Whooping cranes migrate with sandhill cranes along the Rio Grande going to and from their wintering areas in central New Mexico (e.g., the Bosque del Apache National Wildlife Refuge) and other locations farther south. They use open fields and shallow bodies of water for feeding and resting during migration. Migratory flights between these locations tend to be at high altitudes for extended distances. Because open habitats favorable to this species do not occur at LANL, it is not expected that this species will occur within LANL boundaries except possibly as a fly-over. Thus, the potential for exposure of this species as a result of thermal treatment operations at the TA-14 OB/OD units is very low.

Mexican spotted owl. The Mexican spotted owl has been documented at LANL, and nesting and roosting habitat for this species has been identified along Cañon de Valle, adjacent to TA-14 (LANL, 1997). Therefore, the potential exists for this species to occur at or near the OB/OD units. This species was used in the evaluation of ecological pathways.

Broad-billed hummingbird. The broad-billed hummingbird nests in arid scrublands of southern New Mexico and occurs as far north as LANL as a vagrant. Thermal conditions limit the northern extent of successful breeding in this species. Therefore, its potential for occurrence at or near the OB/OD units is low, and the possibility of it nesting in the area is very remote. Consequently, the potential for exposure of this species to hazardous constituents resulting from thermal treatment operations at the TA-14 OB/OD units is low.

Southwestern willow flycatcher. The southwestern willow flycatcher is known to occur in the Jemez Mountains, but breeding has not been confirmed there. Willow flycatchers nest in wooded riparian areas, particularly in willow-cottonwood associations. This species has been detected on LANL property. Although potential habitat exists for this species in Pajarito Canyon, it is unlikely to occur at or near the TA-14 OB/OD units due to the lack of favorable habitat in Cañon de Valle. Consequently, the potential for exposure of this species to hazardous constituents resulting from thermal treatment operations at the TA-14 OB/OD units is very low.

Gray vireo. The gray vireo nests in piñon-juniper woodlands throughout much of central New Mexico, occasionally being as far north as Santa Fe. It has not been recorded in the area of TA-14. Consequently, the potential for exposure of this species to hazardous constituents resulting from thermal treatment operations at the TA-14 OB/OD units is very low.

Meadow jumping mouse. The meadow jumping mouse is typically found in dense, tall, grassy vegetation, especially near streams, meadows, and other wetlands. The species occurs at higher elevations and populations have been found along the Rio Grande in the central part of the New Mexico. It has not been recorded in Los Alamos County and species-specific surveys at LANL have failed to document it in areas of favorable habitat. Because favorable habitat for this species does not occur at or near the OB/OD units at TA-14, it is highly unlikely that this species will be affected by thermal treatment operations at the site.

4.1.2. Conceptual Model

The conceptual model for the TA-14 ecological risk assessment is presented in Figure 3-1. Exposure is believed to be of greater significance to terrestrial receptors than to aquatic receptors due to the temporary nature of the ephemeral drainage. The woodland habitat is characterized in greater detail than the ephemeral drainage because the drainage does not support semi-aquatic wildlife.

4.1.3 Endpoints

Endpoints for the TA-14 ecological risk assessment have been selected to be protective of the specific ecosystems and receptors associated with the area. Emphasis is placed on the two habitat types associated with TA-14: the woodland habitats and ephemeral drainage that leads to Cañon de Valle (this drainage collects runoff from TA-14). Table 4-1 presents the management goals, assessment endpoints, and measurement endpoints associated with these two habitat types. Because the ephemeral drainage is very temporary in nature, it does not support semi-aquatic wildlife species that would normally utilize riparian systems. In addition, because no sediment data exist for the drainage, only surface water data will be used to gauge habitat quality.

4.1.4 Chemicals of Potential Ecological Concern

The identification of COPC is presented in Section 2.0. Because the process used in the selection of COPC for this risk assessment is not risk-based and only involves comparison to background concentrations, all COPC identified in the human health risk assessment will also be utilized as chemicals of potential ecological concern (COPEC). All COPEC are presented in Tables 2-1 through 2-3. Because no surface water background data were available, all chemicals detected in surface water were considered COPEC.

Table 4-1
Endpoints for the LANL Technical Area 14 Ecological Risk Assessment

Management Goal	Assessment Endpoint	Measurement Endpoint
• Protection of the natural plant and animal diversity of the woodland ecosystems of TA-14	• Toxicity of soil to plants	• Comparison of soil chemistry data with phytotoxicity benchmark values
	• Toxicity of soil to terrestrial wildlife	• Quotient Method
• Protection of the aquatic ecosystems associated with the ephemeral drainage	• Toxicity of surface water to freshwater biota	• Comparison of surface water chemistry to water quality criteria • Percentage of total area of equivalent habitat impacted

4.2 Analysis

By definition, the analysis phase "consists of the technical evaluation of data to reach conclusions about ecological exposure and the relationships between the stressor and ecological effects" (EPA, 1996b). This phase follows the problem formulation phase of the ecological risk assessment, addresses exposure, and presents toxicity information. The products of the analysis phase will feed directly into the risk characterization segment.

4.2.1 Exposure Assessment

The exposure assessment examines the exposure pathways, ecological receptors, and methods used to quantify exposure. As discussed in Section 4.2.1, exposure to the selected receptors is only quantitatively estimated if a complete exposure pathway exists.

4.2.2 Exposure Pathways

As presented in Figure 3-1, ecological receptors can be exposed directly to soil contaminants associated with TA-14. Exposure can also occur through food chain interactions. Runoff from the site can also result in potential exposure of surface water and sediment biota to COPEC from TA-14 soils. The most significant exposure pathways for terrestrial receptors are direct uptake by plants and ingestion by wildlife. Direct uptake of COPEC from soil was assumed to be the major route of exposure of plants to COPEC, with exposure of plants to wind-blown soil assumed to be minor. In this assessment, COPEC in soil are considered bioavailable to a depth of 5 feet. This is supported by information on root depths (Reynolds and Wakkinen, 1987; Reynolds and Fraley, 1989). Exposure modeling for the wildlife receptors was limited to the food ingestion pathway. Inhalation and dermal contact were considered insignificant pathways relative to ingestion (Sample and Suter, 1994). Exposures for this screening-level assessment were modeled using an area use factor of 1, implying that all food items and soil ingested are from the site being investigated. Drinking water was also considered an insignificant pathway because of the lack of permanent surface water at this site. The potential exists for surface water biota to be exposed to runoff that collects within the drainage of Cañon de Valle. Consequently, surface water biota in this assessment were considered exposed to COPEC in surface water.

4.2.3 Ecological Receptors

Plants and wildlife were selected as indicators of potential risk to the terrestrial environment. A non-specific perennial plant was used as the receptor to represent plant species at the site. The wildlife receptor species used to evaluate potential ecological risk at the TA-14 OB/OD units were selected to represent the range of trophic levels that comprise the food web in the

woodland habitats of this site, including herbivores, insectivorous, omnivorous, and predators. In general, smaller species within each of these groups were used to model food chain transfers and exposures because they are likely to have smaller home ranges and, therefore, higher exposures to soil contaminants. Preference was generally given to species identified as occurring in TA-14 (based on species lists in LANL, 1995), although TES status was also considered. As discussed previously, nine wildlife species were evaluated for their potential presence at or near the OB/OD site. Of these, only the Mexican spotted owl was identified as being likely to occur in TA-14. This species was therefore selected as the large predator in the representative food web. The other selected receptors are the vagrant shrew (*Sorex vagrans*), western harvest mouse (*Reithrodontomys megalotis*), montane vole (*Microtus montanus*), American kestrel, and the gray fox. Table 4-2 presents the species-specific parameters used to model exposures in each of these receptors.

Although the other eight TES listed by NMED have not been included directly in this assessment due to their low probability of occurrence, the selected receptors will act as surrogate receptors for many of them. For example, the western harvest mouse, a small omnivorous rodent, will act as a surrogate for the larger meadow jumping mouse. The American kestrel is modeled as an insectivorous bird, thereby representing potential risks to other insectivorous birds, which would include the gray vireo or southwestern willow flycatcher if they were to be present at the site. The exposure to the American kestrel as a result of feeding at the site is also expected to be greater than that of a peregrine falcon feeding in the area because of the smaller ranges of both the kestrel and its prey.

With respect to the ephemeral drainage, only surface water biota were considered as potential ecological receptors. No specific taxa were selected to represent these biota. This is because ambient water quality criteria for the protection of freshwater aquatic life were used as toxicological benchmarks and are based on the most sensitive study species.

4.2.4 Exposure Estimation

Because site-specific biological monitoring data were not available for TA-14, exposure concentrations were estimated through the use of models. The maximum measured or the 95 percent UCL COPEC concentrations (whichever was lower) from soil and surface water data were used to conservatively estimate potential exposures and risks to plants and wildlife at this site and to aquatic biota that may be associated with the Cañon de Valle drainage. Table 4-3 presents the transfer factors used in modeling the concentrations of COPEC through the food chain.

Table 4-2
Data Used to Model Exposure in the Terrestrial Wildlife Species
LANL Technical Area 14

Indicator Species	Class/Order	Body Weight[a] (kg)	Dietary Intake[b] (kg[dw]/day)	Trophic Level	Dietary Composition[c] (percent)
Vagrant shrew (*Sorex vagrans*)	Mammalia/ Insectivore	0.0046	0.00111	Insectivore	Soil: 13 Insect: 100
Western harvest mouse (*Reithrodontomys megalotis*)	Mammalia/ Rodent	0.0104	0.00233	Omnivore	Soil: 2 Plants: 50 Insects: 50
Montane vole (*Microtus montanus*)	Mammalia/ Rodent	0.0291	0.00416	Herbivore	Soil: 2 Plants: 100
Gray fox (*Urocyon cinereoargenteus*)	Mammalia/ Carnivore	2.5	0.146	Omnivore	Soil: 2.8 Plants: 13 Insects: 7 Mice: 40 Voles: 40
American kestrel (*Falco sparverius*)	Aves/ Falconiform	0.111	0.0218	Insectivore	Soil: 2 Insects: 100
Mexican spotted owl (*Strix occidentalis*)	Aves/ Strigiform	0.518	0.0379	Carnivore	Soil: 2 Shrews: 25 Mice: 50 Voles: 25

[a]From Silva and Downing (1995) for mammals, and Dunning (1993) for birds.
[b]From the allometric equations in Nagy (1987).
[c]Based on data in EPA (1993), and Martin et al. (1951).

Table 4-3
Transfer Factors Used in Exposure Models for LANL Technical Area 14 Ecological Risk Assessment

Constituent of Potential Ecological Concern	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Barium	1.50×10^{-1} [a]	1.00×10^{0} [b]	2.00×10^{-4} [c]
Beryllium	1.00×10^{-2} [a]	1.00×10^{0} [b]	2.00×10^{-3} [c]
Cadmium	5.50×10^{-1} [a]	6.00×10^{-1} [d]	5.50×10^{-4} [a]
Lead	9.00×10^{-2} [c]	4.00×10^{-2} [d]	8.00×10^{-4} [c]
Bis(2-ethylhexyl)phthalate	5.78×10^{-2} [e]	2.31×10^{1} [f]	2.07×10^{-3} [e]
2,4,6-trinitrotoluene	4.60×10^{0} [e]	1.58×10^{1} [f]	8.28×10^{-7} [e]
RDX	1.22×10^{1} [e]	1.45×10^{1} [f]	1.46×10^{-7} [e]
HMX	2.74×10^{1} [e]	1.36×10^{1} [f]	3.42×10^{-8} [e]
Tetryl	4.31×10^{0} [e]	1.59×10^{1} [f]	9.32×10^{-7} [e]

[a]From Baes et al. (1984).
[b]Default value.
[c]From NCRP (1989).
[d]From Stafford et al. (1991).
[e]From equations developed in Travis and Arms (1988).
[f]From equations developed in Connell and Markwell (1990)

4.2.4.1 *Terrestrial Receptors*

Exposures to COPEC in the indicator wildlife species are estimated from maximum soil concentrations using the methods described in the EPA's "Wildlife Exposure Factors Handbook" (EPA, 1993). In the screening assessment, only the dietary exposure pathway is considered. The inhalation and dermal contact pathways are not considered to be significant pathways for COPEC in the soil. Although both of these pathways may lead to additional absorption of the COPEC, both are also linked to ingestion by the ingestion of soil particles that have been entrapped in the mucus lining of the nasal cavity and throat and the ingestion of soil through grooming. The absorption of COPEC from soil particles directly through the lungs or skin is expected to be insignificant with respect to that from the daily dietary intake of soil.

The drinking water ingestion pathway is also expected to be minor. Surface water in this area is ephemeral and extremely limited, allowing little opportunity for COPEC to accumulate in the water. Ephemeral surface water may exist as runoff from precipitation events.

The basic equation for estimating dose through the dietary pathway is:

$$D_p = \sum_{k=1}^{m} (C_k \cdot F_k \cdot I_k)/W$$

where:

D_p = the potential average daily dose (mg/kg-day).

C_k = the average COPEC concentration in the kth food type (mg/kg dry weight).

F_k = the fraction of the kth food type that is contaminated.

I_k = the ingestion rate of the kth food type (kg dry weight/day).

W = the body weight of the receptor (kg wet weight).

Natural history data used in modeling the exposure in each of the wildlife receptor species include the average or midpoint body weight, the total ingestion rate, and the fraction of the diet composed of various food types. For screening purposes, the calculation of C_k is based on the maximum modeled soil concentration. The food items of a particular type are

considered to be equally contaminated throughout the entire home range of the receptor; therefore, F_k is 1.

Estimates of the concentrations of COPEC in terrestrial plants were made using the chemical-specific concentration in soil from TA-14. Soil-to-plant transfer factors for inorganics were obtained from a variety of sources which include IAEA (1994), NCRP (1989), and Baes et al. (1984). Transfer coefficients for organic COPEC were estimated using the equation derived by Travis and Arms (1988), which is based on the linear regression of the log K_{ow} for 29 organic compounds ranging from 1.15 to 9.35 and analytically derived soil-to-plant bioconcentration factors. Concentrations in above-ground plant parts were estimated using the following equation from Baes et al. (1984):

$$C_v = (C_s)(B_v)$$

where:

C_v = the concentration of the COPEC in vegetation (mg/kg, dry weight).

C_s = the concentration of the COPEC in soil (mg/kg, dry weight).

B_v = the soil-to-plant transfer factor (unitless).

The average COPEC concentration in ingested soil is taken to be the 95 percent UCL or the maximum measured soil concentration, whichever is lower. For soil insects, soil-to-organism transfer factors were used to estimate the COPEC concentrations in their tissues on a dry weight basis. For organic COPECs in soil insects, the transfer factor was derived from the equation developed by Connell and Markwell (1990) for bioaccumulation in earthworms:

$$BF = \frac{y_L \cdot K_{ow}^{b-a}}{x \cdot f_{oc}}$$

where:

BF = the bioaccumulation factor (unitless).

y_L = the fractional lipid content of the organism.

K_{ow} = the octanol/water partition coefficient.

(b-a) = a nonlinearity constant.

x = a proportionality constant.

f_{oc} = the fractional organic carbon content in the soil.

Although derived from earthworm data, the values for the nonlinearity constant (0.05) and proportionality constant (0.66) were applied to modeling uptake in soil insects. Because of differences in integument, it is expected that the uptake by earthworms will generally be greater than that of insects. Therefore, these factors are expected to yield conservative estimates of insect uptake. The lipid content in insects was estimated at 3.1 percent fresh weight (Taylor, 1975), which is 7.9 percent of dry weight, using a value of 61 percent water content in beetles (EPA, 1993). Based on the method described in Brady (1974), the fraction of organic carbon in the soil was estimated by dividing the organic matter content by the value 1.7. The average organic matter content of 21 Southern Great Plains soils (1.55 percent) (Brady, 1974) was used to estimate the organic matter content in TA-14 soils. Except where literature-derived values are available, the soil-to-insect transfer factors for inorganics were assumed to be 1.

Tissue concentrations in vertebrate prey species were estimated from the daily intake of the COPEC through the use of transfer factors for beef. The regression equation developed by Travis and Arms (1988) and based on the log K_{ow} value of the chemical of concern was used to derive food-to-beef transfer factors for the organic COPEC. Transfer factors for the inorganic COPEC were taken from IAEA (1994), NCRP (1989), and Baes et al. (1984). A weighted average of the concentrations of all food items (including ingested soil) was then used in the calculation of tissue concentrations in prey species and the dietary exposure rate in all indicator species.

4.2.4.2 Aquatic Receptors

For this assessment, aquatic macroinvertebrates were exposed to COPEC in surface water. Because risk was elevated by direct comparison of surface water concentrations to water quality criteria, it was not necessary to utilize exposure models.

4.2.2 Effects Characterization

The second major component of the analysis phase is to obtain information on the toxicity of the specific COPEC to the ecological receptors. Toxicity information is compiled into a form

that makes it comparable to either soil or surface water concentrations or to intake values. These values are referred to as benchmark screening values.

4.2.2.1 Plants

General information on the chronic toxicity of inorganic and organic compounds to vascular plants was primarily obtained from Will and Suter (1995). These benchmark values are based on lowest-observed-adverse-effect-levels (LOAEL) and are presented in Table 4-4.

4.2.2.2 Wildlife

No-observed-adverse-effect-levels (NOAEL) for chronic oral exposure were used as benchmarks for toxic effects to wildlife (Table 4-4). Because the NOAELs for the indicator wildlife species are based on NOAELs from test species, the latter were converted to NOAELs specific to indicator species using a power function of the ratio of body weights, as described by Sample et al. (1996). Thus:

$$NOAELw = NOAEL_T \left(\frac{BW_T}{BW_W} \right)^s$$

where:

$NOAEL_W$	=	the no-observed-adverse-effect-level for the wildlife indicator species (mg/kg-day).
$NOAEL_T$	=	the no-observed-adverse-effect-level for the test species (mg/kg-day).
BW_T	=	the body weight of the test species (kg).
BW_W	=	the body weight of the wildlife indicator species (kg).
s	=	a body weight scaling factor (s = 1/4 for mammals and s = 0 for birds).

Table 4-4
Toxicity Data for Ecological Receptors at LANL Technical Area 14

		Mammalian NOAELs		Avian NOAELs	
Constituent of Potential Ecological Concern	**Plant Benchmark[a]**	**Mammalian Test Species[b]**	**Test Species NOAEL[c]**	**Avian Test Species[d]**	**Test Species NOAEL[d]**
Barium	500	Lab rat[e]	5.1	Chicks	20.8
Beryllium	3	Lab rat	0.66	---[f]	---
Cadmium	3	Lab rat[g]	1	Mallard	1.45
Lead	50	Lab rat	8	American kestrel	3.85
Bis(2-ethylhexyl)phthalate	---	Lab rat	1771	---	---
2,4,6-trinitrotoluene	30	Lab rat[h]	1.6[i]	---	---
RDX	100	Lab rat[h]	0.3[h]	---	---
HMX	---	Lab rat[j]	10[i]	---	---
Tetryl	25	Lab rat[j]	13[k]	---	---

[a]From Will and Suter (1995).
[b]From Sample et al. (1996), except where noted. The body weight (in kilograms) for NOAEL conversion for the lab rat is 0.350 (except where noted).
[c]From Sample et al. (1996), except where noted.
[d]From Sample et al. (1996).
[e]Body weight of 0.435 kg was used for NOAEL conversion (Sample et al. 1996).
[f]--- designates insufficient toxicity data.
[g]Body weight of 0.303 kg was used for NOAEL conversion (Sample et al. 1996).
[h]From EPA (1997).
[i]From Ryan (1987).
[j]Estimated using LD_{50} information specific to the compound (e.g., RTECS, 1997), and NOAEL information for TNT as described in Sample et al. (1996).
[k]From Talmage et al. (1996).

When only subchronic oral $NOAEL_T$ values were available, these where converted to chronic $NOAEL_T$ values by applying an uncertainty factor of 0.2 (Sample et al., 1996). Similarly, when only chronic LOAELs were available for test species, an uncertainty factor of 0.2 was used to convert it to the $NOAEL_T$. In cases where only an acute toxicity value was available for a specific COPEC (e.g., a lethal dose to 50 percent of the test population [LD_{50}]) but both a NOAEL and LD_{50} value were available for a closely related compound in the same test species, the $NOAEL_T$ for the COPEC was estimated using the relationship from Sample et al. (1996):

$$NOAEL_{TX} = LD_{50TX}\left(\frac{NOAEL_{TY}}{LD_{50TY}}\right)$$

where,

$NOAEL_{TX}$	=	the no-observed-adverse-effect-level for COPEC X in test species T (mg/kg-day).
LD_{50TX}	=	the acute lethal dose to 50 percent of the test population of test species T for COPEC X (mg/kg).
$NOAEL_{TY}$	=	the no-observed-adverse-effect-level for compound Y (closely related to COPEC X) in test species T (mg/kg-day).
LD_{50TY}	=	the acute lethal dose to 50 percent of the test population of test species T for compound Y.

4.2.2.3 Aquatic Macroinvertebrates

Several sources were utilized to evaluate the toxicity of surface water COPECs to freshwater biota. EcoTox benchmark values published by EPA (1996c) and Tier II chronic benchmarks published by Suter and Tsao (1996) were used as the effects data for aquatic receptors in this risk assessment.

4.3 Risk Characterization

Ecological risks for the terrestrial and aquatic biota associated with the woodland and ephemeral drainage, respectively, were assessed by comparison of predicted exposure to benchmark toxicity values. The HQ of exposures divided by the benchmark values for the terrestrial receptors are presented in Table 4-5. HQ values greater than unity indicate potential risk based on the conservative assumptions used in the exposure models. As presented in the table, HQs greater than one were predicted for the harvest mouse, montane

vole, and gray fox exposed to HMX, RDX, and TNT; and the American kestrel exposed to bis(2-ethylhexyl)phthalate. In no instance did an HQ value exceed a value of 62. Surface water may be potentially toxic to aquatic biota associate with the ephemeral drainage because of elevated concentrations of barium, beryllium, cadmium, and total lead (Table 4-6).

Although ecological risks were predicted, actual ecological risks are expected to be lower than those presented in Tables 4-4 and 4-5. All small mammals are expected to have home ranges within the confines of the site, so risks may actually be present for those species. For the kestrel and fox, however, risks are expected to be lower based on the large home range size of the species and the actual amount of time spent within the boundaries of TA-14. Risk to aquatic biota is expected to be very low due to the very temporary nature of the ephemeral drainage system, which may not be suitable for aquatic life regardless of potentially elevated levels of barium, beryllium, cadmium, and lead. Also, the exposure/risk predictions were based on concentrations that represent the upper bounds of expected mean concentrations. Such concentrations may not reflect actual exposure at TA-14. Overall, ecological risks at the site are expected to be low.

4.4 Uncertainties

Many uncertainties are associated with the characterization of ecological risks at TA-14. These uncertainties result in the use of assumptions in estimating risk that may lead to an overestimation or underestimation of the true risk presented at a site. For this screening level risk assessment, assumptions are made that are more likely to overestimate risk rather than to underestimate it. These conservative assumptions are used to be more protective of the ecological resources potentially affected by the site. Conservatisms incorporated into this risk assessment include the use of the maximum measured soil concentration or 95 percent UCL to evaluate risk, the use of wildlife toxicity benchmarks based on NOAEL values, the use earthworm-based transfer factors or a default factor of 1.0 for modeling COPECs into soil invertebrates in the absence of insect data, and the use of 1.0 as the area use factor for wildlife receptors regardless of seasonal use or home range size. Uncertainties also exist with regard to whether the ephemeral drainage can support aquatic life and the degree of runoff that reaches the drainage from TA-14.

Table 4-5
Ecological Hazard Quotients for Terrestrial Receptors at LANL Technical Area 14

Constituent of Potential Ecological Concern	Receptor Species						
	Plants	Western harvest mouse	Vagrant shrew	Montane vole	American kestrel	Gray fox	Mexican spotted owl
Bis (2-ethylhexyl) phthalate	NAa	3.58E-02	4.95E-02	1.98E-04	**1.36E+00**[b]	5.34E-03	2.08E-03
HMX	NA	**5.56E+01**	4.27E-04	**6.14E+01**	NA	**1.26E+01**	NA
RDX	1.36E-02	**5.63E+00**	9.09E-06	**4.24E+00**	NA	**1.14E+00**	NA
Tetryl	8.08E-02	1.46E-01	9.43E-05	5.16E-02	NA	2.52E-02	NA
TNT	8.73E-01	**1.56E+01**	1.08E-03	**5.81E+00**	NA	**2.71E+00**	NA
Total Beryllium	3.45E-01	2.25E-01	1.22E-02	1.20E-02	NA	4.99E-02	NA
Cadmium	3.70E-01	6.36E-02	1.39E-03	5.03E-02	9.32E-02	1.56E-02	1.18E-03
Total Lead	9.83E-01	4.85E-02	2.09E-02	5.18E-02	1.50E-01	2.50E-02	1.89E-02

[a]NA designates insufficient toxicity data available for risk estimation purposes.
[b]**Bold** values indicate a hazard quotient greater than unity.

Table 4-6
Comparison of Surface Water Concentrations to Ecological Benchmark Values for LANL Technical Area 14

Constituent of Potential Ecological Concern	Surface Water	
	Site Concentration (μg/L)	Benchmark (μg/L)
Barium	87	4.0[a]
Beryllium	1.45	0.66[a]
Cadmium	1.40	1.0[b]
Chromium	4.71	180[b]
Total Lead	5.59	2.5[b]

[a]Tier II values are presented in Suter and Tsao, 1996.
[b]EPA, 1996b Ecotox thresholds (Ambient Water Quality Criteria).

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LA-12913-MS

Natural Background Geochemistry, Geomorphology, and Pedogenesis of Selected Soil Profiles and Bandelier Tuff Los Alamos, New Mexico

Los Alamos
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Los Alamos National Laboratory is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36.

LA-12913-MS

UC-903
Issued: May 1996

Natural Background Geochemistry, Geomorphology, and Pedogenesis of Selected Soil Profiles and Bandelier Tuff Los Alamos, New Mexico

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ence. The UTL is a "hot measurement" test—meaning that site data that are greater than the UTL-calculated threshold value are "in excess" of normal maximum background concentration for a particular element. Values of UTL for naturally occurring metals and nonmetals in soil samples, which encompassed A, B, and C horizons at the Laboratory, are presented in Table 4. These values are also extrapolated for radioisotopes of K, Th, and U by assuming natural abundance of each isotope.

Table 4. List of Upper Tolerance Limits (UTLs) for LANL Soil Background Data

Analyte	SAL (mg/kg)	Mean[a] (mg/kg)	Standard Deviation (mg/kg)	UTL 99%,0.95 (mg/kg)	N	N > DL
Aluminum (LT)	78,000	19000	13800	123000	47	47
Antimony	31	2.45	0.36	2.5 (MAX)	46	2
Arsenic		4.4	2.5	11.6	46	46
Barium (LT)	5,300	161	129	1140	47	47
Beryllium		1.15	0.75	3.31	47	47
Cadmium	38	0.39	0.54	2.7 (MAX)	47	5
Calcium (LT)		5790	12500	54400	47	47
Chromium (Total)[b]		11.7	7.8	34.2	47	47
Cobalt	4,600	15.2	7.6	51.1	47	47
Copper	2,800	5.3	3.6	15.7	47	45
Iron		14500	7320	35600	47	47
Lead	400	15.0	8.3	39.0	47	44
Magnesium (LT)		2920	2150	16100	47	47
Manganese	390	343	238	1030	47	47
Mercury	23	0.05	0.01	0.1 (MAX)	48	4
Molybdenum	380	NA	NA	NA	NA	NA
Nickel	1,500	9.7	5.9	26.7	47	45
Potassium		2420	1304	6180	47	47
Selenium	380	0.43	0.41	1.7 (MAX)	46	23
Silver	380	NA	NA	NA	NA	NA
Sodium		577	453	1880	47	47
Strontium	46,000	NA	NA	NA	NA	NA
Thallium	6.4	0.27	0.24	0.9 (MAX)	45	21
Uranium, natural	29	0.86	0.43	2.09	46	46
Vanadium	540	25	14	66	47	47
Zinc	23,000	41	21	101	47	47
40-Potassium[c]		21.6	5.07	36.1	50	50
232-Thorium[c]	0.77	1.71	0.34	2.68	50	50
234-Uranium[c]	13	1.21	0.29	2.03	50	50
235-Uranium[c]	10	0.052	0.012	0.088	50	50
238-Uranium[c]	67	1.14	0.27	1.90	50	50

[a]Concentration values <DL (detection limit) were replaced by 1/2 of the DL.

[b]SAL for Chromium-III is 80,000 mg/kg and for Chromium-VI is 30 mg/kg.

[c]Data are converted from elemental concentrations reported in this LANL background report (units are pCi/g).

LT - UTL is based on log transformed data.

NA - data not available for LANL background.

MAX - Maximum value is reported, rather than the UTL.

Los Alamos
NATIONAL LABORATORY

memorandum

Chemical Science and Technology
CST-12 · Organic Analysis
Los Alamos, New Mexico 87545

To/MS: Michael Alexander/ESH-16/MS K497
Thru: Gerald Ansell/CST-12/MS E517
From/MS: Betty Harris/CST-12/MS G740
Phone/FAX: 5-3410/5-9345
Symbol: CST-12:96-188
Date: 9/13/96

CONTAMINANTS AT TA-14, Q-SITE

During the summer of 1995 a university team from Hobbs Junior College and I constructed sample collectors at twelve locations at Q-SITE, TA-14. The purpose of the project was to quantify the concentrations of contaminants of concern (COC). Water and soil samples were collected and analyzed for volatile organics, semi-volatile organics, explosives, and metals. Also, samples were screened for radiation.

Results obtained using Gas Chromatography and Mass Spectroscopy (GC/MS), showed no detectable amounts of volatile and semi-volatile organics. However, high performance liquid chromatography (HPLC) analyses confirmed parts per billion (ppb) levels of explosives in the soil at two sample points QCS-3 and QWS-1.* Small pieces of uranium oxide were found in and around a sump, Q-43 (west and near Gun Facility), and along the lower bottom edge, QWW-1, of a recently installed access road. Otherwise, no radiation was detected in the samples.

The United States Environmental Protection Agency (US-EPA) method SW846-700 series, which uses an atomic absorption spectrophotometer with a graphite furnace detector, was employed to determine metal contamination soil and waste samples. Parts per million (ppm) levels of barium, beryllium, cadmium, chromium, and lead were detected.

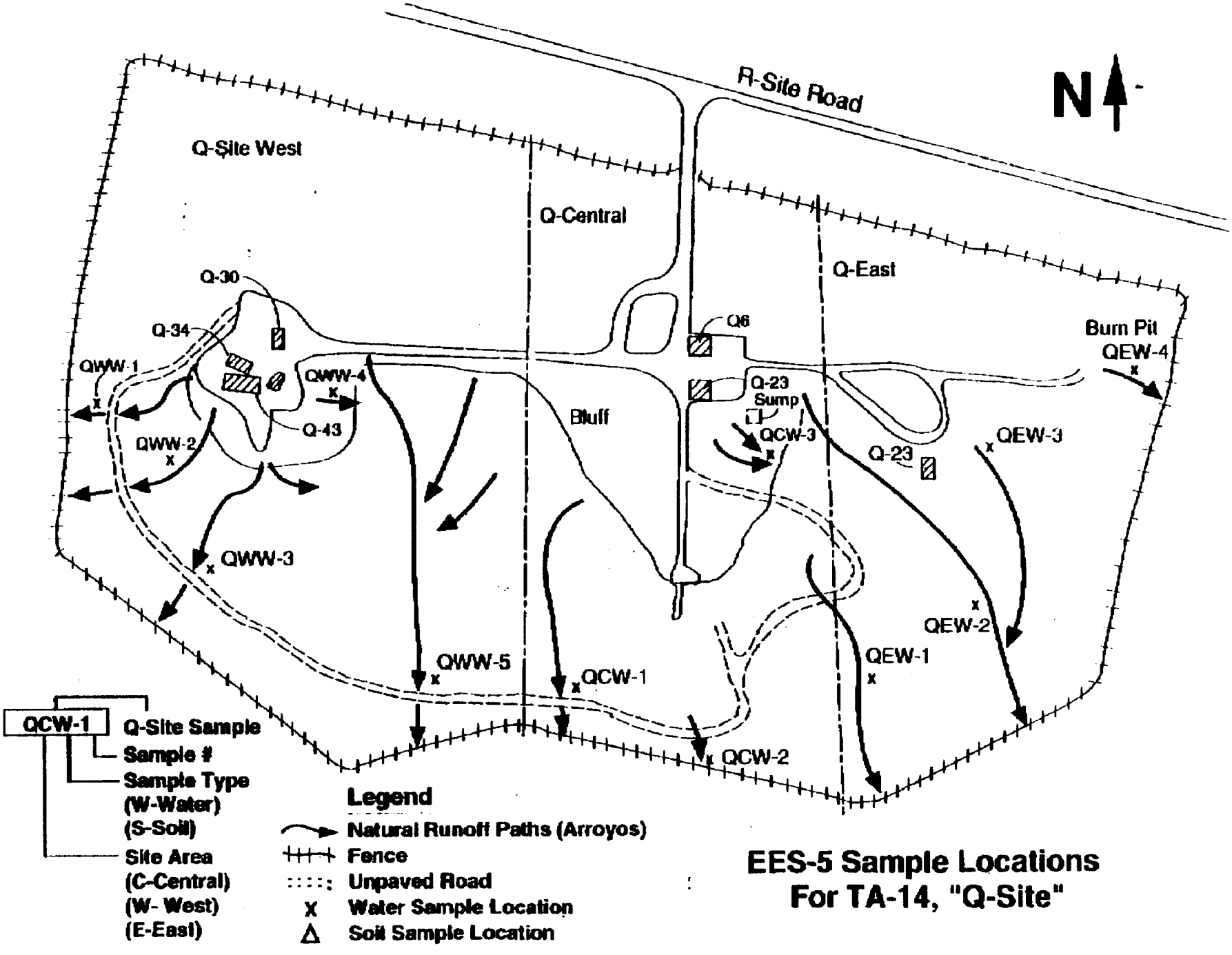
US-EPA SW846 Method 8330 was used by Wayne King, DX-2, to analyze soil and water samples possibly contaminated with explosives.

The concentrations of volatile and semi-volatile organics in soil and water samples were determined by Jeff Roberts of CST-12 by standard US-EPA methods.

The paper describing this work has not been published. Please contact me if you need more information.

---

* Consult ledger on Figure 1 for an explanation of sample nomenclature.



EES-5 Sample Locations For TA-14, "Q-Site"

New Mexico Junior College

HOWE Laboratory

5317 Lovington Highway 505-392-5603 ext. 634 Hobbs, NM 88240

UNM DOE LANL SANDIA NMIMT NMSU

Metals

Dr. Betty Harris
Los Alamos National Laboratories
~~MS-C920~~
Los Alamos, NM 87545

February 27, 1996

Dr. Harris,

Here are the results of the total metals analyses for the soil samples from the project with Professor Jarry Brian at New Mexico Junior College. These soils were digested in dilute nitric acid with subsequent addition of hydrogen peroxide to extract the metals.

TOTAL METALS (ppm)

SAMPLE	Ba	Be	Cd	Cr	Pb	METHOD
QCS-1	300	4.6	0.46	11	38	SW-846 7000 Series
QCS-2	120	2.6	0.14	7.2	30	SW-846 7000 Series
QCS-3	330	2.4	3.4	9.2	62	SW-846 7000 Series
QES1	130	2.8	0.10	13	26	SW-846 7000 Series
QES-2	270	3.0	0.32	10	38	SW-846 7000 Series
QES-3	530	3.3	0.20	16	72	SW-846 7000 Series
QES-3 dup	570	3.7	0.14	18	86	SW-846 7000 Series
QES-4	480	3.6	0.16	12	28	SW-846 7000 Series
QWS-1	170	2.2	0.08	5.2	24	SW-846 7000 Series
QWS-2	140	2.2	0.20	6.0	24	SW-846 7000 Series
QWS-3	120	2.8	0.24	6.0	13	SW-846 7000 Series
QWS-4	170	1.8	0.72	9.0	40	SW-846 7000 Series
QWS-5	210	3.8	0.32	11	48	SW-846 7000 Series

NOTE: The SW-846 7000 series analyses by graphite furnace for the above metals bear the following method numbers:

Metal	Method Number
Barium	7081
Beryllium	7091
Cadmium	7131A
Chromium	7191
Lead	7421

Typical recoveries are as follows:

Metal	Sample	%Recovery
Barium	QEW-4	130
Beryllium	QEW-4	71
Cadmium	QEW-4	67
Lead	QWW-6	102

Dr. Harris,

Thank you for your patience. The new instrument I ran these samples on was fraught with defect. It took a long while to bring the instrument up to my standard. The good news is that I have it functioning well now, and should you need more work of this type, it will take a few days, instead of a few months. The report for the soils metals analyses should arrive in 2-3 days.

Sincerely,

Douglas Strong

Douglas Strong, Ph. D.

Appendix K

Impulse Noise Measurements at Technical Area 14

TO: Michelle Cash, ESH-19 (P915)

FR: Ernie Vigil, ESH-5, (P915)

SUB: IMPULSE NOISE MEASUREMENTS AT TA-14

Impulse noise measurements of HE detonations were obtained at TA-14 on 2 separate dates; Nov. 21, 1991 (clear day) and Dec. 11, 1991 (cloud cover). The HE used was 20 lbs. of a mix of 9501 and guanidine for each shot. The following are the results of the measurements obtained.

Nov. 21, 1991

	Shot 1	Shot 2	Shot 3
Control Room	122 dB	------	125 dB
Outside Control Rm.	------	------	151 dB
Site Gate	145 dB	146 dB	144 dB
Jog Trail	140 dB	148 dB	140 dB

Dec. 11, 1991

Control Room	122 dB	120 dB	122 dB
Outside Control Rm.	151 dB	132 dB	------
Site Gate	140 dB	141 dB	148 dB
Site Fence (near gate)	148 dB	148 dB	150 dB

Note: The site gate, site fence, and the jog trail locations are in close proximity to each other. The fence location was just east of the gate with an unobstructed path to the firing mound which likely accounts for the slightly higher readings. The gate location readings may be lower due to the firing control room being in a direct line with the firing point. The distance to these locations is approximately 460-480 ft. The control room readings are inside the control room which is approximately 80-100 ft. away.